Phonological acquisition in a multidialectal and multicultural context: The case of bilingual preschoolers in Singapore

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Declaration

This thesis is the result of my own work and includes nothing which is the outcome of work done in collaboration except as declared in the Preface and specified in the text. I further state that no substantial part of my thesis has already been submitted, or, is being concurrently submitted for any such degree, diploma or other qualification at the University of Cambridge or any other University or similar institution except as declared in the Preface and specified in the text. It does not exceed the prescribed word limit for the relevant Degree Committee.

Jasper Hong, Sim
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Jasper Sim Hong

This thesis seeks to better understand early phonological acquisition in a context in which linguistic input can be especially varied and variable. It focuses on preschoolers' acquisition of Singapore English, a variety that emerged from long-term language contact, within a multilingual, multicultural setting that is linguistically and sociolinguistically complex. The four individual studies herein explore the variation in the English child-directed speech (CDS) of Singaporean caregivers and its possible connections with or effects on the outcomes of phonological acquisition in their preschool children.

The introductory chapter (**Chapter 1**) describes the sociolinguistic setting and reviews key factors that contribute to variable development and outcomes in early bilingual phonological acquisition, with a focus on input quality (i.e. specific phonetic or phonological properties of the input). **Chapter 2** details the caregiver-child speech corpus that was developed for the production studies in this thesis.

The four studies in this thesis centre on two phonological features of Singapore English, namely the (non)release of coda oral stops and L-allophony. The first study (**Chapter 3**) reveals inter-adult variation in the release of English coda stops by ethnically Chinese caregivers, which is shown to be reflected in their children's production. The other three studies focus on the realisations of coda /l/ in Singapore English, namely vocalised-l, dark-l and clear-l. Through a matched-guise test, **Chapter 4** demonstrates that these three variants are imbued with diverse socio-indexical meanings, and their interpretation and evaluation are dependent on and shaped by the hearer's individual experiences with the social world. **Chapter 5** explores whether, how and why Malay caregivers vary their English coda /l/ in their CDS. The study reveals socially-conditioned variation between maternal and paternal CDS, and within maternal CDS. Finally, **Chapter 6** examines the bilingual development of English and Malay laterals in Malay children, in order to understand how they negotiate the multiple allophones of /l/ in their caregivers' input, and between the competing input models of their caregivers and significant others.

Chapter 7 reiterates and synthesises the findings, and at the same time, discusses six key implications that can be drawn from the four studies: (1) inter-speaker variation can be difficult to predict or model, (2) children acquire the differential speech properties in the input, (3) variation and/or inconsistencies in the input can affect the building of contrastive categories, (4) variation in the input can be complex, (5) there are multiple moderators of language outcomes, and (6) multiculturalism as a social force can be a moderator. The chapter then shows how usage-based accounts of language acquisition, specifically the exemplar model, may be useful in accounting for the variable outcomes observed in this thesis and in bilingual acquisition more generally. It concludes with some limitations and avenues for future work.

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Abbreviations

ADS	Adult-directed speech
AIC	Akaike information criterion
AoA	Age of acquisition
BLP	Bilingual Language Profile
CDS	Child-directed speech
CI	Confidence interval
CLI	Cross-linguistic influence/interaction
EMT	Ethnic mother tongue
F0	Fundamental frequency
F1	First formant
F2	Second formant
F3	Third formant
FAS	Family Affluence Scale
GA	General American English
IDS	Infant-directed speech
L1	First language
L2	Second language
MB-CDI	MacArthur-Bates Communicative Development Inventories
OR	Odds ratio
PC	Pre-consonantal
PoA	Place of articulation
PP	Pre-pausal
PV	Pre-vocalic
RP	Received Pronunciation
SCE	Singapore Colloquial English
ScSE	Scottish Standard English
SES	Socio-economic status
SSBE	Southern Standard British English
SSE	Singapore Standard English
UG	Universal Grammar
VOT	Voice onset time

Chapter 1

Background and motivation

Introduction

The emergence of phonology relies on linguistic input, from which the child extracts language-specific phonetic details and phonological information that are requisite for the building of phonological representations. Despite it being relatively more canonical than adult-directed speech (Dilley et al., 2014; Kuhl et al., 1997), the phonetic input that a child receives is rarely invariant; variability in speech can arise from linguistic and physiological factors (Mücke et al., 2017), such as changes in speaking rate, vocal effort, fatigue, phonetic and prosodic contexts, lexical factors, and anatomical differences, which means that no two tokens of a speech sound produced by caregivers are acoustically identical. Another type of input variability that this thesis is mainly concerned with is variation arising from social and experiential factors and involves differences in manners of pronunciation, as in accents. Variability of this kind is experienced by many children who are raised in multi-dialect and multi-accent environments (e.g. Durrant et al., 2015; Kartushina et al., 2021; Kerswill & Williams, 2000; Thomas & Scobbie, 2015). Monolingual caregivers can also be bilectal, and speak (or use features belonging to) two or more accents in different social contexts (e.g. Foulkes et al., 2005; Smith et al., 2007, 2013). The distribution of the use of different dialects and accents can also be pervasive, such as in a context of a diglossia, in which two dialects are in strict complementary distribution in the wider community (Grohmann et al., 2016; Rowe & Grohmann, 2013).

Early bilingual phonological acquisition is necessarily more complex than monolingual acquisition, as it requires the bilingual child to differentiate the two languages in the input and to simultaneously represent them in separate but interacting phonological systems (e.g. Byers-Heinlein & Fennell, 2014, pp. 275–276). The complexity of bilingual acquisition is exacerbated by the exposure to phonetic input that is likely to be more heterogenous and variable than monolingual input. In addition to the types of variation in monolingual child-directed speech (CDS) that can also exist in either language of a bilingual caregiver, additional variability in the CDS of a bilingual caregiver can arise from the interactions between their two phonological systems, such that the input that a bilingual child receives for each language may be qualitatively different from those received by monolinguals. Differential phonetic features can be attributed to, for instance, late learning of the second language (L2), attrition in the first language (L1), or differing language dominance (Bosch & Ramon-Casas, 2011; Fish et al., 2017; Khattab, 2011; Stoehr et al., 2019). In culturally pluralistic communities that have undergone long-term societal language contact or involve ethnic minorities and heritage language speakers, the input that the children receive at home can also qualitatively differ from the input from their peers or other significant adults in the child's immediate environment (Kirkham, 2017; Kupisch, 2019; Mayr & Siddika, 2018; Sharma, 2011; Mayr & Montanari, 2015).

Input variability and its effects on language learning have been foregrounded by a growing body of work that takes on a more environmentalist or social-interactionist position on early language acquisition (Hoff, 2020; Snow, 2014). These studies have primarily focused on outcomes in the domains of vocabulary, grammar, and morpho-syntax (Durrant et al., 2015; Hoff et al., 2019; Kartushina et al., 2021; Place & Hoff, 2011; Unsworth, 2016); less attention is paid on how variation in specific phonetic and phonological properties of the input can impact phonological outcomes. Further, as will be discussed in greater detail below, differences in the speech between bilingual children and their monolingual peers, as well as differences between and within bilingual populations, are typically attributed to cross-linguistic interactions, language-internal factors, and/or differences in the amount of input; input properties are less often cited as a potential contributor and/or are assumed to be homogeneous, much less directly explored as a primary variable (Kehoe, 2015, pp. 161–162; Stoehr et al., 2019, p. 76). This relative lack of understanding of input effects on phonological acquisition means that the current knowledge of the field has limited applicability in modelling the phonological outcomes of children in multi-dialectal, multi-accent settings in which inter- and intra-speaker variation is the norm. The primary objective of this thesis, therefore, is to better understand early bilingual phonological acquisition in a setting in which input can be especially varied and variable. To this end, four experiments were conducted in Singapore, a society that is especially linguistically and culturally diverse as described below, to answer three overarching research questions (RQ):

RQ1: What inter- and intra-speaker variation is there in the English child-directed speech of Singaporean caregivers?

RQ2: What are the effects of variation in child-directed speech on the phonological development of their preschool children?

RQ3: How different is the nature of phonological acquisition in multi(dia)lectal and multicultural contexts from that in less diverse settings?

1.1.1. Outline of the thesis

The remainder of this chapter introduces Singapore and the multilingual, multicultural and multidialectal context in which the four investigations took place. The determinants of bilingual language outcomes, including cross-linguistic interactions and further details about quality of input as a language-external factor are subsequently discussed. Chapter 2 details the caregiver–child speech corpus that was developed for the production studies in this thesis (Experiments 1, 3 and 4; Experiment 2 is an independent perception experiment). The four studies, each reported in the form of an individual research article, constitute Chapters 3, 4, 5, 6. The concluding chapter discusses the implications of the findings on theoretical models of phonological acquisition and research on child language acquisition.

The Singaporean Context

1.2.1. Being multilingual and multicultural: A brief history

Present-day Singapore is an island-state located at the southern tip of the Malay Peninsula in Southeast Asia (Figure 1.1). It has a resident[1] population of about four million that is ethnically diverse, comprising 74.3% Chinese, 13.5% Malays, 9.0% Indians, and 3.2% of other ethnic origins (Department of Statistics, 2021, p. 7). Before a trading post was established on Singapore by the British East India Company in 1819, Singapore had around a thousand inhabitants, mainly indigenous Malays and around 30 Chinese (Turnbull, 2009, p. 25). The arrival of the British led to an influx of settlers and traders from the region including the Malay archipelago, India and China, contributing to the ethnic and linguistic diversity that is had today (for a detailed sociohistorical account, see Bao, 2015, pp. 15–36; Chew, 2013, pp. 37–53; Leimgruber, 2013, pp. 1–8).

[1] The resident population comprises citizens and permanent residents.

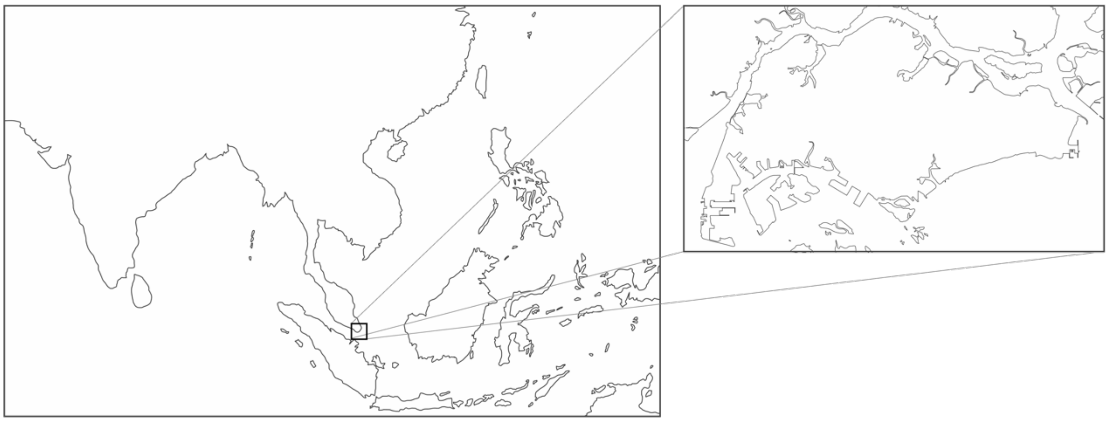

Figure 1.1 The location of Singapore at the southern tip of the Malay Peninsula in South-East Asia. Left: (d-maps, 2022a); right: (d-maps, 2022b).

The English language in colonial Singapore was situated in a linguistic ecology as diverse as the people. The Chinese migrants, who originated primarily from southern regions of China, had distinct regional identities and were linguistically diverse. Many spoke varieties of Hokkien, Teochew or Cantonese, but some in the community also spoke Hainanese or Hakka (Bao, 2015, p. 18; Chew, 2013, pp. 43–48). The Indians, most of whom came from southern India, spoke Dravidian languages, primarily Tamil, but also Malayalam and Telegu. A small minority who came from the north spoke Indo-Aryan languages, including Hindi, Bengali and Punjabi (A. R. Walker, 2005). The Malays in colonial Singapore were also culturally and linguistically distinct groups from around the Malay archipelago. Therefore, while many spoke varieties of Malay, other Malayo-Polynesian languages such as Javanese were also spoken. It was through cross-cultural marriages and cultural assimilation that a common Malay identity emerged (Chew, 2013, pp. 38–43). Peranakans or Babas, who were born in the Straits Settlements (British territories in Southeast Asia that included Penang and Malacca) from Chinese settlers and local Malays, spoke Baba Malay, a Malay-based creole with a Hokkien substrate. They were amongst the first to embrace English as a home language, along with the Eurasians, who were those of mixed Asian and European heritage (Bao, 2015, pp. 18–19, 30; Leimgruber, 2013, p. 16). There were a few *lingua francas* that were used before they were gradually replaced by English. One was Bazaar Malay, a Malay-lexified pidgin with a Chinese substratum that was widely used in the Malay peninsula and the Indonesian archipelago before the beginning of the 20th century. It was the main intra- and inter-group *lingua franca* in colonial Singapore, and it is still spoken by older Chinese and Indian

Singaporeans today (Bao & Aye, 2010; Chew, 2013, pp. 88–95). Hokkien was the other common language used mainly by the Chinese community for intra-group communication, and Tamil by the Indian community (Chew, 2013, pp. 98–103). A pidginised form of English preceded the present-day Singapore English (SgE), and competed with Bazaar Malay as the inter-ethnic *lingua franca*; only by the 1970s, English, pidginised or otherwise, overtook Bazaar Malay as the common language of choice (Bao, 2015, p. 23). It is important to note that, although Singapore was English-founded, English education in colonial Singapore was only provided to a small elite class, and the majority of the population was educated in their native tongues, i.e., in vernacular schools (Bao, 2015, p. 25). Because of a shortage of native-speaking teachers, many teachers in English-medium schools were Eurasians, Babas and Anglicised Indians, who often code-switched between English and Bazaar Malay to make themselves comprehensible to the linguistically plural population (Chew, 2013, pp. 97–98). It was only after World War II that more students were enrolled in English schools; after Singapore's independence in 1965, an increasing number of Singaporeans were instructed in English (Bao, 2015, p. 27).

As is evident from the above, multiculturalism in Singapore preceded Singapore's independence, although its political origin stemmed from rising concerns in the 1950s that an independent Malaya (the dissolution of British rule in Singapore and the Malaya peninsula) would result in a relegation of the Chinese language and Chinese vernacular education in Singapore. An unrest in 1955 led the then local government to 'formally recognise that Singapore was a multiracial society and recommended that equal treatment be given to the four streams of education in practice—Malay, Chinese, English and Tamil' (Lian, 2016, p. 14). Since her independence, Singapore's ethnic pluralism is managed and maintained through state-institutionalised multiracialism. The broad racial categories that were used by the colonial British administration, namely Chinese, Indian, Malay, and Others, remained as the dominant organising framework of race[2] in Singapore, which informs government policies in matters relating to, for instance, urban planning and language policies. The emphasis was for Singaporeans to develop a national identity but not at the expense of the constituent cultures and languages of the three main races

[2] The term 'race' is used here to reflect how ethnic groups are discussed in the Singaporean context. Both 'race' and 'ethnicity' are understood as social constructs.

(Mathew, 2018, p. xiv). Ethnic identities are thus deeply entrenched, and multiculturalism in Singapore is an 'everyday' living phenomenon (Wise & Velayutham, 2009), but Singaporeans embrace an equally strong Singaporean identity (Mathew, 2018, p. xv). What sets multicultural Singapore apart from many other culturally pluralistic newly independent nations in Asia and Africa and super-diverse societies like the United Kingdom and United States, therefore, is that the ethnic differences (including the cultural, religious and linguistic aspects) in Singapore are encouraged, accentuated and preserved, and there is arguably no dominant culture that minority groups are compelled to assimilate into. How multiculturalism explains some of the findings in this thesis will be discussed in the concluding chapter (§7.1, RQ3).

1.2.2. Individual bilingualism and societal multilingualism in present-day Singapore

When Singapore gained independence in 1965, the four languages—Malay, Mandarin, Tamil and English were designated as official languages (Constitution, §153A). Mandarin, Malay and Tamil were also designated as the ethnic mother tongues (EMT) of the Chinese, Malays, and Dravidian-speaking Indians respectively (L. Wee, 2005, p. 55). Many of the other languages are still spoken in Singapore today, although as a result of the post-colonial language and education policies that accelerated the language shifts that were already underway (see Bao, 2015, pp. 29–33), the use of many non-official languages has sharply declined, and many of which have either become heritage languages or lost across generations (for detailed discussions on language planning in Singapore, see, for example, Chua, 2011; Dixon, 2009; Tan & Ng, 2011; Wee, 2010). One such initiative was the bilingual policy instituted in the 1960s. Since 1960, the study of a second language was made compulsory in schools; students in vernacular schools had to study English as a second language, while those in English-medium schools were required to learn an additional language. In 1987, English became the main language of instruction in all educational institutions, and the official EMTs (i.e. Mandarin for Chinese, Malay for Malays, and Tamil for Dravidian-speaking Indians) were taught as a second language. Due to its pragmatic motivations (Chua, 2011; Dixon, 2009), the policy has been premised as the 'functional polarization' of languages (Pendley, 1983, p. 51) or the 'division of labour between languages' (Kuo & Jernudd, 1993, p. 5): English was to serve as the primary working language and the local inter-ethnic *lingua franca*. The EMTs, contrastingly, 're-ethnicise and consolidate separate ethnic communities' (Kuo & Jernudd, 1993, p. 6), and were meant as a means to demarcate and embody the traditional roots and culture of Singapore, acting as a cultural ballast and anchor for Singaporeans against western influences (Rubdy, 2001, p. 342). Consequentially, individual bilingualism and societal multilingualism are the norm in Singapore; even domestic multilingualism is a norm rather than an exception (Gupta, 1994, p. 49). Another key language-related initiative that significantly shaped the sociolinguistic situation of present-day Singapore is the annual 'Speak Mandarin Campaign' launched in 1979. Its initial aim was to encourage the use of Mandarin over the other Chinese languages (which are referred to as '[Chinese] dialects' in Singapore), but since the 1990s, its focus has evolved to encourage the use of Mandarin by English-dominant Singaporeans[3]. Prior to government-led initiatives, however, there was already an impetus to speak Mandarin brought about by the Chinese Revolution of 1911. Initially, Mandarin and the other dialects were in diglossic opposition; the former was learnt in school, while the latter were acquired at home (Bao, 2015, pp. 30–31). Today, Chinese dialects are still spoken, but primarily by those from the previous and older generations, although there are some community-led revitalisation efforts. Within the Chinese community, therefore, the shift to Mandarin was concurrent with a shift to English. Figure 1.2 illustrates these societal language shifts. It presents census data of the language most frequently spoken at home by residents aged five years and older from 1980 to 2020. It can be observed that, across all ethnic groups, English is increasingly used as a home language, displacing the use of EMTs. At the same time, the 'Speak Mandarin Campaign' had caused a sharp decline in the use of Chinese dialects in the Chinese population and an increase in the use of Mandarin. In recent years, English has replaced Chinese languages and Tamil as the most frequently spoken home language for the Chinese and Indian communities respectively. This also means that there is an increasing

[3] The shift in focus of the 'Speak Mandarin Campaign' from 1990 is reflected in their slogans. The Chinese and English slogans for the campaign in 1979 were '多讲华语，少说方言' (*Speak More Mandarin, Speak Less Dialects*) and in 1984, '请讲华语，儿女的前途，操在您手里' (*Speak Mandarin. Your Children's Future Depends on Your Effort Today*). These contrast with the slogans after 1990, such as those in 1994/1995, ('华语多讲流利'; *Mandarin. Use it or Lose it*) and in 2006/2007 ('华语 *COOL*'; *Mandarin Cool!*), for example.

number of Singaporeans who acquire SgE as their first language and/or are English dominant.

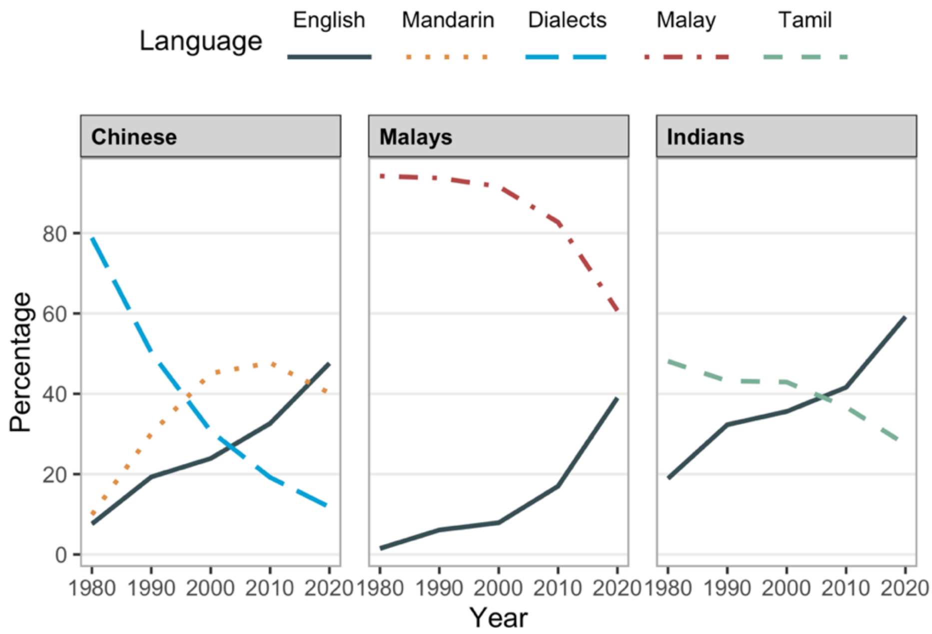

Figure 1.2 Language most frequently spoken at home (in percent) by resident population aged 5 years and over, from 1980 to 2020, grouped by ethnic group (Bao, 2015, p. 33; Department of Statistics, 1992, 2001, 2011, 2021).

1.2.3. Being multi(dia)lectal: Variation in Singapore English

The above has described how Singapore is multilingual and multicultural. The many ways of speaking a language, or being multi(dia)lectal, are discussed in the following sections, with a focus on variation in the use of SgE.

Owing to long-term language contact and the influence of local cultures, English in Singapore has undergone extensive structural nativisation, i.e., the emergence of 'locally characteristic linguistic patterns' (Schneider, 2007, pp. 5–6), resulting in a fossilised (or stabilised) 'culturally-grounded' English variety (Ho, 2001, p. 104). In the literature on varieties of SgE (e.g. Deterding, 2007b; Low & Brown, 2005), it is generally accepted that present-day SgE comprises two broad varieties: a standard variety, referred to as Standard SgE or Singapore Standard English; and a vernacular variety, called Colloquial SgE, Singapore Colloquial English or more commonly, Singlish. The standard variety is often assumed to conform generally to other more established standard varieties of English around the world that are used in the formal domains, especially in terms of vocabulary and grammar (Cavallaro & Ng, 2009, p.146; Low & Brown, 2005). It is the scholastic variety formally taught and assessed in schools, has overt prestige (Cavallaro et al., 2014; Cavallaro & Ng, 2009), and is explicitly regarded by the state as the legitimate and appropriate norm; in other words, the 'correct' or 'good' English. The vernacular variety, by contrast, has undergone substantial substrate-influenced restructuring across all linguistic domains (e.g. Bao, 1998, 2015; Deterding, 2005, 2007; Low & Brown, 2005). Despite being stigmatised by the state, the vernacular plays important social functions in the community. In addition to variation along the standard–vernacular dimension, there also exists variation between ethnic groups, as a result of the different EMTs being spoken. Even in careful or formal speech, ethnically distinctive features are not entirely absent, although the ethnicity of Singaporeans is more easily identified in informal or unselfconscious speech (Deterding & Poedjosoedarmo, 2000; Sim, 2019). The different ways by which accent features may vary between- and within-speakers of Singapore English are described in greater detail below.

1.2.3.1 Between colloquial and standard

Platt's SPEECH CONTINUUM (Platt, 1975; Platt et al., 1983) describes variation in SgE as consisting of a number of lects that are situated in a continuum, ranging from a basilect, which Platt described as barely comprehensible to speakers of established varieties of English (e.g. British and American English), to an acrolect which differs from higher sociolects of the established varieties mainly by the pronunciation (Platt, 1975, p. 363). Platt proposed that the socio-economic and educational background of a speaker contributes to the number and type of sub-varieties usable for functional use; the higher on the continuum the sub-variety is available to a speaker, the greater the overall range available. In other words, a speaker who has acquired the acrolect is presumed to also have basilectal 'Singlish' in their repertoire. In his example, younger Singaporeans who use acrolect in lectures and debates can, with ease, use the basilectal variety when conversing informally with friends or a waitress in a restaurant, whereas the same waitress would only have the basilectal variety at her disposal for all uses (Platt, 1975, p. 369).

Gupta (1991, 1994) applied Ferguson's (1959) use of DIGLOSSIA to describe the variation of English in Singapore. A diglossia, as described by Ferguson (ibid., p. 336), is a relatively stable language situation in which there is a superposed H ('high') variety that is learned largely by formal education and used for most written and formal spoken purposes. This variety is complementary with an L ('low') variety, which is used for ordinary, everyday conversation. Gupta regards the H variety of English in Singapore, which she termed Singapore Standard English (SSE), to be similar to other established standard Englishes, except for its phonology and a small number of cultural-specific lexical items. The L variety, which she referred to as Singapore Colloquial English (SCE), is primarily used in the home and in casual situations. Gupta argued that it is SCE and not SSE that is the normally used with small children outside of pedagogical situations, and therefore Singaporean children who are exposed to English from birth will speak SCE as their native language (Gupta, 1994, p. 7). A crucial difference between Gupta's DIGLOSSIA model and Platt's SPEECH CONTINUUM is that in the former, SCE is recognised as a native variety and assumes a social purpose; its use is a matter of personal choice rather than as a function of a speaker's educational level.

A third model, Pakir's (1991) EXPANDING TRIANGLES, can be regarded as a merger of the two models above. Pakir posits SgE as varying along two clines: formality (intimate to formal) and proficiency (rudimentary to advanced). SSE is situated at the top of the clines (i.e. formal and advanced), while SCE is at the bottom (intimate and rudimentary). Similar to Platt's model, speakers who are most proficient in English would have the biggest triangle that covers the full range of both clines, and therefore have the widest array of styles for their communicative purposes. Speakers with lower education level (used by Pakir as a proxy for English proficiency) have a smaller triangle with a more restrictive range of styles at their disposal. The difference between this model and Gupta's DIGLOSSIA model is that Pakir's model takes into account Singaporeans who have little or no access to SSE due to, *inter alia*, a lack of proficiency and education.

1.2.3.2 Recent descriptions based on indexicality

In recent years, two approaches based on indexicality (Eckert, 2008b, 2012; Silverstein, 2003), the first by Alsagoff (2007, 2010) and the other by Leimgruber (2009, 2011, 2013), were proposed to address the explanatory shortcomings of the earlier models and to reflect the changing language dominance and education level of Singaporeans. These perspectives complement the previous approaches that modelled language use at the level of distinct varieties (e.g. SSE versus SCE), by adopting a more 'micro-sociolinguistic view of variation' (Leimgruber, 2013, p. 103), through the examination of specific linguistic features. In particular, attention is given to the non-linguistic information and social meanings that the linguistic features index, and to how the features are used creatively in the construction of style and identity and in the adoption of particular stances, attitudes, and ideological orientations.

Alsagoff (2007, pp. 30–34) argued that in their use of English, Singaporeans exhibit varying degrees of SCE features within an utterance. She pointed out that the DIGLOSSIA model, which was the dominant model in the 1990s, could not account for the use of L (SCE) features in H-variety domains or vice versa. In other words, domain- or function-specific accounts of variation are inadequate in explaining the overlapping variations that exist *within* domains for the same speakers. In the proposed CULTURAL ORIENTATION MODEL (Alsagoff, 2007), and in its later iteration, the GLOCALISATION MODEL (Alsagoff, 2010), she recast variation in SgE as a negotiation of two counterpoised macro-cultural identities and perspectives in the midst of a tension of being global and being local. Variations thus exist when users style-shift along a 'multi-dimensional continuum of variation' (Alsagoff, 2010, p. 116) to negotiate a certain cultural identity, thereby including varying degrees of the linguistic features of SSE (which she referred to as International SgE) for a globalist orientation, and SCE (which she renamed as Local SgE) for a localist one. These two ends of the continuum are characterised by opposing features: the globalist end is associated with economic capital, authority, formality, distance and educational attainment, to name a few, whereas the localist end is associated with, for example, sociocultural capital, camaraderie, informality, closeness, and community membership (Alsagoff, 2010, p. 116). The degree to which speakers vary in their use of SSE or SCE features therefore depends on the cultural orientations they wish to adopt and the ideologies, values and practices that the specific linguistic features index. As Leimgruber (2013, p. 49) pointed out, however, the indexical features associated with the two ends of the continuum are still reminiscent of a diglossia in that one variety is more appropriate in a situational context than the other.

Leimgruber's (2009, 2013) approach to studying variation in SgE is similar to Alsagoff's model in that it, too, focuses on the social meanings that are indexed by the linguistic features. His approach, however, goes beyond the boundaries of cultural orientations to consider the wide-ranging socio-indexical properties of each SgE feature more broadly. Crucially, this means that linguistic features of SSE/International SgE can also index the attributes that are traditionally or typically associated with the linguistic features of SCE/Local SgE or vice versa, depending on the contexts in which they are used. His approach is directly aligned with 'Third-Wave' sociolinguistics (Eckert, 2012), which focuses on variation as 'a reflection of social identities and categories to the linguistic practice in which speakers place themselves in the social landscape through stylistic practice' (p. 94). Therefore, the use of particular SgE features can be interpreted to reflect the stances the speaker has adopted or the identity that is created, based on the social meanings that the linguistic features index. Such indexical associations between meaning and form, according to Silverstein (2003), can occur at different levels of abstraction or 'orders of indexicality'; a linguistic form gains higher-order indexicality when it gains new meanings that presuppose lower-order meanings. These multiple related social meanings can be further organised in what Eckert (2008b, p. 464) described as an INDEXICAL FIELD — 'a constellation of meanings that are ideologically linked.' Using hyperarticulated /t/ release as an example, as shown in Figure 1.3, Eckert showed how the feature is associated with clarity and emphasis in American English, and in turn its ideological associations allow speakers to employ /t/ release to index different social types, such as nerd girls and gay divas. In other words, the same variant might index different semantically related qualities depending on the context; it may, for instance, index educatedness and nerdiness when used by nerd girls, but prissiness when used by gay divas. The mutability of indexical signs, that is, the way social meanings can evolve by being interpreted and reinterpreted as they are used, is central to the 'Third-Wave' approach. In Singapore's context, SCE features that were once regarded as aberrant or a mark of the lowly educated (in Platt's model) has now become associated with and used creatively to signal a Singaporean identity or other culture-specific social types (Lee, 2022; Wong, 2006).

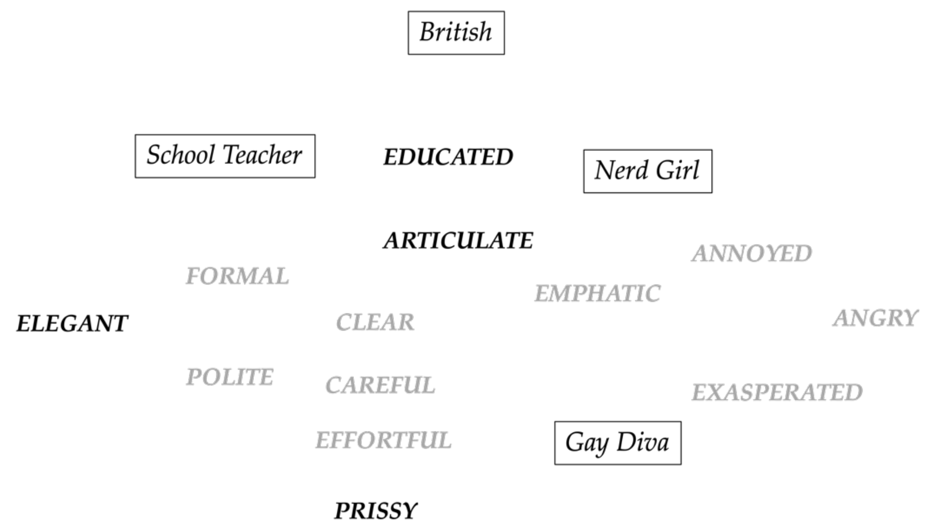

Figure 1.3 Indexical field of /t/ release. Boxes = social types, black = permanent qualities, grey = stances. Adapted from Eckert (2008b, p. 469). Reprinted with permission (License no. 5233841217957).

1.2.3.3 Ethnic variation

Some differences in the use of SgE are associated with ethnicity. Alsagoff (2007, p. 41), for instance, noted that some Singlish pragmatic sentence-final particles, such as *meh* (from Cantonese 咩, to indicate doubt) and *mah* (from Mandarin 嘛, to state the obvious) were more likely to be used by Chinese, whereas *sia* (from Malay *sial*, a swear word) was more likely to be used by Malays (Leimgruber et al., 2021). Ethnic variation has also been observed in the phonological domain. While the stabilisation of SgE as a dialectal variety has given rise to pan-Singaporean features, such as in the vowel inventory (Deterding, 2005, 2007a), some remained ethnically differentiated (Lim, 2000; Y. Y. Tan, 2010; cf. Kalaivanan et al., 2020). In the realisation of English /r/, for instance, Tamil-speaking Indian Singaporeans who used Tamil at home were found to be more likely to produce tapped [ɾ] than those whose home language was English (Starr & Balasubramaniam, 2019). Kwek (2015; also Kwek & Low, 2021) reported that many Chinese Singaporeans realised /r/ as a labio-dental approximant [ʋ], and they did so more than their Malay counterparts, who by contrast produced mainly the alveolar variant [ɹ] but also trill [r] and taps [ɾ]. Such ethnic-related differences are perceivable to Singaporeans; the findings from ethnic discriminability experiments using spoken stimuli (Deterding & Poedjosoedarmo, 2000; Huang, 2003; Lau, 2002; Sim, 2019; Y. Y. Tan, 2012) suggest that Singaporeans are generally able to accurately identify the ethnicity of Singaporean speakers based on speech alone.

There are, however, few established differences at present to suggest that there are definable or distinct (i.e. separate) ethnic varieties or 'ethnolects' (Clyne, 2000) in Singapore English (Leimgruber, 2013, p. 60).

While this may not be the case for all differential features, inter-ethnic differences in the use of present-day SgE could be attributed to cross-linguistic interactions between English and the different EMTs (Kehoe, 2015; Lleó, 2016; Paradis & Genesee, 1996), considering that many Singaporeans had learnt English sequentially in school or later in life. Later-generation Singaporeans who may be exposed to English as a first language or are English dominant could also acquire differential features from the accented input of their caregivers or peers, i.e., through vertical and horizontal transmissions (Kirkham, 2017; Sharma, 2011; Sharma & Sankaran, 2011; Stoehr et al., 2019). As is the case for other bilinguals, language experiences have been shown to modulate the language outcomes of Singaporeans. Sim (2015, 2019) examined the English accents of ten educated English-Malay bilinguals in Singapore (aged 19–28) who differed considerably in their language dominance as measured by four sub-components: language history, use, proficiency, and attitudes. His participants were at least early sequential bilinguals, if not simultaneous, having been exposed to both languages before the age of five years. The comparative acoustic analyses revealed several phonetic and phonological differences between the two groups, with Malay-dominant Malays exhibiting features that were explicated to be a likely result of Malay influence. In an ethnic discriminability task, the Malay-dominant bilinguals were also significantly more often correctly identified as ethnically Malay and were rated as having a significantly more perceivable Malay-accented English accent by naïve hearers. Those who were English-dominant, contrarily, had an English accent that lacked ethnic-specific features so much so that naïve hearers, including those who were English-Malay bilinguals, identified them as ethnically Chinese. Considering that these bilinguals had acquired both languages early, Sim posited that, rather than solely due to effects of cross-linguistic interactions, the use and maintenance of ethnically-marked features could be motivated by socio-indexical reasons; his Malay-dominant participants were associated with Malay-dominant families and social circles, and identified more with a Malay-speaking culture than an English-speaking one. The exposure to a dominantly

Malay-accented English accent could potentially explain how these differential features were acquired.

It is important to note that being generally ethnic-neutral in one's unselfconscious speech does not preclude one from employing ethnic-specific features in certain contexts for their social functions, for instance to signal ethnic membership. The same can be said about Singaporeans who display relatively greater use of ethnic-differentiated features, who could choose to adopt a style that is less ethnic accented, for example in formal contexts or in their careful speech (e.g. Deterding & Poedjosoedarmo, 2000; Sim, 2015, 2019). In other words, Singaporeans may variably use ethnic markers in their ethnolinguistic repertoire (Benor, 2010), including those that are not phonological, for their social meanings (Alsagoff, 2007, p. 41; Leimgruber, 2013). This is especially true for the present generation of Singaporeans who are increasingly more competent in English than their ethnic languages (Bolton & Ng, 2014), and who are more likely to have in their disposal alternative forms in their English repertoire that are imbued with various higher-order socio-indexical meanings, to be used variably and creatively for their various communicative purposes.

1.2.4. Section summary

It is evident from the discussion above that Singaporean children acquire their language(s) in a setting that is linguistically and sociolinguistically complex, and the English input from their caregivers, peers and other significant adults can be particularly heterogeneous. Figure 1.4 presents a simplified overview of the different ways by which accent features may vary between- and within-speakers of Singapore English, as have been described in detail above. Only full details for Malay Singaporeans are shown for the sake of brevity; the speech of Chinese and Indian Singaporeans can vary in similar ways. In the figure, under INTRA-ETHNIC VARIATION, the dotted lines linking 'Malay dominant' and 'English dominant' indicate that language dominance is a gradient phenomenon. Under STYLISTIC VARIATION, the bigger rounded rectangle encapsulating smaller lects illustrates how an utterance can contain features from any lects; in other words, stylistic variation occurs at the level of specific features. The dotted line separating 'SSE' from other lects indicates that standard features are accessible to Singaporeans who are more educated and/or proficient in English.

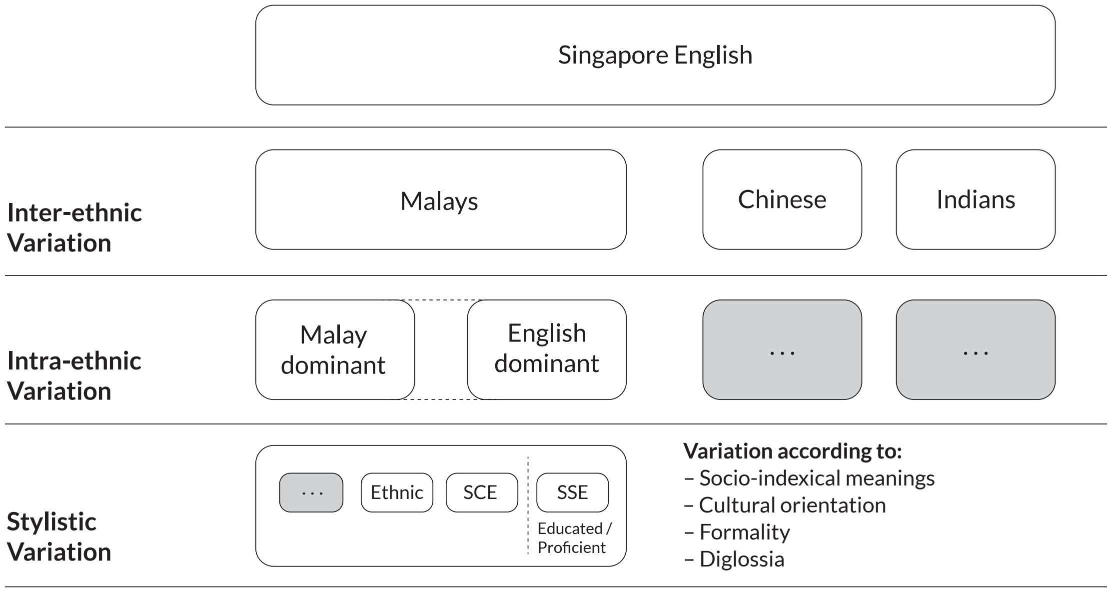

Figure 1.4 Variation in Singapore English.

Variation in Bilingual Outcomes

This final introductory section reviews key factors that contribute to variable development and outcomes in phonological acquisition by early bilinguals (i.e. exposed to two languages before the age of five). The purpose of the review is twofold: (1) to identify potential confounding factors that may have an influence on the results of the experiments in this thesis, and (2) to position input quality as a potential language-external factor that can significantly modulate language outcomes in phonological acquisition. In what follows, cross-linguistic interaction (CLI) and language-internal factors are first considered, before language-external factors, in particular quality of input.

1.3.1. Cross-linguistic interaction

While there is currently no conclusive evidence that suggests that early child bilinguals perform differently from their monolingual counterparts in their overall phonological ability as a result of acquiring two languages (see Hambly et al., 2013, for a review), some studies show that early bilinguals can differ from their monolingual peers in quantitative and qualitative ways that suggest cross-linguistic interactions (henceforth 'CLI'; see reviews by Kehoe, 2015; Kehoe & Havy, 2019; Lleó, 2016). Paradis & Genesee (1996) proposed that these interactions (or interdependence) are 'systemic', that is, occurring 'at the level of representation or competence, sustained over a period of time' (p. 3). These interactions may manifest in different ways (Kehoe, 2015, pp. 156–157; Paradis & Genesee, 1996, pp. 3–4; Lleó, 2016), and beyond the first three types in the list below originally proposed by Paradis and Genesee (1996):

i. **Transfer.** The incorporation of a grammatical property into one language from the other. Fabiano-Smith & Barlow (2010), for instance, reported that the phonetic inventories of their eight Spanish-English bilingual children with a mean age of 3;6 showed evidence of bi-directional transfer. They found the English fricative [ʒ] in the Spanish inventory of one child, the Spanish [ɾ] was found in five out of the eight bilingual children's English inventories, and one child had Spanish [β] in his English inventory (p. 93).

ii. **Acceleration.** The situation in which a property emerges in the grammar earlier than would be the norm in monolingual acquisition. Keffala et al. (2018), for example, found that the acquisition of singleton codas by Spanish-English bilingual children (ages 2;01–4;08) was accelerated relative to Spanish monolinguals' singleton coda acquisition. An acceleration effect was also observed in their acquisition of complex onsets in both Spanish and English.

iii. **Delay.** Or 'deceleration', to avoid the connotation of an impairment (Fabiano-Smith & Goldstein, 2010). Paradis & Genesee (1996, p. 4) originally defined DELAY as the slowing down of the *overall* rate of acquisition as a result of the burden of acquiring two languages. More recent studies (e.g. Tamburelli et al., 2015, p. 713) defined DELAY as the opposite of ACCELERATION; that is, a property that emerges in the grammar later when compared to monolingual norms. In her examination of the development of the vowel systems of three German-Spanish bilingual children at two time periods (at 1;10–2;0 and at 2;3–2;6), Kehoe (2002) found that the bilingual children did not show vowel length contrast in their production of German tense-lax vowels in monosyllabic words, whereas all three monolingual children did. She did not find systematic differences in the acquisition of Spanish vowels, which do not have vowel length contrasts, between monolingual and bilingual children. She interpreted the findings to be evidence of a delay in the acquisition of German vowel length contrast due to the influence of Spanish (p. 332).

iv. **Merger/fusion.** Kehoe (2015, pp. 156–157) and Lleó (2016) pointed out that some other interaction patterns in early bilingualism do occur that do not fit in the three interaction types above. One of which is merging patterns, which involve the coalescing of differences between languages in a grammatical property, which may result in a single grammar. Turkish-German preadolescent bilinguals in Queen (2006), for instance, were found to have fused Turkish and German intonation patterns into a single intonation grammar. In another study, Barlow et al. (2013) examined the laterals of Spanish-English bilinguals with a mean age of 4;7. Spanish /l/ is clearer than English /l/ in all syllable positions. They reported that the English prevocalic laterals of the bilinguals were as clear as monolingual Spanish laterals, but the English postvocalic laterals were darker and comparable to the postvocalic /l/ of English monolinguals. Barlow and colleagues interpreted the findings to be evidence of a merged phonetic category for English prevocalic /l/ but not postvocalic /l/.

v. **Deflection.** Kehoe (2015, p. 157) highlighted deflection patterns in some studies, which involve changes or exaggeration of differences in a property to increase contrast between the two language systems. Yang et al. (2015) examined the vowel development of a Chinese-English bilingual child who was exposed to Mandarin L1 at home and English sequentially from the age of 3;7 from native American English speakers in an English-language preschool. Although the child initially clustered acoustically similar English vowels with the L1 vowels, after two months, at 3;9–3;10, the child had drastically reduced his English vowel space relative to the L1 vowels (p. 10).

The restructuring by the child was interpreted by the authors as a means to create maximal contrast between the two vowel systems.

It is worth noting that DELAY and ACCELERATION are quantitative effects that characterise the developmental trajectory but not the outcomes. In other words, past a certain age, bilinguals and their monolingual counterparts should have developed the same phonetic inventory for their common language, with other factors being equal (Lleó & Cortés, 2013). The other effects, namely TRANSFER, MERGER and DEFLECTION are qualitative; they may be temporary, but they can also persist until a later age or even into adulthood (Marecka et al., 2019; Amengual, 2019; Fowler et al., 2008; Bosch & Ramon-Casas, 2011). Clearly the effects of CLI depend on what two languages come into contact, and therefore we may find differences in the language development and outcomes between bilinguals who differ in their other language. But even within bilinguals of the same two languages from one population, we may observe inter-speaker variation. Kehoe et al. (2004), for instance, found three different CLI patterns in the voice onset time development of four German-Spanish bilingual children aged 1;9–3;0, including delay, transfer, and nil effects of CLI.

1.3.1.1 Predictors of cross-linguistic interaction

Two primary variables, FREQUENCY and MARKEDNESS/COMPLEXITY have been shown to modulate CLI, and these are discussed in turn.

FREQUENCY as a language-internal variable refers to 'the low or high presence of a segment or phonological structure as determined by phoneme- or syllable-type counts' (Kehoe & Havy, 2019, p. 294). Studies on monolingual children have found that frequent structures are acquired before less frequent ones (e.g. Stites et al., 2004; Zamuner et al., 2005). Some work on bilingual children have also shown that a more frequent feature or structure in one language could potentially facilitate the acquisition of the same feature/structure in the other. Lleó et al. (2003), for instance, reported that their Spanish-German bilingual children (ages 1 to 3) produced more codas in Spanish than the Spanish monolinguals, and proposed that the high frequency of coda consonants in German could have facilitated the acquisition of Spanish codas.

FREQUENCY can also be considered as a language-external variable, as in the quantity of relative input of each language that the child receives, which has been the principal measure of language dominance in many studies. It has been shown that, generally, quantity of language exposure is positively correlated with rate of phonological development (Ball et al., 2001; Law & So, 2006; Mayr et al., 2015) and also phonological accuracy (En et al., 2014; Goldstein et al., 2010; Wrembel et al., 2019). In particular, Wrembel et al. (2019) looked at the foreign-accentedness of 32 early Polish-English bilinguals (mean age of 5.79 years) living in Great Britain who were exposed to Polish at home and English at school before the age of three. They found that the children's Polish production was affected by CLI with English, and the amount of Polish input they received at home was negatively associated with foreign-accentedness of their Polish. In bilingual contexts that involve heritage languages, monolingual-like development is not guaranteed if language input and output are limited, even if the language is acquired at birth (Kupisch, 2019, p. 464).

Jakobson (1968) claimed that the MARKEDNESS of sounds or sound distinctions correlates with the order of acquisition by children; a less marked entity is acquired earlier and is more common or frequent in the world's languages. A related concept, COMPLEXITY is defined in relation to allophony and allomorphy; a phonetic/phonological property that contains more elements, structure or is more difficult to produce is regarded as more complex (Kehoe, 2015; Kehoe & Havy, 2019; Lleó & Cortés, 2013). The two terms are related, in that one way to characterise the marked/unmarked dichotomy is that a linguistic property that is more complex is more marked (Rice, 2007, p. 80). Insights from laboratory studies of artificial-phonology learning reveal that formal complexity impedes acquisition, in that patterns become harder to learn as the number of relevant features increases (see Moreton & Pater, 2012), which reflect biases that may also constrain natural-phonology learning. While complexity may cause delays in bilingual acquisition (Kehoe, 2015), it can also have a facilitative effect. Tamburelli et al. (2015), for instance, found acceleration in the development of English complex clusters in simultaneous Polish-English bilingual children (aged 7;1–8;11) that suggests a facilitation effect of complexity from Polish to English. Specifically, they found that their Polish-English bilinguals outperformed the English monolinguals in the word-initial *s + obstruent* condition of a nonword repetition task. They argued that, because Polish's word-initial clusters are ontologically more complex as it also allows word-initial *obstruent + obstruent* clusters that are not found in English, the exposure to Polish clusters facilitated the bilinguals' acquisition of the simpler *s + obstruent* English clusters. Kehoe & Havy (2019) also found that French-speaking bilingual children (aged 2;6) who spoke languages that had high frequency/complexity codas and clusters had better coda presence and accuracy scores in French in comparison to French monolinguals.

1.3.2. Quality of input as a language-external factor

While many studies have attested the effects of CLI, it is not fully understood; findings on CLI are equivocal, and any attempt at making generalisations across studies is beset by differences in the methodology and bilingual contexts examined (see Kehoe, 2015). What remains clear, however, is that CLI and its predictors alone cannot fully explain variable outcomes in bilinguals. In certain contexts, such as in the case of Singapore, other social or language-external factors may play a greater role in modulating phonological development. As mentioned previously in Section 1.1, one under-researched language-external factor that this thesis seeks to explore is quality of input, which in the domain of phonological acquisition refers to the specific phonetic or phonological features of the input. Despite known between- and within-speaker variability in the speech of adult bilinguals (Amengual, 2019; Fish et al., 2017; Guion et al., 2000; Sim, 2019; Simonet, 2010a), studies that examined child bilingual production have often assumed a largely homogenous input. Perhaps in response to this, there is a small but growing body of work that foregrounds the direct role of input quality in early bilingual phonological acquisition. The following describes some of the contexts in which the qualitative attributes of input can be variable.

1.3.2.1 Non-nativelike input and unstructured variation

Bilingual input is 'noisy' (Byers-Heinlein & Fennell, 2014, p. 276); the bilingual child regularly encounters two languages, potentially from the same person, in the same environment, and within one utterance if the caregiver codeswitches. But even the phonetic input of each language can be variable. This is especially so for adult bilinguals who had acquired their second language (L2) later on in life and/or who may not have achieved proficiency in the L2. The phonetic input from these caregivers speaking in their L2 can be particularly inconsistent, and may exhibit non-nativelike phonetic characteristics as a result of, for instance, the imposition of L2 phonology onto the existing L1 system and CLI (Bosch & Ramon-Casas, 2011; Fish et al., 2017; Flege et al., 2003; Fowler et al., 2008; Khattab, 2011), such that they are perceived to have a 'foreign' accent (e.g. Flege et al., 1997; Guion et al., 2000; Piske et al., 2001; Yeni-Komshian et al., 2000). The degree of foreign accentedness can further differ between L2 speakers depending on factors such as age of L2 learning and amount of continued L1 use (see Piske et al., 2001). In their examination of the infant-directed speech (IDS) of late-L2 Spanish-English caregivers, Fish et al. (2017) found that, even with the exaggeration of voice onset time (VOT) in infant-directed speech, the bilingual caregivers' overall VOT for English /p, t/ in IDS was shorter than monolinguals' overall VOT for the same plosives in monolingual adult-directed speech. In addition, while monolingual caregivers produced significantly longer VOT for English voiceless /p, t/ than voiced /b, d/, which may help enhance infants' perception of voicing contrast, the effect was not observed in the bilingual caregivers, who increased the VOT of all stops in IDS to similar extents. Variability in the input, however, is not limited to late-L2 bilinguals. Another way caregiver input can be non-nativelike is through L1 attrition, which is commonly experienced by those who have moved into an environment in which their L1 is not (widely) used (Bergmann et al., 2016; Schmid, 2004). Moreover, even adult bilinguals who acquired their two languages early may exhibit variable production. Bosch & Ramon-Casas (2011), for instance, examined the production of /e/-/ɛ/ contrastive vowels in Catalan (which is not found in Spanish) by 16 early Catalan-Spanish adult bilinguals, half of them were raised in Catalan-speaking homes, while the others were raised in bilingual Spanish-Catalan homes or Spanish-speaking homes. All the participants were fluent and frequent speakers of Catalan. The authors found that while both groups produced separate /e/ and /ɛ/ categories at the acoustic-phonetic level, those who were not raised in Catalan-dominant homes were less stable in the phonological representation in their lexicon, and more error-prone in producing /e/ in words involving the /ɛ/ vowel.

Such inconsistencies and variability in the phonetic input affect language outcomes, for example by delaying phonemic category formation and/or stabilisation. Ramon-Casas et al. (2021) investigated the perception and production of the Catalan mid-vowel /e/-/ɛ/ contrast by 4- to 5-year-old early bilinguals who differed in their language dominance (L1 Catalan or Spanish), and found that Spanish-dominant bilinguals were more error-prone in their production of the /e/-/ɛ/ contrast and also showed a relatively smaller albeit unmerged acoustic distinction between the two vowels. The authors postulated that the variable performance of the Spanish-dominant bilinguals could be attributed to the Spanish-accented Catalan input that was extensively used at home and in their social environment, i.e., the kind of variable input described in Bosch & Ramon-Casas (2011) mentioned above. Another way language outcomes are influenced by non-nativelike input is that differential features in the input can be acquired. In other words, what may appear to be effects of CLI in a bilingual child can in fact be due to properties of the phonetic input. Stoehr et al. (2019) examined the effects of non-nativelike and attrited maternal input on children by investigating the production of VOT by Dutch–German bilingual preschoolers. These children acquired German as a heritage language predominantly from their mothers who spoke German as an L1. They acquired the majority language, Dutch, from their fathers who were L1 speakers of Dutch, and also from their mothers who were L2 speakers. They found that individual variation in the VOT production of these child bilinguals was associated with individual variation of VOT in their mothers' non-native speech in Dutch and their mothers' attrited speech in the heritage language German.

1.3.2.2 Socially-conditioned structured variation

Variation in caregiver input can also be structured and determined probabilistically by linguistic and social factors. Of particular interest is socially-conditioned variation in the input, which involves the presentation of alternative phonetic forms in the same linguistic environment that does not change the semantic meaning of the utterance but encodes some form of socio-indexical meaning. The following describes structured variation that may occur in the direct and indirect input from an individual (i.e. intra-speaker variation), and also between the significant people in the child's immediate environment (i.e. inter-speaker variation).

Intra-speaker variation in CDS. Adults often make modifications to their CDS. Acoustic exaggerations in CDS can convey emotional affect or engage the attention of the child (e.g. see Saint-Georges et al., 2013; Singh et al., 2002; Stern et al., 1982). Phonetic contrasts are often enhanced, which facilitates language learning (e.g. Englund, 2005; Kirchhoff & Schimmel, 2005; Kuhl et al., 1997; Sundberg, 2001). Modifications in CDS can also be a means by which social-indexical information is transmitted, and those that involve sociolinguistic variables are of particular interest here. Although previous studies have focused mainly on segmental modifications in the CDS of monolinguals (Foulkes & Docherty, 2006; Foulkes & Hay, 2015), the CDS of bilinguals in either language can also vary in similar ways, in that linguistic choices that involve sociolinguistic variables are often guided by the social-indexical meanings that are associated with the variants, and in line with community norms.

Foulkes et al. (2005) examined the use of standard versus other less prestigious and stigmatised local variants of (t) by mothers of children aged 2;0–4;0 living in Tyneside, England. They found that, not only did mothers in general use more standard [t] in CDS than in adult-directed speech (ADS), but more standard [t] was also used by mothers of girls and with younger children. That boys heard more local variants than girls was argued to be a way by which mothers tailor their speech to the developing gender of their child, in line with the gendered differences in the community. Smith and colleagues (Smith et al., 2007, 2013) also examined a variety of sociolinguistic variables in Buckie, Scotland in adults and children aged 2;6–4;2. One of the variables was the lexically conditioned *hoose* variable, which involved the alternation between the diphthong [ʌʉ] and the monophthong [u:] in the MOUTH lexical set of words like *house*, *down*. The latter variant is stereotypical of Scots or northern varieties of English and used most by working-class males in spontaneous informal speech. The authors reported that, not only was there more use of the standard variant in CDS than ADS and in CDS towards younger children, but there were also stylistic constraints on use. They found that caregivers used more of the local variant in contexts of play and routine than in those that involved teaching and disciplining, and so did their children. As Foulkes et al. (2005) pointed out, segmental choice in CDS must be ‘viewed with one eye on the social-indexical values of the alternatives’ (p. 198); caregivers in these studies used both standard and nonstandard forms in CDS according to the norms of the community, and this was argued to be important in helping children develop their sociolinguistic competence.

While bilinguals can also orientate towards STANDARD–NONSTANDARD or LOCAL–SUPRALOCAL forms in their CDS in either language, the linguistic choices of those in certain bi(multi)lingual contexts can also vary along an ETHNIC–MAINSTREAM dimension. As is the case of ethnic markers in SgE, differential features that emerge from language contact and acquisition can become 'enregistered' (Agha, 2007), which refers to 'processes and practices whereby performable signs become recognised (and regrouped) as belonging to distinct, differentially valorised semiotic registers by a population' (p. 81). Speech features that have emerged from effects of CLI and late L2 acquisition in one generation can be transmitted to and retained by later generations of proficient L1 speakers. They can further be reallocated with social meanings (Gnevsheva, 2020; Sharma & Sankaran, 2011) to be used creatively as part of their ethnolinguistic repertoire (Benor, 2010; Eckert, 2008a; Hoffman & Walker, 2010), thereby strengthening the associations of these differential features with the particular ethnic or cultural group. Features that characterise British Asian English, the English spoken by South Asian communities in the United Kingdom, are such examples. The varieties of British Asian English show strong influence from South Asian languages, such as in the use of retroflex coronal stops and clear allophones of coda /l/ (e.g. Khattab, 2002; Kirkham, 2017; Sharma, 2011; Stuart-Smith et al., 2011). Sharma (2011) examined the variation in the use of these ethnically-marked variants in the production of /t/, coda /l/, and the FACE and GOAT vowels in four second generation British-born Asians (younger and older males and females) towards different interlocutors. She found that some of the speakers were more strategic and differentiated in their use of the different variants; they were generally more 'ethnic' in their use of variants with Asian speakers and with their direct family members, and more 'mainstream' with Anglo interlocutors.

Socially-conditioned allophonic variation in the input not only reveals to the child the variable rules, i.e., the linguistic context in which variability is permitted (Roberts, 2013, p. 272), but also, through the child's experience with its use in context, helps create form-meaning connections, as the child associates the alternative phonetic forms with the particular contexts and social variables in which they occur (Foulkes & Hay, 2015, p. 295).

Inter-speaker variation in CDS. Systematic differences can also exist in the input between caregivers. Many children, as mentioned in the Introduction, are raised in mixed-accent or multi-dialectal environments (e.g. Durrant et al., 2015; Floccia et al., 2012; Kartushina et al., 2021; Levy et al., 2019). Thomas & Scobbie (2015) examined the FACE and GOAT vowels of a Glasgow boy aged 3;1 raised by parents with different British English accents; his father spoke Scottish Standard English (ScSE), while his mother's accent closely resembled Southern Standard British English (SSBE). The child's vowel inventory revealed features from both accents; for the FACE lexical set, the boy used the SSBE [eɪ] predominantly, reflecting the accent of his mother. The vowel for the GOAT lexical set, however, was more mixed, but the boy used ScSE [o] in a slight majority of the tokens. Inter-speaker differences between bilingual caregivers are commonplace (e.g. Fish et al., 2017; Khattab, 2011; Stoehr et al., 2019), given the large individual variability within and between bilingual individuals and groups, as discussed in detail above.

One source of inter-speaker variation that can greatly influence language outcomes is the wider community, particularly the significant adults and peers in the child's most immediate environment with whom the child has frequent, direct contact. Attendance at a preschool, nursery or day-care, for example, necessarily exposes a child to accents or accent features that can qualitatively differ from the input received at home. Many studies have shown that, when a child is faced with such competing alternatives, the speech model of peers or the dominant community norms often supersede caregiver norms. Kerswill & Williams (2000), in their investigation of koineization (the development of a new variety as a result of dialect contact) in the Milton Keynes New Town, for instance, found that while the 4-year-old children's production patterns of the (ou) variable (the fronting and unrounding of the offset of the diphthong /əʊ/) correlated with their caregivers' production, the production of the vowel by 8- and 12-year-olds oriented towards the variants of the New Town koine and was less affected by their caregivers' pronunciation. The authors noted that '[s]tarting from a parent-centred orientation, young children expand their range of social contacts to other, often older children, eventually forming distinctive teenage peer-groups, with their attachment to youth culture and opposition to adult norms.' (p. 68); their changing social orientation and the concomitant preference for norms conveyed by their peers were argued to be part of their maturing sociolinguistic competence. Specific speech features of bilingual children raised by foreign-born parents and/or in an ethnic minority setting have also been found to converge to mainstream or monolingual norms after accumulated experience with the host language (e.g. Mayr & Siddika, 2018; McCarthy et al., 2014; Sharma & Sankaran, 2011). Khattab (2002; see also Khattab 2011), for instance, examined the acquisition of /l/ in three English-Arabic bilingual heritage speakers born and raised in Yorkshire by Lebanese parents who had lived in Yorkshire for over ten years. The children in her study were 5, 7 and 10 years old. In the Yorkshire dialect, /l/ is reportedly dark in all word positions, which contrasts with the clear /l/ of Arabic. The Lebanese parents in the study had used clear-l word-finally in their English speech to different extents. Their bilingual children, contrastingly, produced mainly dark-l or vocalised-l, similar to their English monolingual peers. If their peer group was more closely affiliated with their ethnic heritage, however, children may use ethnically-marked features more frequently, rather than adhere to mainstream norms (e.g. Kirkham, 2017; Sharma, 2011).

Stanford (2008), however, pointed out that the parent/peer distinction should be viewed as a 'culture-dependent instantiation of a more general pattern of child dialect acquisition' (p. 568), one that involves 'learn[ing] and construct[ing] dialect identity as process of distinction between several groups' (p. 567). In his study of the Sui people, an indigenous minority in rural parts of Guizhou Province of Southwest China, Stanford described a case in which children had to choose between the dialect norms belonging to one group that consisted of the father, male adults, older siblings and older children in the local village, and the norms belonging to the other group, which consisted of the mother and other women who have in-migrated to the local village as a result of exogamous customs, and other children who use the dialect features of those women. Instead of orientating towards either parental or peer norms, Sui children from as young as three were found to construct their linguistic identity along clan lines, by eventually choosing their father's clan dialect features (i.e. the former group) over the features associated with their mother's clan, which they had first acquired from their mother. What can be gleaned from Stanford's case study is that the way social pressures from peers and the wider community interact with language acquisition is less than straightforward.

1.3.3. The interplay between language-internal and language-external factors

It is likely that in any given bilingual context, language-internal and language-external factors simultaneously modulate early phonological acquisition, but in complex ways to the extent that outcomes are not always predictable. Mayr & Montanari (2015) examined the VOT production of two English–Italian–Spanish simultaneous trilingual sisters (aged 6;8 and 8;1) in Los Angeles, California. The children heard Italian from their native Italian-speaking mother, who moved to the United States at the age of 26; native American English, the host language, from their father who also spoke some Italian, and also from other native speakers in school and the wider community; and native Spanish from their nanny, who did not speak Italian nor English. In their formative years, the girls received exposure to English, Spanish, and Italian 24%, 33% and 43% of the time. The girls also attended an Italian-English dual language programme. Although the classroom instruction was mainly delivered in Italian, especially in kindergarten and first grade, many of the children in school were English dominant. In their investigation of the girls' word-initial stop production, the authors found that, due to the 'majority language effect' and a stable input setting, their English stop production was target-like. By contrast, despite the children hearing Italian since birth on a regular basis from native and heritage speakers, not all their Italian stops were target-like; instead, their Italian production showed effects of CLI from English, which the authors attributed to the regular exposure to English-accented Italian from their English-dominant peers. The girls' Spanish stops /p t k/ closely resembled their nanny's stops, but their Spanish voiced stops were not target-like, which could be due to the limited input. Importantly, the authors noted that their Spanish productions were largely unaffected by the other two languages, which led them to hypothesise that the input from a single source may be conducive to phonological acquisition as it is less variable, and therefore could have inhibited CLI.

Lleó & Cortés (2013) attempted to model the hierarchy of factors that may predict bilingual phonological outcomes, by seeking generalisations across studies that examined the production of several phonological phenomena by two distinct but complementary bilingual populations. The first were seven German-Spanish bilinguals aged 1;6 to 3;0 who had similar family and social conditions: a subset of children in this group had a Spanish-speaking mother and a German-speaking father, and lived in Hamburg, Germany, in which the larger social context was monolingual German. The other children were the linguistic mirror-image of those previously described; their mother was German-speaking and their father was Spanish-speaking, and they lived in Madrid, Spain, in which the language of the wider community was Spanish. The similarities in the external factors for this group of children allowed them to focus on language-internal factors. The second population comprised 40 Catalan-Spanish bilingual children aged 3;0 to 5;0 who differed in their language dominance and social contexts: based on the language spoken by their parents, some children were Catalan dominant, while others were Spanish dominant. Furthermore, some children resided in districts with a stronger presence of Spanish, while some others, in districts with a stronger presence of Catalan. This allowed the authors to examine the external factors and ignore internal ones. Overall, between the language-internal variables, they found that FREQUENCY (i.e. the high or low presence of the phonological features/structures in Spanish and German that were examined) was the most crucial factor in accounting for the variable outcomes in the German-Spanish bilinguals. Between language-external factors, they found that the dominant language in the social environment (i.e. the district of residence) had the greatest explanatory power, followed by the language spoken with friends and mates, and the least important was the family's language, i.e., the language spoken by parents to each other.

1.3.4. Section summary

This section established the key factors that contribute to variability in early bilingual phonological acquisition, which are considered in the relevant experiments in this thesis. It was shown that the two phonological systems of a bilingual child can interact in quantitative (delay, acceleration) and qualitative ways (transfer, merger, deflection), and the type and extent of these interactions were shown to be modulated by language-internal factors such as frequency and markedness/complexity, and/or by language dominance as measured by quantity of input. Language-external factors, specifically input quality, were shown to also potentially contribute to variable language outcomes. Variability in the qualitative attributes of input can be non-nativelike and unstructured, but may also be structured and determined by linguistic and social factors. Finally, it was shown that both language-internal and language-external simultaneously modulate early phonological acquisition. The next chapter reports the development of the caregiver–child speech corpus.

CHAPTER 2

The Speech Corpus

A corpus of spoken adult/caregiver and child language data was developed for the production studies (Experiments 1, 3 and 4). The data were collected during fieldwork conducted in Singapore between March 2019 and June 2019. Ethical approval was obtained from the Ethics Committee for the School of the Humanities and Social Sciences (approval no. 19/199). The data collected were handled and stored in compliance with data protection guidelines (i.e. anonymised, encrypted/password protected and kept in a secure location only accessible by the author). The following sections first describe the speakers that were included in the corpus. Its contents, that is, the phonological and phonetic features investigated and the different speech data types that were elicited, are then presented, before details about the elicitation techniques and procedures that guided the collection of the speech data. The chapter closes with a description of the scope of the thesis and the motivations behind the four experiments that follow.

Participants

Families from the three major ethnic groups (i.e. Chinese, Malay and Indian) and their children who were above 2;0 and had not started attending primary school[4] were recruited in Singapore. The selection criteria were:

1. Child is above 2;0 and has not started attending primary school. If the family has more than one child, their firstborn has to satisfy this criterion.
2. Child is developing typically (i.e. no known developmental disabilities or speech/hearing impairments).
3. Both caregivers and child are born and raised in Singapore.
4. Caregivers must speak Malay, Tamil or Mandarin Chinese as their ethnic mother tongue.

Participants were mainly recruited through word of mouth and social media. Some Malay families were recruited through a Malay-Muslim bilingual preschool. A total of 74 families took part in the study, but only 55 families (56 children in total) met all the criteria and had also completed the questionnaires and the vocabulary checklist described below. Of

[4] Children in Singapore only enter primary school upon the year they turn seven.

the 19 families that were excluded from further analyses, six families had firstborns who had started attending primary school, and three families had one caregiver who was not born and raised in Singapore. The remaining ten families met the recruitment criteria but did not complete the questionnaires and/or the vocabulary checklist. The details of the caregivers and child participants from the 55 families are summarised in Table 2.1 and Table 2.2 respectively; further information about each family can be found in Appendix 2A. The methods through which information about the participants was obtained and specific details on the Bilingual Language Profile score, socioeconomic status, and language use and vocabulary size measures are explained in the following sections.

Table 2.1. Demographic characteristics of caregivers (N = 110).

Variable	***n***	**Median (range)**	**Mean (*SD*)**
Ethnicity: Chinese/Malay/Indian	69/38/3[†]		
Age (in years):			
Mothers		33 (28–41)	33.12 (2.93)
Fathers		34 (29–44)	35.22 (3.68)
Bilingual Language Profile score:			
Mothers		60.76 (-58.66–150.84)	58.61 (45.53)
Fathers		47.14 (-143.03–166.18)	50.05 (59.09)
Difference within families		24.88 (0.27–114.24)	33.97 (28.48)
Bilingualism type (mothers/fathers):			
Simultaneous (2L1 < 3;0)	31/29		
Early sequential (L2 < 5;0)	18/19		
Late	6/7		
Education level (mothers/fathers)*:			
Tertiary	4/9		
Bachelor’s	36/31		
Postgraduate (Diploma)	5/5		
Postgraduate (Master’s/PhD)	10/9		
Socioeconomic status score:		22 (16–31)	21.95 (3.08)

Note: [†]One family with inter-ethnic parents (ethnically Chinese mother and Indian father). *The education level of one father could not be ascertained.

Table 2.2. Description of child participants (N = 56) including demographic characteristics and information on age of acquisition, language use and vocabulary size.

Variable	*n*	Median (range)	Mean (*SD*)
Ethnicity: Chinese/Malay/Indian	36/19/1		
Age (in months)		42.00 (25–76)	44.66 (14.08)
Gender: Male/Female	30/26		
Age of acquisition (in months):			
English		0 (0–36)	4.88 (9.72)
EMT		0 (0–48)	8.21 (12.02)
Language use (% of time):			
English		79 (11–96)	73.00 (19.75)
EMT		14 (2–82)	22.29 (19.40)
Vocabulary size:			
English		864.5 (216–1226)	860.61 (274.27)
EMT[†]		239 (0–1222)	363.44 (349.10)
Total		1180 (504–2399)	1225.95 (538.19)

Note: [†]The Tamil vocabulary size of the only Indian child was not collected.

2.1.1. Demographic information and measurements of language experience and development

Caregivers were required to complete three standard questionnaires to aid understanding of their and their child's language backgrounds. Prior to the recording session, each adult participant was asked to complete the Bilingual Language Profile (Birdsong et al., 2012) that was hosted on Google Forms (Appendix 2B). The two other instruments were the Child Language Experience survey and a vocabulary checklist, which were completed by mothers after the recording session. Key findings from these instruments were reported in Table 2.1 and Table 2.2 above. These three instruments are described in detail below.

2.1.1.1 *Bilingual Language Profile*

The language dominance of the caregivers was ascertained through the Bilingual Language Profile (BLP; Birdsong et al., 2012), following Sim (2015, 2019). The BLP is a self-report tool that assesses language dominance through four sub-components, namely language history, use, proficiency and attitudes. The dominance scores were automatically tabulated, and possible scores ranged from –218 (Malay-dominant) to +218 (English-dominant); the use of a continuous measure reflects the view that dominance is seen as a continuum rather than a dichotomy (Grosjean, 2008).

2.1.1.2 Child Language Experience survey

A Child Language Experience survey (Appendix 2C) was developed for this corpus with reference made to existing instruments that consider language use within multilingual contexts (e.g. Law & So, 2006; Liu & Kager, 2017; Tan, 2011). It elicited parent-reported information about the child's language history, use, proficiency and attitudes, reflecting broadly the four sub-components of the BLP, although unlike the BLP this survey was not intended to generate a composite language dominance score. The survey also took into account an ambient language environment that is potentially multi-dialectal, by requiring mothers to indicate the specific varieties of languages (e.g. Singaporean English, Mainland Chinese, Filipino English) that their child was exposed to.

In the first part of the survey, which elicited details about the child's language history, mothers were asked to list all the varieties of languages their child know/speak and their age of first exposure. Information about the child's nursery or preschool was also obtained. This included the amount of time per week that the child spent at the preschool, the varieties of languages spoken by the child's three main caregivers or teachers, and details about any language classes that the child might be attending. The child's language use was calculated from an accumulated measurement of the type (i.e. variety) and estimated amount and proportion of time for which the language variety was used. Specifically, parents were asked to report the languages and specific varieties that their child used with significant adults and children (input and output, both direct and indirect), the estimated percentage of the time that each language/variety was used, and the time spent with these people in hours per week. The calculation also included the child's language use in self-interaction and consumption of media. Finally, the child's language proficiency with regard to speaking and understanding, as well as their language attitudes in terms of cultural identification and preferences, were asked through rating-scale questions similar to the items in the BLP.

The family's socioeconomic status (SES) was also ascertained through the survey by the inclusion of the Family Affluence Scale (FAS) (Currie et al., 1997, 2008; Hartley et al., 2016), an established measure of adolescent SES. The FAS assesses SES by aggregating information on material affluence based on the material condition of the household. Some minor modifications were made to the original FAS. Specifically, the question in the original FAS, 'Do you (the child) have your own bedroom for yourself?' was removed. This item was deemed less relevant for very young children, who may share a bedroom with their caregivers. Moreover, housing type is more indicative of the SES of the caregivers in Singapore, since it is positively correlated with household income. Therefore, the item was replaced with the question, 'What type of home does this child live in?'. The question 'Do you pay people from outside the family to work at your home on a regular (that is, on a daily or weekly) basis?', which was considered in an updated version of the FAS (Hartley et al., 2016), was added. This study also included education level and profession of the parents as part of the measure. These items, which can be found in Part 5 of the Child Language Experience survey, generated a composite score, with the highest possible SES score being 35.

2.1.1.3 Expressive vocabulary size

Several studies have found a relationship between the size of a child's productive lexicon and phonological ability (e.g. Kehoe & Havy, 2018; Vihman, 2016). At the time of the data collection, there was, however, no established way to measure productive or expressive vocabulary for children of the age range in this study (Milton & Treffers-Daller, 2013); standardised measures like the Peabody Picture Vocabulary Test or the Renfrew Word Finding Vocabulary Test are not measures of vocabulary size. Since the main criterion of these tests is frequency (i.e. how common the lexical items are), for this study, productive vocabulary size was measured by a self-report checklist comprised of three lexical sets (Appendix 2D). The first set was the local variant of the standardised MacArthur-Bates Communicative Development Inventories adapted by the National University of Singapore (NUS MB-CDI) meant for children from 0 to 36 months. Two other sets of high-frequency words were taken from the wordlists of the international Cambridge English Qualifications assessments (Cambridge English, 2019) meant for children in kindergarten to lower primary levels (A1 Movers), and lower to upper primary levels respectively (A2 Flyers). Words from these three sets were high-frequency words that children were expected to know at each level. Items for older children (i.e. A2 Flyers) were included to account for the potentially larger vocabulary size of older and/or highly English-dominant children and to avoid ceiling effects. The latter two sets were adapted to the Singaporean context and translated into Mandarin Chinese by the author and into Malay by a Malay speaker. Unfortunately, no Tamil speakers were available to translate the lexical sets into Tamil. The translations were checked by two highly proficient speakers of Mandarin Chinese and two speakers of Malay, and subsequently by two English-Mandarin bilingual mothers of young children. The final vocabulary checklist contained a total of 1226 items in the three languages. Multiple linear regression analysis performed using R statistical software (R Core Team, 2020) and the 'lme4' package (Bates et al., 2015) on the vocabulary scores administered to 59 children (all of the children in the corpus whose vocabulary size was measured) revealed that age and amount of exposure to English were statistically significant predictors of the English vocabulary scores ($R^2 = 0.42$; age: $\beta = 0.60$, $p < 0.001$; English use: $\beta = 0.26$, $p < 0.05$). Ethnic mother tongue use and age as main effects were also significant predictors of ethnic mother tongue vocabulary scores ($R^2 = 0.26$; age: $\beta = 0.27$, $p < 0.05$; ethnic mother tongue use: $\beta = 0.48$, $p < 0.001$). These results suggest that the vocabulary checklist is adequately discriminating between the participant groups of interest included in this study, at least for the purpose of controlling for lexicon size in later experiments.

Speech Features, Stimuli and Materials

This section describes the contents of the speech corpus. It details the segmental and prosodic features of interest, as well as the stimuli and materials through which these features were elicited.

2.2.1. Phonetic and phonological features

While much is known about the distinctive features of SgE, there exists an immense range of variation within and between the speech of individuals, as has been described in the Introductory chapter (§1.2.3). Moreover, very little about inter- and intra-speaker variation in child-directed speech that is derived from or modulated by social factors is currently understood (Chevrot & Foulkes, 2013; Foulkes & Vihman, 2015; Kehoe, 2015;

Stoehr et al., 2019). For these reasons, a broad selection of phonetic variables across a variety of speech styles was elicited, in hope that the corpus would be a versatile resource for the testing of research hypotheses that are not limited to those that this thesis sought to answer. The phonological features that were chosen for structured elicitation were thought to have a greater likelihood of exhibiting inter-adult differences, particularly because many of them are phonetic traits that could have arisen through language contact and acquisition. These features are described in turn below. Among the included variables, l-allophony and coda oral stops are the two main features examined in the four experiments herein; more details about the motivations for the experiments can be found at the end of this chapter.

2.2.1.1 *Segmental features*

L-allophony. Cross-linguistically, alveolar laterals differ with regard to their degree of velarisation and/or pharyngealisation, with some languages having a darker (more velarised or pharyngealised) variant than others (Recasens, 2004, 2012), which is articulatorily characterised by a greater degree of tongue predorsum lowering and of postdorsum retraction towards the uvular area or upper pharyngeal wall. Some varieties of languages exhibit a clearer or darker variant in all syllable positions, while in others the two variants are syllabically conditioned (Carter & Local, 2007; Kirkham et al., 2020). The laterals of Standard Southern British English (SSBE) and General American English (GA), for instance, are described to be clearer at the onset but darker at the coda position. Syllable-final /l/ in SgE, by contrast, tends to undergo l-vocalisation, a process by which the tongue tip contact with the alveolar ridge is absent and the lateral is replaced by either a (labial-)velar approximant or a back vowel or semivowel (e.g. *hill* [hiu]). Coda laterals may also be deleted or assimilated to the nucleus after back vowels (e.g. *ball* [bɔː]) or after a schwa (e.g. *little* [lɪtə]; syllabic [l] does not typically occur in SgE; (Deterding, 2007b; K. K. Tan, 2005; L.-H. Wee, 2008). Sim (2015, 2019) found that the English coda laterals of Malays were less likely to be vocalised or deleted, but the laterals of Malay-dominant Malays were phonetically clear. This is likely to be a Malay-derived phonetic trait, since Malay laterals are clear in all syllable positions (Clynes & Deterding, 2011; Yunus Maris, 1980). The laterals of English-dominant Malays, contrastingly, showed allophonic velarisation (i.e. darker in the coda). No study has yet examined the /l/ of Indian Singaporeans, but descriptions of Indian English and also studies on British Asians of South Asian heritage show that clear-l and also retroflex [ɭ] are variably used syllable-finally (Sailaja, 2009; Sharma, 2011).

Oral stops. Word-initial fortis stops /p, t, k/ in SgE have been observed to be only slightly aspirated, and to a lesser degree than the same stops in SSBE (Deterding, 2007b). This is especially so for Malay-dominant Malays (Lau, 2002; Sim, 2015). This could be due to the influence of Malay voiceless stops, which are similar to English stops in their places of articulation, but are unaspirated (Clynes & Deterding, 2011; Othman & Atmosumarto, 1995). The lack of aspiration in word-initial stops may also be observed in Tamil speakers, as the same stops in Tamil are slightly aspirated, if not unaspirated (Keane, 2004).

Word-final oral stops in SgE tend to be unreleased (or inaudibly released) or replaced by a glottal stop, and unreleased stops are also often accompanied by glottal reinforcement. In addition, syllable-final voiced obstruents are often devoiced (Bao, 2003; Deterding, 2007b; Gut, 2005). Bao (2003, p. 29) further added that this feature is widely attested in all social strata of the community and found in both formal and informal speech, such that the atypical release or aspiration of coda stops can be interpreted to index a pretentious or pedantic stance in some contexts (Leimgruber, 2013, p. 66). The variable feature of coda stop nonrelease could be attributed to substrate influence of the categorically unreleased coda stops of Bazaar Malay (and Malay, its lexifier) and Hokkien (Bao, 1998), which were the intra- and inter-ethnic *lingua francas* before being displaced by English in the 1970s.

Dental fricatives. Th-stopping, the realisation of dental fricatives /θ, ð/ as stops [t, d], and th-fronting, the realisation of /θ, ð/ as [f, v], are common in many dialects of English (Wells, 1992), and also in SgE, although not categorically so for all Singaporeans. In the speech of one speaker alone, Deterding (2007b, pp. 15–17) found the use of [θ, t, f] for <th> to be highly variable and potentially constrained by phonological and lexical factors. Moorthy & Deterding (2000) also found their use to vary according to context: they found that the Singaporean undergraduates in their study used more dental fricatives in a formal conversation with a British lecturer compared to speaking with a Singaporean student that they were familiar with, where th-stopping was more frequent.

Vowels. The vowel inventory of SgE is much smaller than SSBE or GA (Deterding, 2007b, pp. 25–26; Leimgruber, 2013, pp. 64–65), as can be observed in Table 2.3. Compared to these two varieties, in SgE there is an absence of phonemic length and quality distinctions between tense-lax pairs (e.g. *beat* and *bit* are homophones), /æ/ is merged with /ɛ/, and /eɪ/ and /oʊ/ are monophthongised to [e] and [o] respectively. /eɔ/ is rare or even non-existent (Lim, 2004). There may be inter-speaker variation according to language dominance and ethnicity. Sim (2015, p. 31) found that while his Malay-dominant participants conflated the vowel pairs even in careful speech, their English-dominant counterparts distinguished all the monophthongs in terms of both vowel quality and quantity in their speech production (see also Lau, 2002). In addition, for some Malays, in certain lexical items in which /ɛ/ is used, such as *bread* and *umbrella*, a more closed /e/ was used instead. Deterding (2007a) examined the differences in vowels of the three major ethnic communities and also found that not only did his Malay participants conflate the tense-lax pairs, the realisation of /ɜː/ was more fronted, almost clustering with /ɛ/ and /æ/.

Table 2.3. Vowel inventory of Singaporean English.

	Front	Central	Back
Close	i		u
Close-mid	e		o
		ə	
Open-mid	ɛ		ɔ
Open		ʌ	
Diphthongs	ɔɪ aɪ ɪə ʊə au		

Other Indian English features. Very few studies have examined the ethnically distinct features in the English spoken by Indian Singaporeans, although features of varieties of Indian English are well documented (e.g. Sailaja, 2009; Sharma, 2011; Stuart-Smith et al., 2011). Some of these features were examined: other than coda /l/, which can be clear or retroflex as described above, /t, d/ are commonly replaced by retroflex [ʈ, ɖ]. The rhotic consonant /r/ may be realised as tapped [ɾ] or trilled [r], the former being more common in the speech of Tamil Singaporeans (Starr & Balasubramaniam, 2019). Indian speakers may also not differentiate between /w/ and /v/, and the voiced labiovelar approximant [ʋ] is sometimes used instead.

2.2.1.2 Prosodic features

Prominence and intonation. Word-level prominence in SgE differs from other standard varieties of English like SSBE and GA. There is arguably no clear stress pattern; syllables of a polysyllabic word may be perceived as equally stressed, and when there is perceivable stress, its placement can be on a different syllable from other varieties of standard English (Deterding, 1994, 2007b; Low, 1998). Some recent work by Ng (2011, 2012, 2019), however, characterised a predictable relationship between (underlying) lexical stress and tone in colloquial SgE at the level of the prosodic word, which was generalised as: a high tone (H) is assigned to the final syllable of the prosodic word, a low tone (L) is assigned to initial unstressed syllables, and a mid tone (M) is assigned to all remaining syllables in between. Her examples, *I see*, *icy* and *eye sea* contrast in their tones, which are LH, MH, HH respectively. However, Chong and German, in their description of the intonational system of SgE using the autosegmental-metrical framework (A. J. Chong, 2013; A. J. Chong & German, 2015, 2017, 2019; German & Chong, 2018), demonstrated that the relationship between stress and F0 is less than straightforward when it is examined at the post-lexical level. They proposed that variation in F0 is determined by a unit of phonological structure called the accentual phrase (AP), which typically consists of a content word and any function words to its left, and is marked by a low and high tone on its left and right edges respectively. Their analyses revealed that whereas H is always aligned to the right edge of the AP in the initial position of an Intonational Phrase regardless of the underlying lexical stress, F0 showed more sensitivity to a stressed syllable in non-initial APs more often. In particular, in contrast with Ng's analysis that stressed syllables are assigned a mid tone, Chong and German found considerable variation in the tonal alignment within utterance-medial APs, and that the L tone could align with the stressed syllable of the content word.

There is potential variation in the tonal melody, and tonal scaling and alignment of tonal targets at the phrase level by Chinese and Malay Singaporeans. Some intonational features unique to the Malays were reported in previous studies on SgE. Lim (2000), for instance, found that for her Malay participants, the alignment of the F0 peak in mono- and disyllabic utterance-final words was much later than their Chinese and Indian counterparts. A few studies have also found that, whereas the right edge of a content word is usually marked with a high tone in SgE (A. J. Chong, 2013; Deterding, 1994; Ng, 2011), some of the utterance-medial H tones may be unspecified in the English spoken by Malay-dominant Malays, resulting in stretches of level tones (Sim, 2015; Y. Y. Tan, 2010, pp. 180–182). In relation to the complex relationship between stress, prominence and intonation as described above, there could also be potential intra- and inter-ethnic variation in the tonal realisations between tri-/tetrasyllabic stress-initial and stress-medial non-compound words (e.g. *calculator – binoculars*), and between tri-/tetrasyllabic non-compound and closed compounds or words that can be decomposed into two nouns (e.g. *crocodile – fingernail*).

2.2.2. Materials and types of speech data

In the interest of keeping the elicitation tasks reasonably manageable for the participants, some SgE features described above, especially those that are more ethnically marked (e.g. retroflexion), were elicited only from speakers of the respective ethnic mother tongue or from members of the specific ethnic group. In addition, it was mentioned above that EMT-dominant Malay and Indian Singaporeans were found to be more likely to exhibit the use of differential features that could potentially be derived from the influence of Malay and the Indian languages (e.g. Lau, 2002; Sim, 2015, 2019; Starr & Balasubramaniam, 2019). To further investigate the effects of long-term language contact and bilingualism on the acquisition of some of these speech features, Malay and Tamil stimuli were also created for Malay/Indian caregivers and children. These included materials to elicit Malay word-initial plosives, laterals, and its prosody, as well as materials to examine Tamil speakers' Tamil laterals and retroflex consonants. The bilingual acquisition of Mandarin and English was not the focus of this thesis, in part because it would be challenging to disentangle the effects of historical language contact of English and Hokkien from the effects of the bilingual acquisition of Mandarin (and the trilingual acquisition of Hokkien, for caregivers who speak it as a heritage language). The additional Malay and Tamil materials are specified below as the stimuli are described. The complete set of stimuli can be found in Appendix 2E. An overview can also be found in Section 2.4 of this chapter.

Most of the child stimuli used in the structured elicitations were also replicated in the adult stimuli, in order to facilitate comparisons. To ensure that the words chosen were suitable for young children, reference was made to standardised instruments used to measure vocabulary size, specifically the NUS MB-CDI and the Oxford Communicative Development Inventory, which comprised high-frequency lexical items that should be acquired by most typically developing children by the age of two to three years. Malay and Tamil stimuli were translated and cross-checked by proficient speakers of Singaporean Malay and Tamil. The final set of materials was checked by two English-Mandarin bilingual mothers of young children. The following subsections describe the different speech data types included in this corpus and the materials through which the stimuli were elicited. Specific details about when and how the materials were used and the elicitation techniques are described in Section 2.3.

2.2.2.1 Wordlists

Many of the segmental features of interest were elicited through single word stimuli. These were embedded in the carrier phrase '*I say _ again*' and presented as a list of isolated sentences for adults that were read. For the Malay stimuli, the carrier phrase was '*Dia kata _ tiga kali*' /dia kata _ tiga kali/ '*I say _ three times*'. The Tamil carrier phrase was நான் மீண்டும் _ சொல்கிறேன் /nɑːn miːɳɖɯm _ solgɪɾeːn/ '*I say _ again*'. Many of the items were read again by the adults to their child in a picture description task (Appendix 2F, §2). Unless otherwise stated, the same words were elicited from the children using picture cards in a picture-naming task (Appendix 2F, §1). The word stimuli included the following phonological features:

Word-initial plosives. These were English monosyllabic or stress-initial disyllabic words with initial /p, t, k, b, d, g/ followed by /i, a, u/, with an optional coda (e.g. *pea, park, pool*). Malay materials with the same stops and vowel contexts were created. (Appendix 2E, §1.1)

***Syllable-final and intervocalic* /l/.** These were English mono- and disyllabic words with /l/ in C**V_#**, C**V_C**, (C)**V_.C**V and C**V_.V**C contexts (e.g. *ball, cold, elbow, police* respectively). The Malay and Tamil wordlists included items with /l/ in similar phonological contexts. (Appendix 2E, §1.2)

Vowels. The eleven monophthongs and seven diphthongs of SSBE, against which the vowel system of SgE is often contrasted (e.g. Deterding, 2007a; Leimgruber, 2013), were placed in words with a C1VC2 structure. The /hVd/ environment, frequently used to minimise coarticulatory effects (e.g. Cox, 2006), was not suitable for the Singaporean context because of the potential variation in how unfamiliar/nonsense words (e.g. *hud, hoyd, howd, hode*) would be pronounced. The lexical set in Sim (2015, p. 29) was used instead: for the monophthongs, C1 is /k/ or /d/ and C2 is /t/ or /d/, while for diphthongs, C1 is /b/ or /t/ and C2 is /d/. The tense–lax pairs were minimal pairs (e.g. *bid–bead, cod–cord*). These words were not included in the child stimuli. (Appendix 2E, §1.3)

Polysyllabic words. These were tri- and tetra-syllabic words with or without initial stress. They comprised non-compound words (e.g. *crocodile, broccoli*), and closed compound words or words that can be decomposed into two nouns (e.g. *fingernail, strawberry*). (Appendix 2E, §1.4)

Words with /ɛ/. Only for Malay participants, these were English words with /ɛ/. (Appendix 2E, §1.5)

Dental fricatives. Only for Chinese participants, these were English words with dental fricatives /θ, ð/ in various word positions in which th-stopping or th-fronting typically occurs (e.g. *three*, *teeth*). (Appendix 2E, §1.6)

Retroflex consonants. Only for Indian participants, these were English and Tamil words containing /r/ and /t/. The English items contained /r/ in the word-initial position, syllable-initial consonant clusters, and intervocalic position (e.g. *red, dress, carrot*). /t/ in the English items was word-internal, in either intervocalic position or after nasals (e.g. *watermelon*, *auntie*). /r/ in the Tamil items was intervocalic, and could be realised as retroflex or as a trill/flap. /t/ in the Tamil items was also intervocalic, and could be realised as retroflex or dentalised. (Appendix 2E, §1.7)

Words with /w/ and /v/. Only for Indian participants, these were English words containing /w/ and /v/ in word-initial and intervocalic positions (e.g. *wheel, flower, vase, oven*). (Appendix 2E, §1.8)

2.2.2.2 Sentences

There were two sets of sentence stimuli. The first set (Appendix 2E, §2.1) was read aloud only by adults, and was taken from Sim (2015, Appendix B). This set comprised 25 English sentences, including five simple statements, five questions without morphosyntactic markers, five wh-questions, five yes-no questions, and five coordinated questions. These were kept short, mostly below ten syllables. The content of these sentences was culturally and emotionally neutral to avoid subjective interpretation by speakers that might otherwise affect comparability. All segments in these sentences were fully voiced.

The second set of sentence stimuli (Appendix 2E, §2.2) was designed for this corpus to allow for the examination of the prosodic features described above. The constituents of the sentences were depicted in picture cards (Appendix 2F, §3), which were used in an information gap activity between a caregiver and child that elicited semi-spontaneous speech. The complete set of stimuli comprised 44 English sentences grouped in 11 thematic sets (e.g. shopping, hobby, animals), and for the Malay participants, an additional 16 Malay sentences grouped in four thematic sets.

The 11 English sets comprised simple declarative sentences. Each sentence was formed of one of four subjects (*Dan, Ben, Lina* or *Mary*), a disyllabic verb in the present continuous form, and an object (1 to 4 syllables) with an optional determiner (e.g. *Mary is cutting a watermelon*). The same four subjects were repeated in all the thematic sets, and the sentences in each set were formed using the same verb. The disyllabic subjects and verbs were all stress-initial. The tri- and tetra-syllabic objects comprised a mix of compound and non-compound words with and without initial stress. The Malay sets also consisted of simple declarative sentences, each containing one of the same four subjects as in the English sets, a disyllabic verb with the verbal prefix *me(n)*, and an object formed of 1 to 4 syllables (e.g. *Ben melukis bulan* 'Ben paints the moon'; *Lina membeli gula-gula* 'Lina buys candies').

2.2.2.3 Narrative passages

Two English narrative passages were used to elicit adult read speech (Appendix 2E, §3). The first was *North Wind and the Sun* and the second was the *Wolf Passage* (Deterding, 2006). Malay adult participants also read the Malay translation of the *North Wind and the Sun* (Clynes & Deterding, 2011). To elicit English child-directed read speech, mothers were asked to read *Duck and Goose* (Hills, 2006). This book was chosen because its content was found to elicit most if not all of the phonological features of interest described above, albeit in different phonetic contexts. Fathers read a book of their/child's choice to their child.

2.2.2.4 Conversation

Materials to elicit English adult spontaneous speech included conversation topics for an informal conversation with the author. The conversations started with topics such as their most memorable trip and their hobby or pastime. To elicit English spouse-directed speech, the caregivers engaged in a 'Who would you save?' scenario (Appendix 2F, §4), an ethical dilemma that required them to discuss which six of ten people they would save from a sinking ship based on the given descriptions.

Procedures and Elicitation Techniques

The remaining sections of this chapter delineate the procedures and elicitation techniques that were used during the field recording. The recordings took place in the participants' homes, and all tasks were completed in one session that typically lasted from 1.5 to 2 hours. At the start of each recording session, caregivers were shown the ethical approval letter (Appendix 2G, §1) and were asked to carefully read the participant information sheet (Appendix 2G, §2), before their consent to take part in the study was obtained (Appendix 2G, §3). At the end of the session, caregivers were asked to complete the remaining two questionnaires (i.e. the Child Language Experience survey and the vocabulary checklist). They were allowed to complete the survey/checklist in their own time, but within two weeks from the recording session. Caregivers were compensated with supermarket or book vouchers for their time (S$5 for each 30 mins spent), and the child was given a small toy or a set of stickers of their choice. Their receipt of the compensation and gift was recorded.

The sections below focus on the activities that were performed during the recording session. The activities for the session were divided into four main blocks: (1) caregiver–child tasks, (2) researcher–caregiver tasks, (3) picture naming task and information gap activity, and (4) caregiver–caregiver activity, with opportunities for breaks during and between tasks as required. To motivate the child participants, they were awarded star tokens as they completed each task, which they then used to exchange for stationery, stickers or toys at the end of the session. All recordings took place in quiet rooms with minimal reverberation. For the family with two child participants (C54), the activities were first done with the older child (C54O), before moving on to the younger (C54Y). The elicitation techniques for these tasks and activities (in bold typeface) are explained in detail below.

2.3.1. Blocks 1 and 2

After informed consent was obtained, each session began with blocks (1) and (2) performed simultaneously. The mother would perform tasks in block (1) with the child in one room, while the author performed the tasks in block (2) with the father in another room. The parents swapped places with each other once they had both completed their tasks. For the tasks in block (1), the caregiver and child each had pinned on their collar an omni-directional lapel microphone, which was connected to a Nagra ARES-MII recorder recording at a sampling rate of 44.1 kHz at 16 bit. The adult was given instructions to ensure a good recording; they were instructed on the optimal position of the microphones if adjustments were needed, and were made aware of potential noise that could arise from the activities that would affect the recording. They were also reminded to avoid talking at the same time as the child. Parents were also instructed to use only English to interact with their children, in order to avoid a bilingual mode (Grosjean, 2011), and to speak as they would normally with their child. The activities in block (1) involved caregiver-child interactions in contexts of routine/play and instruction/education. Caregivers typically performed the tasks in the order listed below, although they were not required to do so, and were encouraged to make changes based on the interest or engagement level of the child:

1. **Unstructured casual interactions**, including but not limited to playing with toys and puzzles, sketching and drawing, or casual conversations about people and events. (Duration: 15-20 minutes)
2. **Picture description task**. The caregiver was asked to describe the scene in the picture card and to teach the child all the English words in the picture. (Duration: 5-10 minutes)
3. **Reading a book**. Mothers read 'Duck and Goose' (Hills, 2006), while fathers read a book of their choosing. (Duration: 5-10 minutes)

At the same time, using a Zoom H5 recorder recording at a sampling rate of 44.1 kHz at 16 bit, the author recorded the other caregiver performing the tasks in block (2) in another quiet room:

1. **English wordlist**. Each target word and its carrier phrase was read three times by Chinese participants, and twice by Malay and Indian participants (in order to leave sufficient time for the additional Malay and Tamil wordlists respectively).
2. **English sentences** (set 1). Read once.
3. **Wolf passage**. Read once.
4. **North Wind and the Sun** (in English). Read once.
5. **A casual conversation about everyday topics** (e.g. how they spent their free time). Conversations were approximately 10 minutes long.

and additionally for the Malay and Indian participants,

6. **Malay/Tamil wordlist.** Each target word in carrier phrase was read two times.
7. **North Wind and the Sun** (in Malay, for Malay participants). Read once.

2.3.2. Block 3

This block included the picture naming task and the information gap activity, which were performed in a quiet room. Only children close to or above 3;0 took part in the picture naming task, and those close to or above 4;0 also participated in the information gap activity. One of the caregivers, typically the mother, performed the picture naming task with the child, with the author's passive presence. Mothers (but not fathers) then performed the information gap activity with the child, with the facilitation of the author. Their speech was recorded using the same lapel microphones attached to their collars and a Zoom H5 recorder, both recording at a sampling rate of 44.1 kHz at 16 bit.

In the **picture naming task**, the caregiver showed picture cards from a deck in a random order and prompted the child to name the objects twice by saying, for example: '*This is a...?*' Caregivers gave clues ('*Woof, woof! What is the dog doing?*') or recounted specific experiences ('*We went there last Saturday*') to help their child with any unfamiliar words, before asking the child to repeat after them as the last resort. For Malay and Indian participants, caregivers interacted briefly with the child in Malay or Tamil, before moving on to the Malay or Tamil stimuli.

In the **information gap activity**, the child had to help their caregiver match puzzle pieces by giving structured clues based on what they saw on picture cards. The parent first introduced the names of four child characters that recurred in all sets. The child was then asked to name the four characters without assistance, to ensure that the child could identify them during the actual task. The caregiver and child then sat in opposite sides of a table or space, while the author sat near the child, as shown in Figure 2.1. The activity started with the trial set. For each set, the author presented to the child but not the caregiver a picture card that depicted the four characters performing the same action but with different objects. At the same time, the caregiver received the same characters and objects but as individual pieces that were jumbled. The objective was for the child to help their parent match the correct character with the right item by giving clues from the picture card. The mother began each set by giving a prescribed prompt that reflected the action verb that all the four children were performing, for example: '*The children are eating something. What are they eating*?' After each correct clue given by the child (e.g. '*Ben is eating bread*'), the caregiver was asked to repeat the clue as a form of confirmation, and to match the relevant pieces. At the end of each set, the child was asked to repeat all four clues so that the caregiver could check their answer. Malay participants only completed eight English sets including the trial (instead of 11) as indicated in Appendix 2E (§2.2), in order to create time for the additional four Malay sets. Similar to the picture naming task, a short interaction in Malay ensued after the English sets, before the same procedure was repeated for the Malay sets.

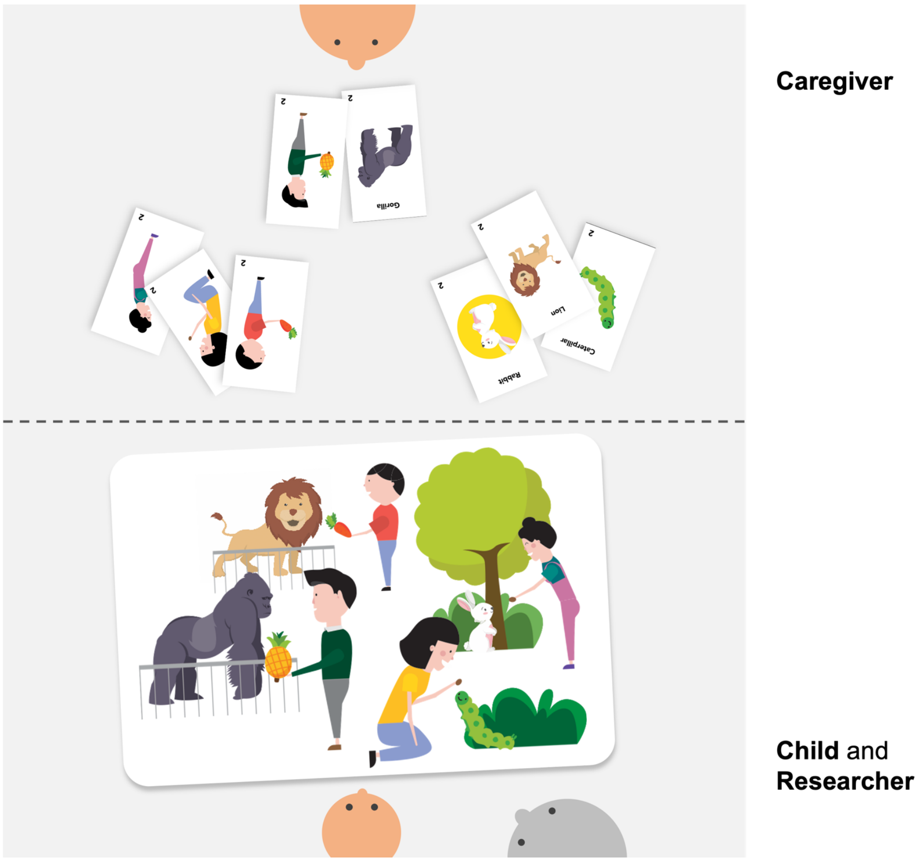

Figure 2.1 Experimental set-up for the information gap activity.

2.3.3. Block 4

Before the session concluded, the caregivers came together for the final activity in block (4), which was the **'Who would you save?' scenario**. Their interactions were recorded by a Zoom H5 and a Zoom H4n recorder (sampling rate: 44.1 kHz at 16 bit). Caregivers were first given time to decide which six of the ten passengers on a sinking ship they would save, before being asked to share their choices with each other and to negotiate to come to an agreement.

An Overview of the Corpus

The sections above described an originally built caregiver-child speech corpus that comprises spontaneous and style-controlled audio recordings of adult-directed and child-directed speech from 110 Singaporean caregivers and their 56 preschoolers. An overview of the contents of the speech corpus, including information on the types of speech data and the stimuli, as well as the elicitation methods used, is presented in Table 2.4.

Table 2.4. Contents of the speech corpus, including data types and stimuli, and the methods through which the speech data were elicited.

Data type	Stimulus	Elicitation method
Wordlists	**All participants. Words containing:** • Word-initial plosives /p, t, k, b, d, g/ +MLY • Syllable-final and intervocalic /l/ +MLY +TML • ^ Monophthongs and diphthongs • Three or four syllables, with or without initial stress; non-compounds and closed compounds **Malay participants only** • Words with /ɛ/ **Chinese participants only** • Words with dental fricatives **Indian participants only** • Words with /r/ and /t/ +TML • Words with /w/ and /v/	**Caregivers:** words presented embedded in carrier phrases and read to author. Words were read again to their child during the picture description task. **Children:** words elicited by caregivers through picture cards in the picture naming task.
Sentences	**^ Set 1** Simple statements, questions without morphosyntactic markers, wh-questions, yes-no questions, and coordinated questions. Taken from Sim (2015). **Set 2** +MLY Simple declarative sentences (Subject + Verb + Object).	**Set 1:** read by caregivers to author. **Set 2:** stimuli presented in picture cards. Sentences elicited from both caregiver and child through the information gap activity.
^ Narrative passages	• *Wolf Passage* (Deterding, 2006) • *North Wind and the Sun*. Malay translation taken from Deterding (2011) +MLY • Mothers read *Duck and Goose* (Hills, 2006) • Fathers read a book of their/child's choice	*Wolf passage* and *North Wind and the Sun* were read by caregivers to the author. Caregivers read the books to their child.
^ Conversation	Conversation topics such as their most memorable trip and their hobby or pastime.	Conversation between caregiver and author.
Informal interaction	Toys, puzzles, sketching and drawing, and/or casual topics about people and events.	Interaction between caregiver and child
^ 'Who would you save?' scenario	A list of descriptions of ten passengers on a sinking ship. Caregivers choose six of the ten to save.	Discussion between caregivers.

Note: ^ elicited from caregivers only. +MLY +TML denote additional Malay and Tamil materials for Malay and Indian participants respectively.

Defining the Scope of this Thesis

It is clear that not all features in the corpus could be examined in this thesis due to constraints of length and time; as noted above, the wide variety of variables was elicited so that the corpus could serve as a versatile resource for other future work. Several considerations guided the design of the experiments in this thesis. This section presents the rationale for the selection of the speaker groups, the linguistic variables chosen for analysis, and the purpose of the experiments in relation to the research goals. To remind the reader, this thesis aims to examine: (1) the inter- and intra-speaker variation in the English CDS of Singaporean caregivers, (2) the effect of such variation in the input on the phonological development of preschool children, and (3) the ways in which phonological acquisition in multidialectal and multicultural contexts differs from that in less diverse settings. These research questions were explored in the following four experiments that include three production studies (two involving the Malay community and one the Chinese; Chpts. 3, 5, and 6) and one perception study (Chpt. 4).

Speaker groups. The English-Malay bilinguals, whose speech is examined in three of the four experiments, were selected as the main speaker group for the purpose of this thesis for several reasons. First, much of the research on SgE phonology hitherto has focused on the locally dominant accent of the Chinese ethnic majority, and as a consequence, little is known about language variation and change in minority/minoritised contexts, much less about the phonological acquisition in the children of this population. It is hoped that this thesis will fill some of this gap. The Tamil-speaking community could not be examined in this thesis, unfortunately, plainly because there was only one ethnically Indian family in the corpus. Second, the Malay community was chosen for the practical reason that they are relatively linguistically more homogeneous than the others (see §1.2.2), and therefore variation that could arise from speaking or overhearing other heritage languages or ethnic mother tongues, which may act as a confounder, is kept to a minimum. A third reason is that the Malay ethnic community in Singapore is, to the author's knowledge, the only one so far to have been shown to exhibit clear and robust intra-ethnic variation across several phonological features (Sim, 2015, 2019), and this was deemed advantageous as the primary goal of this thesis is to elicit the effects of these differences on child phonological acquisition.

Linguistic variables. In view of the exploratory nature of the present research goals, a key consideration in the selection of linguistic variables for analysis is their relative potential for speaker variation. L-allophony in SgE, and more specifically coda /l/, was chosen as the linguistic variable for the two production studies that involve the Malay community (Chpts. 5 and 6) and for the perception experiment (Chpt. 4). Whereas many descriptions of the features of SgE including their variation were based on impressionistic observations or anecdotal evidence, the allophones of the coda lateral in SgE have been empirically demonstrated to systematically vary between Chinese and Malay Singaporeans, within the Malay speech community, and between the local varieties and SSBE/GA (see §2.2.1.1). Laterals in SgE are therefore also relatively more sociolinguistically salient, in part due to their multiple social category associations (at the very least with ethnicity and language dominance), and are potentially more likely to be imbued with diverse socio-indexical meanings that could influence linguistic choices. Another advantage is that the linguistic and social variation of laterals is a well-studied phenomena within the field of bilingual acquisition and language contact. This allows comparisons to be made with speakers from other social contexts, especially the British Asians (Khattab, 2002, 2011; Kirkham, 2017; Kirkham & McCarthy, 2021; Sharma, 2011; Stuart-Smith et al., 2011), and other bilinguals (Clothier, 2019; Morris, 2017; Simonet, 2010a, 2010b).

Compared with the Malays, however, there is less speaker variation in the English coda /l/ of Chinese Singaporeans, and this was found to be also the case for the Chinese caregivers in this corpus after an impressionistic analysis. For this reason, the variable release of coda oral stops in SgE was chosen as the linguistic feature for analysis for the Chinese participants. There are some advantages in selecting a different variable for this group in relation to the three research goals: first, as mentioned in §2.2.1.1, variation in the release of coda oral stops is considerably less socially stratified than coda /l/, and therefore variation in and input effects of a speech feature that is less or not sociolinguistically salient can be examined. Second, while the variation in coda /l/ described above involves alternative variants, variation in coda stop release occurs at the subphonemic level. This allows the testing of input effects of fine-grained phonetic details. Third, any variation in and input effects of coda /l/ may be entangled with effects of cross-linguistic interaction (CLI) with Malay. As Mandarin does not allow coda oral stops, CLI cannot account for any variation or input effects that may be observed in the Chinese participants.

Purpose of the experiments. The specific research questions that each of the four studies seeks to answer contribute towards the three overarching aims: for each linguistic variable, the inter- and/or intra-caregiver variation in CDS is first examined, followed by the input effects on its acquisition in the preschoolers. The findings to these two research questions contribute to the understanding of the third, and that is how acquisition in multidialectal and multicultural contexts differs from that in less diverse settings.

Experiment 1 (Chpt. 3) examines the variation in the non-release of English coda oral stops in the input of Chinese caregivers and its effects on the coda stop development of their preschoolers. As noted above, the non-release of coda stops as a linguistic variable is not particularly sociolinguistically salient, and therefore the current study focuses only on the potential between-caregiver variation in informal maternal CDS. This study aims to demonstrate that in a setting that has undergone long-term societal language contact, between-speaker variation may be present even if speakers acquired the language(s) early. It also ascertains whether children who receive equally high amount of English input may vary in their production as a result of such qualitative differences in the input.

The next three experiments are devoted to studying the use and acquisition of the sociolinguistically more complex variable, L-allophony. While between-speaker variation has been attested in past studies, as noted above, little is currently known about the socio-indexical meanings that the local variants of /l/ (i.e. clear and vocalised), which emerged from sociohistorical processes of language contact and acquisition, have come to possess, and how these social meanings relate to those of the variant associated with exonormative norms (i.e. dark /l/). Such information can help in the understanding of the linguistic choices that caregivers make in their CDS. The primary aim of the first experiment involving coda /l/ (Chpt. 4), therefore, is to ascertain the accrued social meanings of the three /l/ variants through an investigation of the public's social perceptions. Experiment 3 (Chpt. 5) then explores the potential variation in coda /l/ in the English CDS of the

Malay caregivers, by testing whether their use of /l/ variants is conditioned by situational context (informal, casual interactions versus teaching and reading), and whether there are differences between maternal and paternal CDS patterns. The final experiment (Chpt. 6) explores the bilingual acquisition of English and Malay laterals by Malay preschoolers, in order to understand how they negotiate the mixed phonetic representations of /l/ that is present not only in the input of their caregivers, but also in the speech of other significant adults and peers in the wider community. Together, these three studies aim to demonstrate the linguistic and sociolinguistic complexity in phonological acquisition in children in similar social settings.

CHAPTER 3

Variation in quality of maternal input and development of coda stops

Original abstract: This study examines the effects of input quality on early phonological acquisition by investigating whether inter-adult variation in specific phonetic properties in the input is reflected in the production of their children. We analysed the English coda stop release patterns in the spontaneous speech of fourteen mothers and compared them with the spontaneous production of their preschool children. The analysis revealed a very strong positive input–production relationship; mothers who released coda stops to a lesser degree also had children who tended to not release their stops, and the same was true for mothers who released their stops to a higher degree. The findings suggest that young children are sensitive to acoustic properties that are subphonemic, and these properties are also reflected in their production, showing the importance of considering input quality when investigating child production.

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Introduction

Individual variation in early language development and language outcomes of both monolingual and bilingual children may be attributed to differences in input quantity and quality. A growing number of studies have shown that greater access to linguistic information through a larger amount of language input generally leads to faster development in various linguistic domains (Hoff, 2006; Unsworth, 2016). In terms of phonological development, studies of bilingual children, for instance, have shown that the child's dominant language, which is typically defined as the language the child hears and uses the most frequently with significant others, is associated with higher rate of phonological development (Ball et al., 2001; Law & So, 2006) and also phonological accuracy (En et al., 2014; Goldstein et al., 2010; Wrembel et al., 2019). What is often overlooked, however, is that variability in phonological development or outcomes can also be a result of differences in the quality of input, that is, the specific phonetic and phonological properties in the language models. Monolingual children may be raised in mixed-accent or bi-dialectal families (e.g. Stanford, 2008; Thomas & Scobbie, 2015), or by bilectal caregivers who may modify their child-directed speech according to the age and gender of child, and situational context (e.g. Foulkes & Docherty, 2006; Smith et al., 2007). Language input in bilingual communities can be even less homogenous, given the possible variation in the language background of caregivers (Lleó, 2016). Caregivers who speak a majority language and a heritage language, for example, may speak the native language with non-nativelike phonetic characteristics, and depending on their L2 use and length of residence outside of their L1 community, phonetic properties of both languages may also be qualitatively different from others (Fish et al., 2017; Flege et al., 1997; Guion et al., 2000; Mayr & Montanari, 2015; Post & Jones, 2020). Further, even when both languages are acquired early, bilingual caregivers may differ in their language dominance, which may influence the extent of cross-linguistic interactions in their production and perception (e.g. Amengual, 2018; Amengual & Chamorro, 2015). Such variation is commonplace in sociocultural contexts like Singapore and Malaysia, where speakers are all native speakers of their dialect but may differ in some properties of their accents according to their language background and various sociolinguistic factors (e.g. Phoon, Abdullah, & Maclagan, 2013; Sim, 2019). While much is known about variation in adult production, relatively fewer studies have examined the effects of such qualitative differences in the input on phonological acquisition in children. The present study focuses on this underexplored area of child phonological acquisition by examining whether inter-adult variation is reflected in the production of their children.

Studies that examined this input-production relationship have shown that speech properties of child production reflect specific properties of the caregiver input, especially in the early developmental years. Thomas & Scobbie (2015), for example, examined the FACE and GOAT vowels of a Glasgow boy aged 3;1 raised by parents with different British English accents; his father spoke Scottish Standard English (ScSE), while his mother's accent closely resembled Southern Standard British English (SSBE). For the FACE lexical set, the boy used the SSBE [eɪ] predominantly, reflecting the accent of his mother. The vowel for the GOAT lexical set, however, was more mixed, but the boy used ScSE [o] in a slight majority of the tokens. Studies of bilingual children also revealed how differential properties in the speech of caregivers are reflected in their children's speech. Khattab (2003), for instance, studied the voice onset time (VOT) production of two English-Arabic siblings aged seven and ten years, who were acquiring Arabic as a heritage language in England from their parents. She found that the idiosyncratic use of nasals and implosives in the production of voicing lead of the younger child was similar to the patterns found in the mother's pre-voiced stops. A recent study by Stoehr, Benders, van Hell, & Fikkert (2019) examined more directly the effects of non-native and attrited maternal input on children by investigating the production of VOT by Dutch-German bilingual preschoolers. These children acquired German as a heritage language predominantly from their mothers who spoke German as an L1. They acquired the majority language, Dutch from their fathers who were L1 speakers of Dutch, and also from their mothers who were L2 speakers. They found that individual variation in the VOT production of these child bilinguals was associated with individual variation of VOT in their mothers' non-native speech in Dutch and their mothers' attrited speech in the heritage language German. Effects of quality of input on bilingual outcomes can sometimes be difficult to ascertain, because differential features learned from the input can also resemble effects of cross-linguistic interactions in the bilinguals.

This study furthers the investigation of the input–production relationship and differs from these past studies in the following ways. The phonetic feature of interest in this study is English word-final oral stop release. Compared to segments and VOT, the presence or absence of coda stop release is much more variable and less predictable. For example, while /p, t, k/ are aspirated when they occur in the onset of a stressed syllable but not in a cluster after /s/, the same stops at the word-final position are not always (audibly) released, even if they precede the same phonetic environment. Therefore, this study also tested whether very young children are sensitive to differences in the statistical distribution of a variable feature in the input. Another difference is that instead of heritage languages, this study looked at a contact variety of English, Singapore English. There is therefore less variability and better comparability than when comparing between monolinguals and bilinguals, or native and non-native speakers, because all parents and children in this study were locals and native speakers of Singapore English and Singapore Mandarin, and were living in the same broader linguistic community, but they differed in how frequently they released their English coda stops. Although these dyads were bilinguals, cross-linguistic interaction (CLI) is unlikely to present as a confounding factor. This is because, in addition to the children being highly English dominant, Mandarin does not allow coda oral stops (Hua, 2006), and the variable feature of coda stop non-release is a feature of Singapore English, the children's L1.

3.1.1. Coda stop release in English

While coda stops are always unreleased in some languages (e.g. Korean, Cantonese), stop release is optional in many varieties of English. Speakers of established standards of English such as British and American English, for example, do not release coda stops all the time, and even less so in spontaneous speech. The release of stops is further modulated by factors such as place of articulation (PoA) and the position of the stop within the utterance. Fabricius (2002), in her sociolinguistic examination of t-glottaling (the pronunciation of syllable-final /t/ as glottal stop [ʔ]) in Received Pronunciation, reported that in interview style, t-glottaling at word-final position occurred 36% of the time before pauses, 40% before vowels, and on average 74% of the time before consonants, but it occurred generally less frequently in the more careful reading passage style. That there is variability in how coda stops are released was also reported for American English by Song, Demuth, & Shattuck-Hufnagel (2012), who examined the development of acoustic cues to coda contrasts in monolingual children by analysing the spontaneous speech productions of six mother-child pairs. They found that for mothers, the likelihood of stop release varied with both PoA and utterance position. Specifically, velar stops were released more frequently than alveolar stops, and utterance-final stops were released more frequently than utterance-medial ones (which included pre-vocalic stops).

Contrastingly, word-final singleton stops in Singapore English tend to be unreleased (or inaudibly released) or replaced by a glottal stop, and unreleased stops are also often accompanied by glottal reinforcement. In addition, syllable-final voiced obstruents are often devoiced (Bao, 2003; Deterding, 2007b; Gut, 2005). Bao (2003) further added that these features are widely attested in all social strata of the community and found in both formal and informal speech. Quantitative information on stop release patterns in Singapore English was reported by Gut (2005), who examined the realisations of coda stop in the spontaneous speech of 16 adult Singaporean speakers (mostly Chinese) with an average age of 29 years. They were reported to be fluent and dominant in English, but were mostly early sequential bilinguals who learnt English from an average age of 5;6. Gut (2005) found that overall, coda stops were more frequently realised as a glottal stop and unreleased than released, but did not find a significant difference in the realisations between voiceless and voiced stops, nor between Chinese and non-Chinese speakers. She reported similar effects of phonetic environment on the likelihood of coda stop release. Before consonants, coda stops of Chinese speakers were found to be released only about 10% of the time (52% unreleased, 38% as a glottal stop). Stops that preceded vowels and pauses were released more frequently (about 38% and 41% respectively), but were also as likely to be replaced with a glottal stop. There was also an indication of weak effects of PoA on stop release, as she found that of all tokens, /k/ was released most often, at 37.2% (n = 113), while /t/ and /d/ were released less frequently, at 23.1% (n = 511) and 31.5% (n = 124) respectively. Compared to /k/, alveolar stops /t/ and /d/ tended to be unreleased (34% and 33% respectively), and /t/ was also the most likely to be produced as a glottal stop (42.9%).

3.1.2. Acquisition of English coda stops

Previous studies have shown that children produce coda structure early, usually by around the age of two. As early as 1;6, children also exhibit adult-like use of cues to coda voicing and place contrasts (Demuth et al., 2009; Song et al., 2012), but the degree of systematicity and range of values for these cues may be different from adults. Song, Demuth, & Shattuck-Hufnagel (2012), for instance, found that at 1;6, children had more frequent stop releases, a greater mean number of release bursts, and more frequent and longer post-release noise than mothers. Indeed, early production can be inconsistent, and shows great within-speaker variability, where the same child may produce some coda consonants but not others (Stites et al., 2004). Their early use of coda consonants may also be influenced by linguistic properties, such as segment type, vowel length, stress, position within the word, and prosodic structure (Kirk & Demuth, 2006). However, normative studies have shown that English-speaking children produce most coda stops (/p, b, t, d, k, g/) by the age of three (Dodd et al., 2003). Song, Demuth, & Shattuck-Hufnagel (2012) also found the cues to coda contrasts, such as the effects of PoA and phonetic environment on stop release, were generally adult-like by 2;6.

The phonetic realisation of coda stops may differ between children, in part due to phonetic qualities of the input. Phonological acquisition in some contexts may involve competing alternatives between caregiver input and local norms, and some are further associated with social meanings. British-born speakers of South Asian heritage in United Kingdom, for example, having been exposed to Indian English by their caregivers and others in the ethnic community, may use retroflex [ʈ] in their English speech even if they are English dominant or English monolinguals, and some use them variably with the mainstream alveolar variant depending on the interlocutor (Sharma, 2011). In other contexts that have experienced significant language shifts like Singapore, previous generations of speakers may differ greatly in their language backgrounds, and so children of later generations may receive L1 input from caregivers who were L2 learners, or from L1 speakers who have retained features from previous generations of L2 learners, and consequently exhibit these features in their own speech, even if they are highly English dominant. Indeed, Bao (1998) posited that the feature of non-release of coda stops in Singapore English is likely due to influence of substrate languages including Malay and

Chinese dialects such as Hokkien, which are major languages in the sociolinguistic history of Singapore. Unlike Mandarin, these languages allow final codas /p, t, k/ like English, but they are unreleased and their preceding vowel is also glottalised. En, Brebner, & McCormack (2014), who examined the English phonology of English-Mandarin bilingual preschool Singaporean children (ages 4;0–4;5) using the Phonology Assessment from the Diagnostic Evaluation of Articulation and Phonology (Dodd et al., 2002), found that Mandarin-dominant children used phonological processes that may indicate potential effects of CLI (e.g. cluster reduction) that were not found in English-dominant children. However, all 70 children in the study, regardless of whether they were Mandarin or English dominant, glottalised syllable-final stops and devoiced syllable-final obstruents (e.g. [eʔk̚] and [eʔ] for *egg*), which suggest that, rather than being effects of CLI, these two features were learned from the input. Similarly, in his examination of intra-ethnic variation in the English-Malay adult bilinguals in Singapore, Sim (2019) found that his Malay-dominant participants exhibited features that may potentially be attributed to CLI, such as unaspirated word-initial stops and the use of clear [l] syllable finally, as these were not found in the speech of English-dominant English-Malay bilinguals. English-dominant Malays, by contrast, displayed features that were not typical of Singapore English. For example, they preserved all tense-lax vowel pairs and produced VOT comparable with speakers of other established standards of English, but still sounded essentially Singaporean. However, he noted that all participants were early or simultaneous bilinguals, and should have formed separate phonetic categories for their two languages. Sim posited that the use and maintenance of ethnic features could also be due to socio-indexical reasons; based on the results from the language background survey, his Malay-dominant participants were associated with more Malay-dominant families and social circles, and identified more with a more Malay-speaking culture than an English-speaking one. The exposure to a dominantly Malay-accented English accent could potentially explain how these differential features were acquired.

In complex multilingual contexts like Singapore, therefore, individual variation may be attributed to qualitative differences in the input given by individual caregivers. This means that even if two children received an equally high amount of English input, phonetic features in their English accents may differ because of qualitative differences in the input, and this is what the study sets out to investigate. If indeed children's production reflects the between-speaker variation in stop release in adults, the findings will lend support to acquisition theories that pay greater emphasis on the role of input and the learning of phonetic forms, highlighting the sensitivities of children to subphonemic variation. To this end, this study sets out to test these three hypotheses:

H1 Children will exhibit adult-like patterns in the distribution of realisations of coda stops.

H2 Some mothers will release coda stops more frequently than what is expected based on local norms.

H3 There will be a positive association between the stop release patterns of children and their mothers.

H1 is based on past findings on coda stop development that by as early as 2;6, children's stop production was generally adult-like (Song et al., 2012). Any systematic variation in the realisation of coda stops observed in the adults in this study should also be observed in their children, who were at least 2;8. H2 is based on the previous discussion that the accents of Singaporeans are not homogenous and can differ in qualitative aspects, even between bilingual speakers of the same languages, due to factors such as their language history, background and attitudes (e.g. Sim, 2019). H3 is based on past studies that observed similarities in the phonetic aspects of the input and the speech of monolingual children (e.g. Foulkes & Docherty, 2006; Smith, Durham, & Fortune, 2007) and bilingual children (e.g. Mayr & Montanari, 2015; Stoehr, Benders, van Hell, & Fikkert, 2019). Therefore, not only do we predict that children will produce adult-like patterns as a group (as specified in H1), we also predict that individual variation in the stop release patterns between mothers will be observed in the production of their children. For both H2 and H3, the analysis will also attempt to ascertain other language-external factors that contribute to any variation in stop release.

Methodology

3.2.1. Participants

The mother/child corpus used in this study consists of 14 Singaporean Chinese dyads, and the children were aged between 2;8 and 4;8 (*M* = 3;7). These participants were selected from a larger corpus of 60 Singaporean families based on responses in a child language experience survey. This ensured that the participants were comparable across various language-external factors that could affect phonological production (Kehoe & Havy, 2019; Sorenson Duncan & Paradis, 2016), which included language background and language dominance (e.g. En, Brebner, & McCormack, 2014; Goldstein, Bunta, Lange, Rodriguez, & Burrows, 2010), child's vocabulary size (e.g. Scarpino, 2011), and socioeconomic status (e.g. Campbell et al., 2003). Children below 2;6 were excluded, as their production patterns may still be stabilising and input effects may not be evident (Song et al., 2012; Vihman et al., 1994). Each component of the survey is further described below. Table 3.1 presents a summary of the details of the child participants.

Table 3.1. Description of the child participants including age, gender, age of acquisition (AoA), percent use of English and Mandarin, English vocabulary score (Eng. Vocab.), total vocabulary score (Total vocab.), socio-economic status (SES) score, and mother's Bilingual Language Profile (BLP) score.

Family ID	Age	Gender	AoA English	AoA Mandarin	% English use	% Mandarin use	Eng. vocab.	Total vocab.	SES	Mother's BLP score
C5	45	F	0	0	78	18	734	1187	23	31.34
C9	39	M	0	0	84	14	1027	1180	21	82.28
C17	53	M	0	0	79	8	860	968	21	3.46
C18	32	F	0	0	96	3	843	1023	25	129.68
C20	56	M	0	18	83	6	1136	1833	28	91.09
C24	34	F	0	0	79	20	885	1043	22	57.22
C30	48	F	0	0	71	28	1226	1907	22	68.75
C31	36	F	0	0	74	25	932	1327	19	20.89
C35	47	M	0	24	89	10	966	1017	23	150.84
C39	45	F	0	0	85	8	811	1083	24	107.43
C46	37	F	0	32	85	7	854	870	21	129.14
C47	47	M	0	12	92	4	1098	1337	31	106.26
C55	32	M	0	0	76	14	954	1376	23	65.20
C74	54	F	0	0	91	8	946	1491	26	114.43

Note: Age and AoA are in months.

The children were first matched in their language background. The children (8 girls and 6 boys) were all firstborns, to eliminate potential influence from older siblings. They were typically developing simultaneous bilinguals of Singapore English and Singapore Mandarin, who were exposed to both languages by the age of three (Genesee & Nicoladis, 2007). Their parents also spoke Mandarin and English.

Language dominance was measured with reference to existing instruments that were developed for multilingual contexts (e.g. Tan, 2011). The language use of the child was calculated from an accumulated measurement of the type (i.e. variety) and estimated amount and proportion of time the language variety was used with the significant people in his/her immediate ecosystem. Specifically, parents were asked to report the languages and specific varieties that their child used with significant adults and children (both direct/indirect input and output), the estimated percentage of the time that each language/variety was used, and the time spent with these people in hours per week. The calculation also considered the child's language use in self-interaction and exposure to media. The children selected for this study were all English dominant, who used Singaporean English at least 70% of the time (M = 83, SD = 7.28), to also minimise confounding effects of potential CLI. The exposure to other established standard varieties of English, particularly American and British English, from media consumption, was unexpectedly low for all children (around 1 to 2% of all English input), and therefore the influence of these varieties was limited. Some children were also exposed to other varieties such as Indonesian English or Filipino English through their domestic helpers, but exposure to those varieties was also low, with the highest being 11%. There are several caveats that concern the percentage language use results in Table 3.1 and the bilingual status of the children in this study. Many studies have classified bilinguals as those who have received a minimum of 10–20% of input in one of their languages (e.g. Kehoe & Havy, 2018; Lauro, Core, & Hoff, 2020). This would mean that some of the children in this study would be considered monolinguals and others, bilinguals. However, at least for this study, a dichotomous classification based on purely quantitative terms may disregard the pluralistic nature of language acquisition in such a multilingual context, where in fact the children may be more 'bilingual' than the cumulative scores indicate them to be. Child C5, who would be considered a monolingual, for example, was reported to use English

100% of the time with her peers, stay-home helper and paternal grandparents, but used almost exclusively Mandarin with her maternal grandparents, and Mandarin about 20-40% of the time with her parents. Similarly, children C18 and C47 have the lowest percentage Mandarin use because they used mainly English with family members, but received Mandarin input 30-40% of the time at the preschool/childcare that they attended on weekdays. Moreover, the cumulative scores of percentage of input between studies are not always comparable because of, for instance, differences in calculations and the different contexts that were considered in the measurement. Since the aim of this present study is not to compare between monolinguals and bilinguals, the child participants are all here regarded as English-dominant English-Mandarin bilinguals, with some regarded as more English-dominant than others in terms of overall language use. The language dominance of the mothers was measured using the Bilingual Language Profile (BLP; Birdsong et al., 2012), which is a self-reported measure of the mother's language history, proficiency, use and attitudes. The composite dominance scores were automatically tabulated, and possible scores range from −218 (Mandarin-dominant) to +218 (English-dominant). The BLP scores of the mothers in this study suggest that none was Mandarin dominant (M = 82.72, SD = 43.97, range = 3.46–150.84), but were English dominant to varying degrees and in different ways according to the four components measured by the BLP.

The survey also included the Family Affluence Scale (FAS; Currie et al., 2008), an established measure of socioeconomic status (SES), but modified[5] to fit the Singaporean context. The FAS assesses SES by aggregating information on material affluence based on the material condition of the household. This study also included education level and profession of the parents as part of the measure. These items in the survey generate a composite score, with the highest possible SES score being 35; the average SES score of the participants was 23.5 (SD = 3.15, range = 19-31).

Finally, a parental vocabulary checklist to measure their child's lexicon size was administered. As there was no established way to measure productive/expressive vocabulary for children of this age range (Milton & Treffers-Daller, 2013), a checklist

[5] The question in the original FAS, 'Do you have your own bedroom for yourself?' was replaced with 'What type of home does this child live in?'. The question 'Do you pay people from outside the family to work at your home on a regular (that is, on a daily or weekly) basis?' was also added.

composed of two elements was created for this study. The first is a local variant of the standardised MacArthur-Bates Communicative Development Inventories (MB-CDI), adapted by the National University of Singapore in both English and Mandarin Chinese, which was suitable for children below 36 months. The second component consists of two sets of high-frequency words taken from the vocabulary lists of the international Cambridge English Qualifications assessments for children from kindergarten to upper primary levels. The latter sets were adapted to the Singapore context and translated by the first author, who is a speaker of Singapore Mandarin, and the items were checked by two mothers who were also native speakers of Singapore Mandarin to ensure that the translations were accurate and reflective of local usage. The final checklist contained a total of 1226 items in the two languages. Linear regression performed using R statistical software (R Core Team, 2020) and the lme4 package (Bates et al., 2015) on the checklist scores administered to 59 families of children of ages between 2;1 and 6;4 (i.e. the larger corpus mentioned above) revealed that age and amount of exposure to English were statistically significant predictors of the English vocabulary scores (age: $\beta = 0.60$, $p < 0.001$; English use: $\beta = 0.26$, $p < 0.05$; $R^2 = 0.42$). Ethnic mother tongue use and age as main effects were also significant predictors of ethnic mother tongue vocabulary (age: $\beta = 0.27$, $p < 0.05$; ethnic mother tongue use: $\beta = 0.48$, $p < 0.001$; $R^2 = 0.26$). This suggests that the vocabulary checklist is adequately discriminating, at least for the purpose of controlling for lexicon size in this study.

3.2.2. Materials

Naturalistic data from unstructured play and semi-structured interaction between the mother and child were used in the analysis. Each interaction lasted approximately 30 to 40 minutes for each pair. Activities during unstructured play included but were not limited to playing with toys, puzzle play and sketching/drawing. Parents were also asked to take part in semi-structured interaction using a large picture card that featured a park scene with many animals, food, objects and people engaged in leisure activities. Only speech in the informal style was included in the analysis, to control for potential stylistic variation (Smith et al., 2007). Words that were read, or mimicked/imitated were excluded. Spontaneous speech is more representative of child-directed speech and the variant used in day-to-day interactions between mother and child. Elicitation techniques such as picture naming or word list reading, although allowing better control over the materials and therefore higher comparability of results, would very likely elicit canonical forms that might not reflect natural speech or local dialectal norms. An example of an interaction between a mother (M) and child (C) during a drawing activity is provided below, with words that were included in the analysis in bold and coda stops underlined, according to criteria that are described in the later section.

(1) C: **Look**!
M: What's this supposed to be?
C: It's supposed to be a **shark**!
M: A **shark**?!
C: With fins, and one fin on **top**.
M: Yeah, the dorsal fin. You **forgot**? It's called the dorsal fin.
C: Dorsal fin.
M: How does the dorsal fin **shape** like?

3.2.3. Recording procedures

The recordings took place in a quiet room with minimal reverberation in the participants' homes, without the presence of the researcher or any other person. To ensure that the recordings are of adequate quality for acoustic analysis of fine phonetic details, the mother and child each had pinned on their collar an omni-directional lapel microphone, which was connected to a NAGRA ARES-MII recorder recording at a sampling rate of 44.1 kHz at 16 bit. The mothers were also given instructions to ensure a good recording; they were instructed on the optimal position of the microphones if adjustments were needed, and were made aware of potential noise that could arise from the activities that would affect the recording. They were also reminded to avoid talking at the same time as the child. Noise from various sources such as traffic and electric fan was attenuated and kept to a minimum. Parents were also instructed to use only English to interact with their children, in order to avoid a bilingual mode (Grosjean, 2011), and to speak as they would normally with their child; minimal use of Mandarin, if any, was found in their interactions in the recordings.

3.2.4. Auditory and acoustic analysis

All word-final singleton oral stops in monosyllabic and stress-final disyllabic content words in the corpus were extracted, but bilabial stops /b, p/ were subsequently removed from further analysis due to their small number (*n* = 71) and unequal distribution according to phonetic environments between mothers, and thus the analysis comprised of only alveolar /t, d/ and velar /k, g/ stops. The target stops were also categorised according to their following phonetic environment: they occurred either before pauses (e.g. *that cat.)*, vowels (e.g. *cat is*) or before consonant-initial words (e.g. *cat fell*). Homorganic stops were excluded. Table 3.2 shows a breakdown of tokens produced by each participant, categorised by their following phonetic environment. Since the materials yielded an inadequate number of pre-vocalic stops for statistical analysis, and since pre-vocalic (PV) and pre-pausal (PP) coda stops have been found to be released equally frequently in previous studies as mentioned above, they were grouped together in the analysis, to be compared with pre-consonantal stops (PC). Unusable tokens such as those of poor acoustic quality or those with ambiguous stop bursts were discarded (see below for the acoustic cues that were used in the analysis). The final set of data contained 700 adult tokens (*M* = 50, *SD* = 8.06, range = 40–66) and 339 child tokens (*M* = 24, *SD* = 7.45, range = 15–39).

Table 3.2. Number of tokens analysed according to mother-child pairs and phonetic environments, including pre-vocalic and pre-pausal (PV+PP), and pre-consonantal (PC) positions.

Pair ID	Mother			Child		
	PV + PP	**PC**	**Total**	**PV + PP**	**PC**	**Total**
C5	34	20	54	20	10	30
C9	30	23	53	15	8	23
C17	26	18	44	20	19	39
C18	38	15	53	9	12	21
C20	21	19	40	7	8	15
C24	38	26	64	23	13	36
C30	35	31	66	13	7	20
C31	23	22	45	13	12	25
C35	15	25	40	13	6	19
C39	25	18	43	14	10	24
C46	39	14	53	5	17	22
C47	30	14	44	11	7	18
C55	36	13	49	9	6	15
C74	30	22	52	19	13	32
Total			700			339

The various realisations of the coda stops were identified manually by the first author using both aural cues and acoustic cues in the waveforms and spectrograms on Praat (v. 6.1.6; Boersma & Weenink, 2019). In connected speech, stops may be dropped entirely by adults, but their omission could also be developmental in the case of very young children, and therefore stops that were dropped were categorised separately for the initial analysis. Representative spectrograms and waveforms of the possible realisations of coda stops in Singapore English (i.e. released, unreleased, and glottal stop replacement), as well as those that were dropped, are shown in Figure 3.1, (a)–(d) respectively. The relevant acoustic events that were used in the identification were those defined in Miles, Yuen, Cox, & Demuth (2016) and Song, Demuth, & Shattuck-Hufnagel (2012), which are also shown in Figure 3.1: (i) presence of a coda stop: observable formant transitions at the end of the vowel from the vowel steady state, based on the effects the different stops have on the F2 and F3 of the vowels (E. R. Thomas, 2011); (ii) glottalisation: presence of creaky voice, shown by glottal irregularity near the end of vowel as indicated by aperiodicity in the spectrogram and irregular spikes of energy in the waveform; (iii) coda burst: characterised by an abrupt spike in the waveform and a strong energy transient on the spectrogram; and (iv) post-release noise: high energy aperiodic frication in waveform and on the spectrogram. The identification of the different realisations was first done auditorily and then confirmed by the absence or presence of key acoustic events: if there was at least one release burst with or without post release noise, or frication if the stop was replaced by an affricate, or if it was replaced by an ejective (i.e. [t][tʰ][t͡s][t']), the token was labelled as 'released'. If there was an absence of burst/noise that indicated a release but with formant transitions indicating the presence of a stop (i.e. [t ̚]), it was coded as 'unreleased'. Stops with flat periodicity and formant structure were coded as a 'glottal' stop [ʔ], or 'dropped', based on the presence of creaky voice. A second rater, a phonetician who was not involved in this project, was trained in the coding and asked to rate 100 randomly selected tokens (about 10% of all tokens). As the cues for released stops were reliable and their identification was straightforward, tokens that were coded as 'released' were excluded from the random selection of the 100 tokens. The rater was therefore asked to rate whether the 100 tokens were dropped, unreleased, or replaced by a glottal stop. 88% of the tokens were in agreement. Cohen's kappa was computed to assess the agreement; there was substantial agreement between the raters, $\kappa = 0.77$ (95% CI, 0.65 to 0.89), $p < 0.001$.

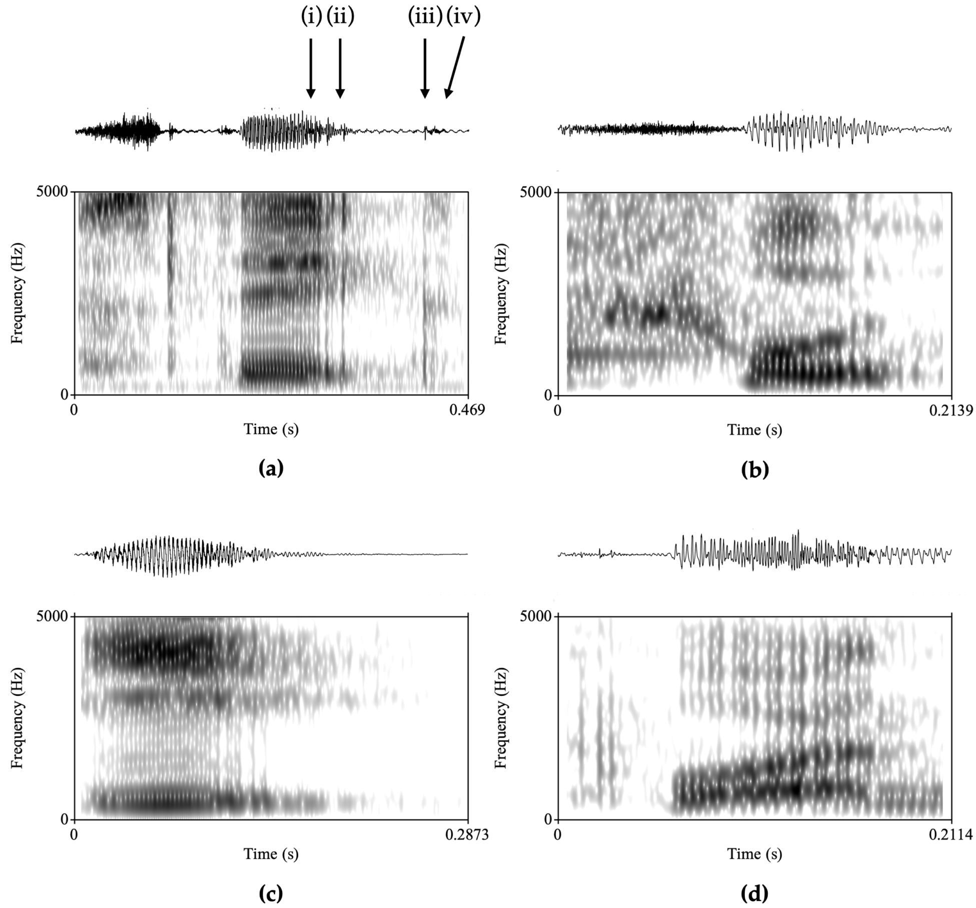


Figure 3.1 Representative waveforms and spectrograms taken from adult speech data for (a) released coda stop in the word *steak* (with monophthongisation of /eɪ/) [steʔk], (b) unreleased coda stop in the *food* [fuʔd̚], (c) glottal stop replacement in the word *eat* [iʔ], and (d) dropped coda stop in the merged words *put on* [pʊɒn]. Acoustic cues: (i) coda stop transition, (ii) glottalisation, (iii) burst, and (iv) post-release noise.

3.2.5. Statistical analyses

Mixed-effects logistic regression analyses were conducted using R statistical software (R Core Team, 2020) and the lme4 package (Bates et al., 2015). The specific response variable and the fixed and random effects included in the models are described below. For all models, to evaluate the contribution of each predictor, and to arrive at a more restricted model, pairwise model comparisons between a full model that included all the explanatory variables and a more restricted model that excluded the predictor under consideration were performed using likelihood ratio tests.

Results

3.3.1. Overall means

The distribution of the four realisations for each mother and children was first examined. Table 3.3 presents the overall means for each mother and child. Based on the gross averages, for mothers, there were more stops that were not released: 44% of the stops were unreleased, 15% were replaced by glottal stops, and 33.7% were released. Children, contrastingly, produced more released stops (52.5%) than unreleased stops (35.1%) and glottal stops (7.4%). In addition, mothers dropped 7.3% (n = 51) of all stops, and children dropped 5% (n = 17). As expected, many cases of final consonant deletion (48 for mothers and 5 for children) were elisions due to connected speech processes, resulting in the merger of words (e.g. [sɪɒn] *sit on*). No more than three stops per child were dropped, and thus the other 12 child tokens that were dropped were likely speech errors rather than due to developmental delay. All children in this study can therefore be regarded to have acquired the full coda structure. As predicted, individual results in Table 3.3 show that both mothers and children vary considerably in how frequently coda stops were released; the average stop release for mothers ranged from 5.8% to 69.4% and for children, from 21.1% to 90.9%.

Table 3.3. Overall percentages of coda stops that were released, unreleased, produced as glottal stop and dropped by each mother-child pair.

Pair	Released		Unreleased		Glottal stop		Dropped	
	Mother	Child	Mother	Child	Mother	Child	Mother	Child
C5	44.4	60.0	42.6	30.0	7.4	6.7	5.6	3.3
C9	54.7	60.9	26.4	30.4	15.1	8.7	3.8	0
C17	50.0	66.7	36.4	17.9	11.4	10.3	2.3	5.1
C18	41.5	85.7	32.1	9.5	22.6	4.8	3.8	0
C20	20.0	53.3	65.0	33.3	12.5	0	2.5	13.3
C24	10.9	25.0	56.2	41.7	18.8	22.2	14.1	11.1
C30	18.2	40.0	57.6	25.0	24.2	25.0	0	10.0
C31	20.0	36.0	71.1	56.0	4.4	8.0	4.4	0
C35	20.0	21.1	42.5	63.2	25.0	5.3	12.5	10.5
C39	16.3	29.2	46.5	66.7	14.0	0	23.3	4.2
C46	60.4	90.9	18.9	9.1	15.1	0	5.7	0
C47	43.2	72.2	27.3	27.8	20.5	0	9.1	0
C55	69.4	80	24.5	20.0	2.0	0	4.1	0
C74	5.8	37.5	67.3	53.1	13.5	0	13.5	9.4

The overall means of stop release by mother-child pairs are further presented graphically in Figure 3.2, in increasing order of mothers' production. A positive association between mother and child overall production patterns can be observed in the figure; mothers who released coda stops to a lesser degree also had children who tended to not release their stops, and the same is true for mothers who released their stops to a higher degree. A correlation test was performed on the means of overall stop release between children and parents. Due to the small sample size, a non-parametric correlation, Kendall's tau, was used. The overall percent release of coda stops of the children significantly correlated with the percent release of coda stops of the mothers, $\tau = 0.58$, $p = 0.004$.

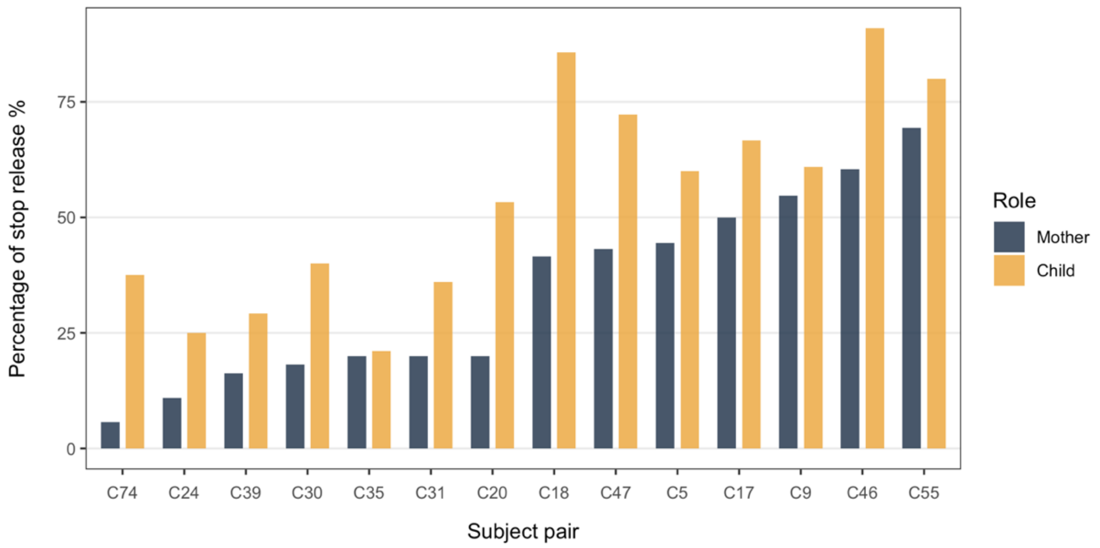


Figure 3.2 Distribution of overall percentages of stop release by caregiver-child pairs, ranked in increasing order of mothers' production.

3.3.2. Realisations of coda stops according to phonetic environment and place of articulation

As the realisations of coda stops in Singapore English are also influenced by phonetic environment and PoA, the percentages of the three main realisations (i.e. excluding dropped tokens) as a function of these factors are presented graphically in box plots and violin plots in Figure 3.3. Individual observations of all participants were included. Visual inspection of Figure 3.2 revealed two groups of mothers, with the division falling between participants C20 and C18; one group of mothers released coda stops less frequently, below 25% of the time, while mothers in the other released coda stops more frequently. For the sole purpose of visual comparison in Figure 3.3, the individual observations were grouped into two groups: '(L)ower' for mothers (and their children) that released coda stops less frequently, and '(H)igher' for the group that released coda stops more frequently. The outlines of the violin plots illustrate the kernel probability density, which is the proportion of the data located at a particular point, with thicker parts representing higher frequency of sample points.

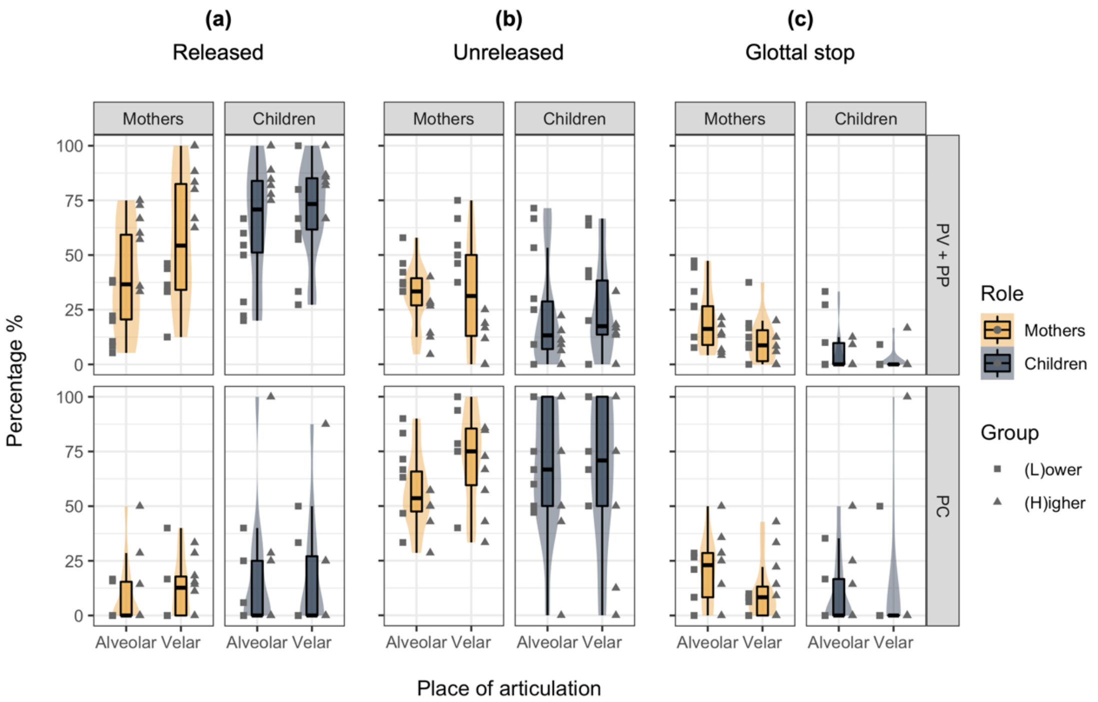


Figure 3.3 Box and violin plots of percentages of (a) released stops, (b) unreleased stops and (c) glottal stops as a function of role (left and right panels of each plot), phonetic environment (top and bottom rows) and place of articulation (left and right of each panel), with the inclusion of individual observations, grouped by (L) and (H). The outlines of the violin plots illustrate the kernel probability density (the proportion of the data located at a particular point).

To assess the effects of role (mother or child), PoA and phonetic environment on the realisations of coda stops, three separate mixed-effects generalised regression models, one for each of three main realisations, were run on all tokens. Each model included role, PoA and phonetic environment and all their two-way interactions as fixed effects, subjects and tokens as random effects, and the binary outcome of the realisation of focus as the response variable.

Stops that were released were first examined. In the best-fitting model that performed significantly better than an intercept-only baseline model ($\chi^2(3) = 227$, $p < 0.001$, marginal $R^2 = 0.29$, conditional $R^2 = 0.47$), the three main effects were significant predictors; PV+PP stops were more likely to be released than PC stops, $B = 2.41$, $OR = 11.12$, $p < 0.001$, 95% CI [7.41, 16.69], and velar stops were more likely to be released than alveolar stops, $B = 0.88$, $OR = 2.42$, $p < 0.001$, 95% CI [1.52, 3.85]. Children were also more likely to release their stops than mothers, $B = 0.99$, $OR = 2.70$, $p < 0.001$, 95% CI [1.90, 3.82]. In Figure 3.3, it can be observed that the inter-speaker variation in the release of stops mentioned above is most pronounced for PV+PP stops, evinced by the large interquartile ranges and long whiskers of the boxplots, as well as the relatively uniform widths of the violin plots that indicate large spread. By visual inspection, the differences between (L) and (H) groups are consistent after effects of PoA and phonetic environment are considered, although less categorical than when comparing global averages. Across contexts, some mothers, mostly belonging to (H), still released more stops on average than other mothers, mostly belonging to (L). This is evinced by how, especially for PV+PP stops, the individual observations of (H) mothers cluster within the upper quartile of the boxplots, with many at or near the maximum; the converse is true for those in (L), with more falling below the median, and at or near the minimum of the range. Child production generally reflects this pattern, and the differences between (L) children and (H) children are also most evident in their production of PV+PP stops. While participants may not fall neatly into the (L)/(H) groups across all contexts, it is evident that there is considerable inter-speaker variation with regard to the frequency of stop release, even after effects of PoA and phonetic environment were considered.

Unreleased stops were then examined. The best-fitting model with unreleased stops as the response variable performed significantly better than an intercept-only baseline model ($\chi^2(3) = 117$, $p < 0.001$, marginal $R^2 = 0.14$, conditional $R^2 = 0.29$). The main effect of phonetic environment and its interaction with PoA were significant predictors. Compared to PV+PP stops, PC stops were significantly more likely to be unreleased, $B = 1.29$, $OR = 3.63$, $p < 0.001$, 95% CI [2.42, 5.46]. That the interaction between PoA and phonetic environment is significant but not the main effect of PoA indicates that the difference between alveolar and velar stops is only significant when phonetic environment is considered. Specifically, velar PC stops were significantly more likely to be unreleased than alveolar PC stops, $B = 0.70$, $OR = 2.02$, $p = 0.025$, 95% CI [1.09, 3.74].

Finally, glottal stops were analysed. A caveat is that not all children in this study produced glottal stops and only 25 such tokens were recorded, so the results may not be indicative of patterns of Singapore children. In the best-fitting model that performed significantly better than an intercept-only baseline model ($\chi^2(4) = 33.69$, $p < 0.001$, marginal $R^2 = 0.13$, conditional $R^2 = 0.29$), the main effects of role, PoA, and the interaction between role and phonetic environment were significant predictors. Alveolar stops were significantly more likely to be replaced by glottal stops than velar stops, $B = 1.08$, $OR = 2.95$, $p < 0.001$, 95% CI [1.63, 5.35]. The significant interaction between role and phonetic environment reveals that, compared to mothers, children were more likely to replace PC stops with glottal stops than they did with PV+PP stops, $B = 1.11$, $OR = 3.05$, $p = 0.03$, 95% CI [1.12, 8.31].

In summary, the analysis revealed some systematicity in the distribution of realisations of coda stops in Singapore English in the adults, and children's production generally reflected these patterns. Effects of phonetic environment and PoA on stop release were found; PV+PP stops were released more often than PC stops, and velar stops were released more often than alveolar stops. Stops that were not released were mostly unreleased rather than replaced by glottal stops. This was especially so for PC stops, which were mostly unreleased. There was also a PoA effect on whether stops that were not released were unreleased or replaced by a glottal stop; alveolar stops were more likely to be replaced by glottal stops, while velar stops were more likely to be unreleased. There were however two main differences between the production of children and mothers. Firstly, children released significantly more stops than mothers. Second, while phonetic environment did not influence the likelihood of glottal stop replacements for mothers, children replaced more PC stops with glottal stops than they did for PV+PP stops. The analyses also revealed considerable inter-speaker variation in both mothers and children in how frequently stops were released.

3.3.3. Predictors of inter-speaker variation in stop release

Finally, the predictors of inter-speaker variation in stop release patterns between mothers and between children were explored. Mixed-effects generalised linear regression analyses were run to model the binary outcome of stop release (i.e. released or not released) in the mother and child data, which were analysed separately. Subjects and tokens were added as random effects. Language-internal fixed-effects factors included the two previously explored factors: PoA and phonetic environment. Although Gut (2005) did not find effects of phonological voicing on the likelihood of stop release in her adult participants, it was added into the two models as a fixed effect to confirm the findings. Language-external or lexical fixed-effects factors that may potentially condition the release of stops were included in the saturated models. For the mothers, these fixed effects included their age, the age of their children, SES, and their language dominance measured by the BLP. For the children, the language-external or lexical fixed-effects factors included their age, percentage English use, gender, SES, English vocabulary score and total vocabulary score. To ascertain the input–production relationship, the mean stop release of their respective mothers was included in the child model. As PoA and phonetic environment influence stop release as shown above, the mean stop release of each mother specific to PoA (i.e. velar or alveolar) and phonetic environment (i.e. PV+PP or PC) was calculated, generating four averages per mother. Each individual child token was then compared with the respective specific mean of their mother (Mother_%) according to the PoA and the phonetic environment of the child token, rather than the global average.

The results for the full models for mothers and children are presented in Table 3.4 and Table 3.5 respectively. In the model for mothers, PoA ($\chi^2(1) = 10.3$, $p = 0.0013$), phonetic environment ($\chi^2(1) = 127$, $p < 0.001$), and age of mothers ($\chi^2(1) = 6.29$, $p = 0.012$) yielded significant improvement of model fit. The best-fitting mothers-only model confirms that velars were more likely to be released than alveolar stops, $B = 1.15$, $OR = 3.15$, $p < 0.001$, 95% CI [1.66, 5.99], and PV+PP stops were more likely to be released than PC stops, $B = 2.68$, $OR = 14.56$, $p < 0.001$, 95% CI [8.34, 25.40]. It also revealed a positive association between mother's age and stop release, $B = 0.17$, $OR = 1.19$, $p = 0.01$, 95% CI [1.04, 1.36]. The BLP score was further broken down into its four individual components (i.e. language use, history, attitudes, and proficiency) and analysed in a separate model, but none of the components was a significant predictor. In the model for children, phonetic environment ($\chi^2(1) = 5.1$, $p = 0.024$) and their mother's production ($\chi^2(1) = 9.89$, $p = 0.0017$) contributed significantly to model fit. The best-fitting children-only model confirms that PV+PP stops were more likely to be released than PC stops, $B = 1.34$, $OR = 3.80$, $p = 0.004$, 95% CI [1.55, 9.35], but the effect of PoA was not significant, due to the almost equally frequent release of alveolar stops, especially by children in the (H) group. The children-only model also revealed a positive association between mother's production and the likelihood of stop release, $B = 0.03$, $OR = 1.03$, $p < 0.001$, 95% CI [1.01, 1.05].

Table 3.4. Regression coefficients of a saturated mixed-effects logistic regression model fit to the coda stops of mothers with stop release as response and subject and token as random effects.

Fixed factors	***B***	***SE***	***OR***	**[95% CI]**	***p***
(Intercept)	-6.43	2.56	0.00	[0.00 – 0.24]	**0.0012**
PoA	0.91	0.30	2.48	[1.37 – 4.49]	**0.003**
Phonetic environment	2.48	0.26	11.98	[7.17 – 20.03]	**< 0.001**
Voicing	0.58	0.32	1.79	[0.96 – 3.33]	0.07
Age (child)	-0.03	0.03	0.97	[0.91 – 1.03]	0.29
Age (mother)	0.17	0.06	1.18	[1.04 – 1.34]	**0.009**
SES	-0.04	0.09	0.96	[0.81 – 1.14]	0.64
BLP	-0.002	0.006	1.00	[0.99 – 1.01]	0.67

Note: CI = confidence interval. Reference category for PoA is alveolar, phonetic environment is PC, and voicing is voiced. Observations = 700. Marginal R^2 = 0.35, Conditional R^2 = 0.52.

Table 3.5. Regression coefficients of a saturated mixed-effects logistic regression model fit to the coda stops of children with stop release as response and subject and token as random effects.

Fixed factors	***B***	***SE***	***OR***	**[95% CI]**	***p***
(Intercept)	-4.28	2.97	0.01	[0.00 – 4.67]	0.15
PoA	-0.15	0.38	0.86	[0.41 – 1.83]	0.70
Phonetic environment	0.96	0.42	2.61	[1.14 – 5.98]	**0.02**
Voicing	0.24	0.39	1.27	[0.60 – 2.73]	0.53
Age (child)	-0.01	0.03	0.99	[0.94 – 1.04]	0.70
% English use	-0.01	0.04	0.99	[0.91 – 1.07]	0.81
English vocab.	0.003	0.003	1.00	[1.00 – 1.01]	0.28
Total vocab.	-0.002	0.001	1.00	[1.00 – 1.00]	0.24
SES	0.15	0.10	1.16	[0.95 – 1.42]	0.15
Gender	-0.80	0.55	0.45	[0.15 – 1.33]	0.15
Mother_%	0.04	0.009	1.04	[1.02 – 1.05]	**< 0.001**

Note: CI = confidence interval. Reference category for PoA is alveolar, phonetic environment is PC, voicing is voiced, and gender is female. Observations = 339. Marginal R^2 = 0.31, Conditional R^2 = 0.42.

Discussion

This study examined the coda stop release patterns of 14 Singaporean mother and child dyads, in order to uncover inter-speaker variation in the adults and to investigate the effects of such qualitative differences in the input on the development of coda stops of their children. The three hypotheses set out earlier predicted that while children as a group would exhibit adult-like patterns with regard to the distribution of realisations of coda stops, there would be individual variation in the frequency of stop release in the children that could be attributed to variation that would also be observed in their mothers. The findings of this study support all three hypotheses, which are summarised and discussed in turn.

Our findings support the first hypothesis, as the overall production patterns of both mothers and children in this study generally reflected the local adult norms reported in Gut (2005). A caveat is that the specific quantitative information in Gut's study is not directly comparable with the findings of this study. This is because her sample comprised a different number of stops according to their PoA and phonetic environment, and further in her analysis these two effects were analysed separately. Therefore, only general patterns reported in her study are discussed. In terms of stop release, gross averages revealed that, like most Singaporeans, mothers and children in this study released coda stops relatively less frequently than speakers of other standard varieties of English. However, children in the present study were found to release stops more frequently than their mothers, which has also been reported in previous studies (e.g. Song, Demuth, & Shattuck-Hufnagel, 2012). One reason could be the children's syntactically less complex utterances; children often produce words in isolation, and indeed children in this study produced 13.9% more pre-pausal tokens than mothers. Another reason that is pointed out by other studies could be biological or physiological, where the higher rate of stop release in children is attributed to the immature motor development and their smaller laryngeal airway, which results in greater subglottal and intraoral pressures (Imbrie, 2003; Song et al., 2012). A third possible reason (suggested by an anonymous reviewer) was that once the children in our study had begun to produce stops in an adult-like way, they overproduced or over-articulated them; it took longer for them to fully match adult models. This is similar to reports that children fail to reduce English unstressed vowels in an adult-like way until age six or later (Payne et al., 2012). Effects of PoA and phonetic environment reported by Gut (2005) were also observed in the regression models that included all mother and child tokens; pre-vocalic and pre-pausal stops were released more often than those before consonants, and velar stops were released more often than alveolar stops. The effect of PoA was, however, not observed in the children-only model, which is likely due to the almost equally frequent release of alveolar stops, especially by the children in the (H) group. No effect of voicing was found. In terms of the distribution of unreleased and glottal stops, stops that were not released were mostly unreleased (or inaudibly released), and compared to velar stops, alveolar stops were more likely to be replaced by glottal stops, and these patterns are also aligned with those found in Gut (2005). The findings here show that children's production patterns generally reflect those in the input. While some of these patterns could potentially be explained by other factors (e.g. for instance aerodynamics, where velar stops are released more often because of the smaller occlusion that results in a larger pressure build-up), features such as the predominance of unreleased stops are largely attributed to patterns in the input, as these are dialect-specific features.

The second hypothesis predicted variation in the frequency of stop release between mothers. We found that some mothers matched the rate of coda stop release of American and British adults and children reported in the mentioned studies, while others released the coda stops much less frequently, and to a degree similar to local norms, even after effects of PoA and phonetic environment were considered. Inter-adult variation in the speech of caregivers, however, can sometimes arise due to differences in the modifications made to their child-directed speech. For instance, mothers of much younger children or infants may exaggerate certain phonological contrasts or use more canonical forms. In some bilectal contexts, more standard variants are used when interacting with younger children and girls, while more vernacular forms or local variants are used towards older children and boys (Foulkes & Docherty, 2006). Such effects of age and gender, however, were not found in this study. This is likely because the nonrelease of coda stops is an invariable feature and one without much sociolinguistic salience, given that the nonrelease of coda stop is a pervasive feature of Singapore English that is widely attested in all social strata of the community (Bao, 2003). In other words, for many Singaporeans, the release and nonrelease of stops are not alternative forms. Furthermore, in casual conversations, some mothers have been found to use predominantly nonstandard variants or local dialects even with young children of the same age group (e.g. Smith et al., 2007). Likewise, we expect mothers in this study to pay less attention to their speech in casual play with their children, and not adopt an alternative variant that deviates from their informal register. Therefore, the inter-adult variation observed in this study is very likely to be due to individual differences in the phonetic realisations of coda stops. A preliminary analysis performed to uncover potential determinants of the variation was inconclusive. The only significant language-external predictor was the age of mothers. However, the adults in this study were mostly from the same age group and therefore the differences are unlikely to be due to them belonging to different phases of the bilingual education policy or exhibiting age-graded language variation, nor are they a result of differences in length of exposure to English. The effect of age that is observed here may be contributed by factors at a more micro-level that were not considered in the analysis. For example, a factor in this study that correlated with age that may offer some explanation, interestingly, is their seniority in their jobs. All six of the oldest mothers, who were above 35 years old, held managerial positions in the middle to upper management that also involved frequent interactions with clients. Of the six, five belonged to the (H) group. The communicative demands of their jobs may perhaps have made them more aware of their speech features, and may have also motivated them to adopt phonetic features of exonormative standards that index positive meanings and stances that are crucial for their roles, such as standardness, education, or attention to detail. The other language-external factor, language dominance as measured by the BLP, was not found to be significant predictor of stop release, nor were the individual component scores. However, inspection of individual questions in the BLP revealed some differences in their language history that could be explored in future studies. It was mentioned previously that, due to language shifts, previous generations of Singaporeans differed considerably in their language backgrounds, and thus the input that later generations received may differ in both quantitative and qualitative ways. The responses in the BLP may suggest that (H) mothers were raised in a more English dominant environment; three (H) mothers only started learning Mandarin after 3;0, and four of them only started to feel comfortable using Mandarin in their teenage years.

The final hypothesis of the study tested the effects of such qualitative differences in the maternal input on their children's production. The analysis revealed a very strong statistically significant positive input–production relationship, even after effects of PoA and phonetic environment were considered; mothers who released coda stops to a lesser degree also had children who tended to not release their stops, and the same was true for mothers who released their stops to a higher degree. The variation observed is unlikely to be due to age-related effects, as supported by the regression analysis. Children as young as 1;6 have been found to exhibit adult-like cues in coda stop production, and by 2;6, production patterns closely approximate those of the adults (e.g. Demuth et al., 2009; Song et al., 2012). That children C18 and C55, who were 2;8 and the youngest in the group, released their stops frequently suggests that the nonrelease of stops of other children in this study was unlikely to be a result of biological or physiological constraints. Similarly, older children who released their stops less frequently than others, such as C74, C30 and C35, show that the nonrelease of stops was unlikely to be due to developmental delay or differences in the length of exposure to English input. Language dominance is also an unlikely determinant, as children in this study were all highly English dominant and matched in their amount of English use. In addition, effects of CLI are not expected, as Mandarin lacks coda oral stops, and previous studies have shown that both early and late L2 English learners were able to produce English singleton coda stops without much difficulties (e.g. Xu & Demuth, 2012; Rattanasone & Demuth, 2014). Other language-external or lexical effects, such as SES and vocabulary sizes, were also non-significant predictors. The findings therefore strongly suggest that the main contributor of the variation observed in the children was the qualitative differences in the maternal input, corroborating the strong input–production relationship attested in previous studies (e.g. Stoehr et al., 2019).

The findings of this study lend support to acquisition theories that focus on the role of the input. Previous studies have shown that infants are sensitive to within-category variation and that fine-grained distinctions are retained, based on their speech perception (e.g. Cristià, 2011; McMurray & Aslin, 2005), suggesting that the variation in acoustic realisations that are irrelevant to category membership is not ignored in the acquisition process, contrary to the assumption of more traditional theories of language acquisition.

Given that children in this study acquired the same phonemes and phonological rules but differed in the phonetic implementation based on their mother's production, the findings suggest that young children are indeed sensitive to fine acoustic properties that are nonphonemic, and further these properties are also reflected in their production, suggesting that the source of input matters.

One question that arises is how variability in other sources of input such as that of their father, peers and other significant adults may have an influence on the phonological acquisition in children, and how they negotiate variable input. Variation at the societal level is commonplace in multilingual contexts. In the case of Singapore, apart from the inter-ethnic and intra-ethnic variation that exists in the speech of peers and other significant adults such as teachers in the childcare or nursery, children also hear foreign accents from the consumption of media. Previous studies have shown that it is important to consider the relative significance of the various models of input to the children. Parents are the primary sources of input in the formative years, and thus in this study we see strong correspondences between properties of the input and properties of the children's output. In mixed-dialect environments, children may adopt accent features of both fathers and mothers (e.g. Thomas & Scobbie, 2015). However, this input–production relation is often overridden by peer effects or community norms as children get older. In their adolescence, they gain a deeper awareness of sociocultural and appropriateness norms, and the speech models of their peers and the community become more significant to the children (e.g. Stanford, 2008). In situations where multi-lingualism or multi-dialectism is the norm, however, the individual may choose to retain their accent acquired from earlier models because of its value as a marker of a certain identity (e.g. Sharma, 2011; Sim, 2019). The study on the VOT production of two English-Italian-Spanish simultaneous trilingual sisters in the United States by Mayr & Montanari (2015) exemplifies this point. The two children heard English from their native English father and other native speakers from the larger native English-speaking community, Italian from their Italian-speaking mother and teachers, accented Italian from their English-dominant peers in the Italian school the two children attended, and Spanish from their monolingual nanny. Due to the 'major language effect', their English production was target-like, but their VOTs in Italian were not, perhaps due to the accented speech of their English-dominant peers. The children produced Spanish VOTs that were similar to the adult model, as the nanny was their significant input model. Such studies on multiple accents or foreign accent and their social pressures and influence on child phonological acquisition are sparse, and this clearly is an avenue for future research.

Taken together, the considerable between-speaker variation, as well as the strong input–production relationship attested in this study, echo the conceptual and methodological implication that a complete, accurate depiction of child production cannot be achieved by averaging group behaviours. While this is especially so for studies on multilingual populations, one must be equally cautious to assume group homogeneity by virtue of the adults being 'native' speakers, given that there can also be considerable individual variation (e.g. Cristià, 2010). We propose that, at the very least, child production studies should take the production patterns of the significant caregiver into account.

To conclude, the variability in the stop release of mothers contributes to the understanding of the complex linguistic environment in which children in multilingual contexts acquire their phonological representations. Through the use of a variable property in Singapore English, this study has demonstrated the direct role of maternal input in phonological development, and has shown that the input effects extend to specific phonetic details. More importantly, the findings of this study show that variable production in children is not only due to differences in the quantity of input; qualitative aspects of the input also play a significant role.

CHAPTER 4

Negotiating social meanings in a plural society: Social perceptions of variants of /l/

Original abstract: This study illustrates how speech features that emerged from language contact and acquisition in a pluralistic society can accrue diverse social-indexical meanings over time. The social perceptions towards three variants of coda /l/ in Singapore English, namely dark-l, the variant associated with prescriptive norms, and clear-l and vocalised-l, which are variants that arose through language contact, were examined. The findings show that clear-l and vocalised-l are associated with specific ethnic groups and have equally diverse meanings, but their meanings have evolved differently; vocalised-l is an emerging local standard, whereas clear-l remains largely stigmatised. Their diverse meanings are shown to be connected by social factors within a network of interrelated signs, and their interpretations are dependent on the hearer's experiences, such that we are observing different parts of the sociolinguistic reality. Restricted experiences with the social world and regulation of social perception are also shown to potentially contribute to accent-based prejudices.

Article: Sim, J. H. (2022). Negotiating social meanings in a plural society: Social perceptions of variants of /l/ in Singapore English. *Language in Society*, 1-28. doi:10.1017/S0047404522000173. (with minor changes made following examiners' comments).

Introduction

Differential speech features that emerge from language contact and acquisition, such as those that characterise British Asian English (e.g. Kirkham, 2017; Sharma, 2011) or structural innovations in New English varieties (e.g. Deterding, 2007b; Gut, 2011) can come to gain social-indexical meanings. These features can become emblematic of a particular socio-demographic group or context based on association by contiguity (Agha, 2007; Silverstein, 2003), and can be selectively used in the creative construction of social personae, styles and identities, such as through the adoption of a more ethnically distinctive style (Benor, 2010). Like other indices, social meanings of differential features are mutable along with the constantly evolving social landscape, where they are (re-)interpreted as they are used (Eckert, 2012), and may become reallocated with new social functions across generations (e.g. Gnevsheva, 2020; Sharma & Sankaran, 2011). This is the case for multilinguistic communities who have experienced or are experiencing shifts in language use at the societal level, in which social meanings may constantly emerge and evolve, along with what is considered as standard/mainstream or local/marked. Moreover, in culturally and linguistically pluralistic societies, the interpretation of a feature can vary between individuals; not only can one feature index several distinct social personae and qualities, but there is also considerable variation in the backgrounds of the listeners and their experiences with the sociolinguistic world (Johnstone & Kiesling, 2008). This study examines the social perceptions towards three variants of coda /l/ in Singapore English (SgE): dark-l, the variant associated with prescriptive norms, and clear-l and vocalised-l, which are variants that arose through language contact. The key findings revealed that while the local variants are primarily associated with the ethnic groups whose other language(s) may have contributed to their emergence, their meanings may have evolved differently; vocalised-l is perceived by many to be pan-Singaporean and is ascribed social meanings of dark-l that suggest an emerging local standard, whereas clear-l remains exclusively associated with the ethnic minorities and is largely stigmatised. The three variants are also revealed to have very diverse and sometimes conflicting social meanings. These are described to be interrelated in a highly complex meaning network and linked by various social factors, and the myriad interpretations are but fragments of a whole sociolinguistic reality, shaped by listeners' experiences with the complex sociolinguistic reality or a lack thereof. Drawing on Eckert's (2008a) notion of an indexical field, the social-indexical meanings of these variants are further organised in a shared space, which is shown to potentially be a means to document change in social meanings in response to the evolving sociolinguistic landscape.

4.1.1. Social-indexical meanings of /l/

The way differential features become recognised as characteristic of a variety/dialect or associated with a particular ethnic/cultural affiliation (Benor, 2010; Eckert, 2008a; Hoffman & Walker, 2010) is enabled through a sociohistorical process of what Agha (2007) termed 'enregisterment', which refers to 'processes and practices whereby performable signs become recognised (and regrouped) as belonging to distinct, differentially valorised semiotic registers by a population' (p. 81). Many studies have shown that a single variable can carry social meanings, and manipulating a single phone is enough to alter the hearer's evaluation of a speaker (e.g. Chappell, 2016; Plichta & Preston, 2005; Walker, García, Cortés, & Campbell-Kibler, 2014). According to Silverstein (2003), such indexical associations can occur at different levels of abstraction or 'orders of indexicality'; a linguistic form gains higher-order indexicality when it gains new meanings that presuppose lower-order meanings. These multiple related social meanings can be further organised in what Eckert (2008a, p. 464) described as an indexical field — 'a constellation of meanings that are ideologically linked.' Using hyperarticulated /t/ release as an example, she showed how the feature is associated with clarity and emphasis in American English, and in turn its ideological associations allow speakers to employ /t/ release to index different social types, such as nerd girls and gay divas. In other words, the same variant might index different semantically related qualities depending on the context; it may, for instance, index educatedness and nerdiness when used by nerd girls, but prissiness when used by gay divas.

The speech feature of interest in this study is allophones of the alveolar lateral. Cross-linguistically, alveolar laterals differ with regard to their degree of velarisation and/or pharyngealisation, with some languages having a darker (more velarised or pharyngealised) variant than others (Recasens, 2012). In addition, some varieties of languages exhibit a clear or dark variant in all syllable positions, while in others they are syllabically conditioned (e.g. Kirkham, Turton, & Leemann, 2020; Recasens & Espinosa, 2005). Varieties of Southern British English, for example, are often described to have clearer /l/ in the onset and a darker /l/ in the coda (Wells, 1992). Contrastingly, likely due to effects of cross-linguistic influence of languages with clearer /l/ variants such as Panjabi, Urdu and Arabic, British Asian English is often characterised as having clearer allophones of coda /l/ (e.g. Khattab, 2002; Kirkham, 2017; Sharma, 2011). In her study of second generation British Asians, Sharma (2011) found that some speakers constructed different personae by being more ethnically distinct in their speech features towards family members and India-born speakers, but more mainstream with Anglo speakers. Differential features can also emerge from and evoke attitudes that are linked with various socio-historical and -political processes. One such example is Simonet's (2010b) study of the alveolar laterals of Catalan-Spanish bilinguals. Majorcan Catalan has dark-l in all positions, while Spanish has clear-l in all positions. Simonet (2010a, 2010b) found that, particularly in Majorca, not only is darker /l/ associated with Catalan-dominant Catalan-Spanish speakers, but it also indexes local and perhaps rural origins of the speaker. Simonet explained that this was perhaps so because Spanish monolingual speakers settled mostly in the main Majorcan metropolitan areas during the mass migratory waves in the 1950's and 1960's, when Majorcan Catalan had a low level of social prestige for socio-political reasons. This led Simonet to argue that a reason why his Spanish-dominant female participants had a merged L1+L2 lateral category could be because they may have distanced themselves from what they might have perceived as Catalan-accented Spanish, which could also explain why they also produced clearer laterals than older females of similar linguistic background.

4.1.2. Variants of coda /l/ in Singapore English

Many structural innovations in New English varieties can be attributed to various influences of the indigenous languages/substrates (Gut, 2011; Schneider, 2003). Similar to the formation and use of ethnolects (e.g. Gnevsheva, 2020; Sharma & Sankaran, 2011), these features can stabilise to form a widely accepted local variety, as is the case of Singapore English (Deterding, 2007b), and are adopted by later generations of speakers and remain in production even if speakers have attained proficiency in English, and further be reallocated with social meanings. Therefore what would have been learner errors or effects of cross-linguistic influence for one generation may be acquired from the input by later generations of speakers, and in turn be used in stylistic practice. Two coda alveolar laterals described in previous work on SgE, vocalised-l and clear-l, are examples of such innovations. Coda /l/ of Singaporeans tends to be vocalised, a process in which the lateral is replaced by either a (labial-)velar approximant or a back vowel or semivowel (e.g. *pill* [piu]). After back vowels, coda /l/ may be deleted (e.g. *ball* [bɔː]). Many Malay Singaporeans exhibit a different variant of coda /l/. In his examination of the English production of ten educated Singaporean English-Malay simultaneous/early sequential bilinguals between the ages of 19 and 28, Sim (2019) found that his Malay-dominant participants used predominantly clear-l syllable-finally. Sim posited that, rather than this being an effect of cross-linguistic influence, clear-l could have been learned through the input, similar to British Asians (e.g. Kirkham, 2017; Sharma, 2011). Their maintenance and use of coda clear-l could also be motivated by social-indexical reasons; Sim's Malay-dominant Malays were associated with more Malay-dominant families and social circles, and identified more with a Malay-speaking culture. While the present paper is not concerned with the aetiology of these two variants, the phonological or phonetic properties of the substrate languages could have contributed to their emergence: Chinese languages do not allow coda laterals, and while Malay has voiced alveolar laterals syllable-finally, they are always clear, in all syllable positions. No study has yet examined the /l/ of Indian Singaporeans, but descriptions of Indian English and also studies on British Asians of South Asian heritage show that clear-l and also retroflex [ɭ] are variably used syllable-finally (Sailaja, 2009; Sharma, 2011). While it cannot be assumed that clear-l is also used by Indian Singaporeans, we may expect the clear variant to also be associated with them in this study.

Despite a largely stabilised local norm in Singapore, features belonging to established standard varieties of English are often regarded as prescriptively correct. The variant of /l/ associated with these standards would be dark-l. Just as Received Pronunciation (RP; Agha, 2003) and Putonghua (Dong, 2010) were enregistered as standard and a status emblem, enregisterment of an 'internationally-acceptable' English in Singapore as legitimate and the appropriate norm is facilitated through many state-motivated metadiscursive practices that reinforce its indexical values, such as in classroom instruction, media, political speeches, and government campaigns, most notably the 'Speak Good English Movement' (Rubdy, 2001). At the same time, the local varieties and their divergent features are enregistered as incorrect or nonstandard. Such enregisterment of social meanings can transform into socialised habits of speech perception and production. Recent descriptions of SgE describe variation based on the social-indexical meanings of alternative forms of a linguistic feature (e.g. Alsagoff, 2007; Leimgruber, 2013; Starr & Balasubramaniam, 2019). Depending on the speaker, listener and context of their use, variants that are associated with standard varieties of English can be used to index formality, authority, and educational attainment. Contrastingly, local dialectal features, which include 'Singlish' and ethnic markers, embody sociocultural capital and often index informality, camaraderie, and group membership.

4.1.3. Multiplicity of interpretations

Matched-guise studies that involved SgE varieties revealed that attitudes are not homogenous amongst Singaporeans, and guises of more colloquial varieties (which included standard–local accents more generally) did not index solidarity traits for all as one would expect (Cavallaro et al., 2014; Cavallaro & Ng, 2009). Indeed, indexical meanings can vary even for members within a community, based on their personal experiences with their particular sociolinguistic worlds. In their study of monophthongal /aw/ in Pittsburgh, Johnstone & Kiesling (2008) found that those who heard monophthongal /aw/ as indexing local identity were least likely to use it in unselfconscious speech, and many of those who did use it did not identify it as indexing localness. Locals also attributed higher-order indexical meanings, if they did so at all, to local forms in different ways. The findings show that while a feature may be statistically associated with a particular socio-demographic group or context, it cannot be assumed that the indexical meaning is widely shared with or is the only meaning to members of a community. In another study, Campbell-Kibler (2008) showed that listeners' overall impression of a speaker affects how they interpret the English variable (ING) (the alternation between word-final *-in* [ɪn, ən] and *-ing* [ɪŋ]) in the person's speech; some regarded the *-in* guise as compassionate, while some others, condescending. She added that the 'differences of opinion relate not to disagreements about (ING) alone, but to a difference in how the listeners incorporate their understanding of the variable into their image of the speaker' (p. 638).

Agha (2003) noted that the specific ways a hearer characterises a variant, and therefore also the degree of access to the social meanings of these variants the hearer has, depend on their experiences and their history of socialisation to these contrasts. In socioculturally complex societies like Singapore, there is evidently even greater potential for social meanings to be diverse and subject to different interpretations, in part due to the variation in speaker and listener attributes. Bilingual experience is highly varied, and so are language outcomes, and therefore some speakers or a subpopulation may produce certain features more frequently than others in the community it indexes. Sim (2019), for instance, found that, in spontaneous speech, Malay-dominant Malays used coda clear-l predominantly, while their English-dominant counterparts used dark-l most of the time. In his examination of l-vocalisation in the speech of educated Chinese Singaporeans, Tan (2005) found that the percentage of l-vocalisation (compared to dark-l) varied significantly between speakers, ranging from 39% to 89%. Depending on the hearer and their experiences, variants can be characterised in increasingly specific ways; clear-l, for example, can be associated with non-Chinese, Malays, Malay-dominant Malays, and may further evoke images of various related subgroups/subcultures of the community, and thereby also influencing the social meanings that these hearers apply to the variants.

4.1.4. Current objectives

The primary aim of this study is to explore the accrued social-indexical meanings of three variants of coda /l/ in Singapore English, namely dark-l, vocalised-l and clear-l, against the backdrop of the various socio-historical and -political processes that have shaped them. It seeks to answer these research questions:

1. Have the variants come to be associated with particular ethnic groups, and furthermore, do they index subcommunities or specific social types?
2. What are the social interpretations of these variants and how do they differ between variants?

3. How does diversity in listener attributes and experiences in a pluralistic society result in variation in the interpretation of and attitudes towards these variants?

METHODOLOGY

The study was based on the matched-guise technique, which elicits listeners' reactions to various recordings, or guises, by the same speaker(s) that differed only in the variables of interest.

4.2.1. Stimuli[6]

The creation of the stimuli was constrained by the many inter-ethnic differences in other linguistic features such as intonation (e.g. Lim, 2000) which, if acoustically manipulated, could render the stimuli highly unnatural. Therefore, the stimuli were monosyllabic words instead of sentences or short paragraphs. They also came from two speakers of different ethnicities, one who was Malay and the other Chinese, as a means to account for potential variation in speech features other than those informed by previous studies, such as voice quality. Both speakers were born and raised in Singapore and were English-dominant. The Malay speaker was a 34-year-old female, who was teaching in an English-medium school. She used Malay with her family and some friends and was still affiliated to the Malay ethnic community. The Chinese speaker was a 27-year-old female. She had limited interactions with Singaporeans of other ethnicities and therefore her overall speech features were essentially that of a typical educated Chinese Singaporean.

The materials were three pairs of monosyllabic words that were matched in their vowels (/ɔ, ʌ, i/). The pairs were: *hall, fall*; *hull, sull*; *heel, feel*. These words were semantically and phonologically ethnically neutral in SgE. Stimuli for the first word of each pair were produced by the Malay speaker, and the others by the Chinese. The speakers were recorded separately in sound-attenuated rooms, using a Zoom H5 recorder, at a sampling rate of 48 kHz at 16 bit. The Malay speaker was first trained in producing the vocalised and dark variants by the author. The Chinese speaker, who already could produce

[6] The stimuli of this study were not taken from the speech corpus described in Chapter 2 of this thesis.

vocalised-l and dark-l, was trained in the production of clear-l through listening to the recordings of two Malay-dominant Malays. Speakers were then asked to produce alternate tokens for the target words, each carrying a different variant of /l/. Fillers that included other ethnic features, including those specific to Indian Singaporeans, were also recorded. There was a total of 40 tokens, including 22 fillers.

The /l/ tokens were first checked to ensure that they were representative of the three variants, using acoustic and auditory cues, before manipulation. Clear-l has a relatively higher F2 and low F1. The mean F2 of the clear-l tokens was 2015.26 Hz (*SD* = 60.99) while the mean F2 for dark-l was 903.29 Hz (*SD* = 85.41), and these values fall within the ranges that distinguish the darker and clearer variants of /l/ across language varieties reported in Recasens (2012). Following previous matched-guise experiments that involved controlled stimuli (e.g. Campbell-Kibler, 2007; Fridland, Bartlett, & Kreuz, 2004; Graff, Labov, & Harris, 1986), the pitch, duration and intensity of the tokens were manipulated on Praat (Boersma & Weenink, 2019), to limit variability between alternate tokens, such that any change in judgment of the hearers can be attributed to the different variants of /l/. However, the coarticulatory effects of the different laterals on the vowel could not be manipulated without them sounding unnatural, and so the tokens also differed slightly in their vowel quality, but the difference is not expected to affect the judgements of the hearers. The stimuli were subsequently checked. Three linguists trained in phonetics were first asked to rate the naturalness of the tokens and to identify the variant of /l/ in each token. Seven naïve Malays were then asked to rate the clear-l tokens on how 'Malay sounding' they were, and were asked to give reasons for low ratings. Most tokens that were rated poorly were those produced by the Chinese speaker, which were deemed by all listeners to sound more 'Indian' and were described to be 'thicker' than the Malay /l/, which could mean that there was more laminal contact with the alveolar ridge in the clear-l of the Chinese speaker. The poorly rated clear-l tokens were re-recorded and checked again, and all the clear-l tokens were rated as at least 'Probably Malay'.

4.2.2. Informants

The responses came from 111 informants recruited through social media and snowball sampling. Their basic demographics are shown in Table 4.1. The participants had no hearing impairment that would affect their ability to complete the task. They were mostly native Singaporeans, except for six, three of whom had been living in Singapore for at least 15 years since before they were five years old, and the other three had lived in Singapore for more than 20 years at least since they were ten years old. These six participants were also either ethnically Chinese or Malay, and also had Mandarin or Malay as their ethnic mother tongue (EMT) respectively. Listener attributes and factors that could differentiate their varying degrees of access to the various variants in their linguistic environment were considered (Cavallaro et al., 2014; Cavallaro & Ng, 2009; Sim, 2019). In addition to their ethnicity, age, gender, and education level, all participants were asked to describe their language use pattern on a scale of 0 (only English) to 10 (only EMT), and also their cultural affiliation, again from 0 (only English-speaking) to 10 (only EMT-speaking). Informants were also asked to rate from 0 (never) to 10 (always) the amount of interaction they had had with Singaporeans of the three major ethnic groups (i.e. Chinese, Malays and Indians; three scores). The gender of 32 participants could not be ascertained, and the missing data were coded as a new level ('unknown') for the statistical analyses. A caveat is that there were very few ethnically Indian listeners, and therefore their results were interpreted with caution.

Table 4.1. Listener demographics.

Variable	***n***	**Median (range)**	**Mean (*SD*)**
Ethnicity: Chinese/Malay/Indian	65/36/10		
Age		30.5 (18–53)	30.22 (7.98)
Gender: Male/Female/Unknown	29/50/32		
Education level:			
Secondary or below	1		
Post-secondary	16		
Undergraduate	16		
Bachelor's	56		
Postgraduate	22		
Language use (0 = English only)		3 (0–8)	3.03 (1.75)
Cultural affiliation (0 = English only)		4 (0–9)	3.66 (1.99)
Interactions with (0 = Never):			
Chinese		9 (3–10)	8.62 (1.80)
Malays		5 (1–10)	5.66 (3.18)
Indians		4 (0–10)	4.28 (2.88)

4.2.3. Experimental design

The experiment was hosted on Qualtrics. Participants first underwent a headphone screening test (Woods et al., 2017), before attempting the experiment that comprised two parts: an ethnic association task and an attitude judgement task. In the instructions that preceded each part, participants were told that the speakers were Singaporeans.

In the ethnic association task, listeners heard each token a maximum of five times (one sound file per token, with a one second pause between repetitions), and responded to the question, 'How near is the pronunciation you have just heard to what you would expect from the ethnic groups shown?' by clicking on a point on a three-way scale developed for this study[7] (Figure 4.1). The scale takes into account the relativity of ethnic markedness as perceived by a listener and that a feature can potentially be perceived as shared by members of more than one ethnic group. The ends of the scales indicate a feature as being absolutely representative of the respective ethnic group, and points along the scale and away from one group indicate decreasing affiliation of the feature with that ethnic group but increasing affiliation with the other; the middle point of each side indicates that a feature is considered by a listener to be equally representative of both ethnic groups. Finally, respondents were told to choose the option in the middle of the triangle, 'Could be any', if the feature was thought to be not ethnically distinct. Listeners heard all 40 tokens. The tokens were pseudorandomised such that no two tokens by the same speaker and no two tokens of a word (i.e. with alternative forms) appeared consecutively. Participants completed a practice trial that consisted of two tokens before the actual task.

[7] I thank Francis Nolan for his comments on the methodology and for proposing the idea of a combined rating scale.

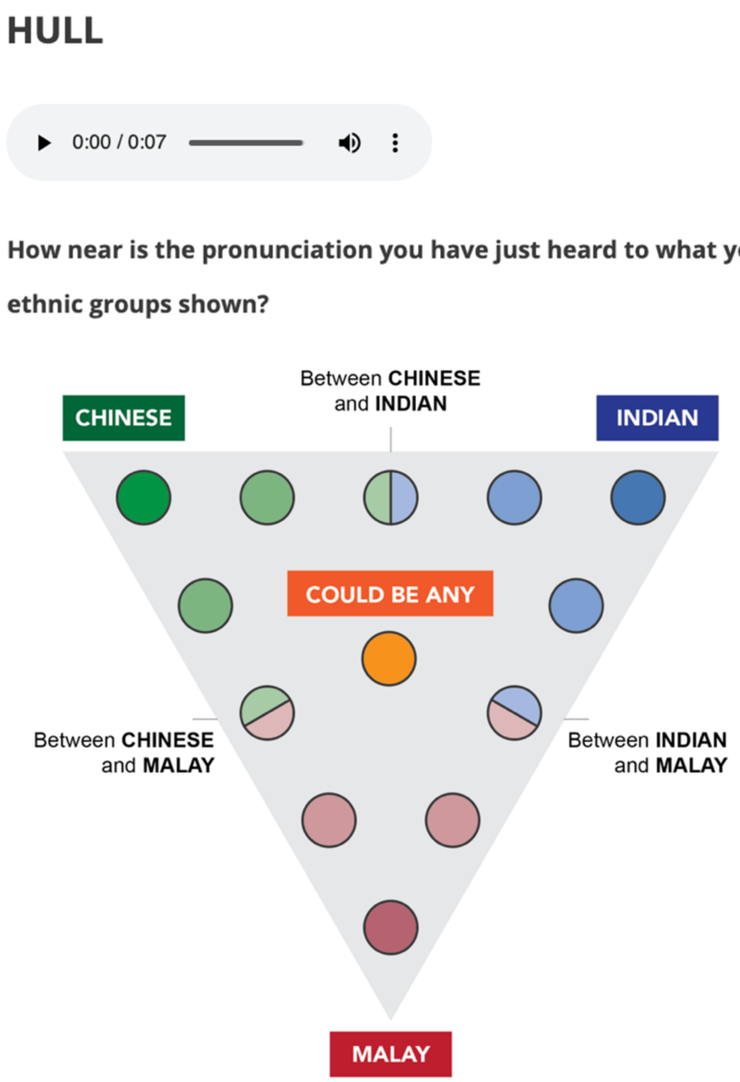
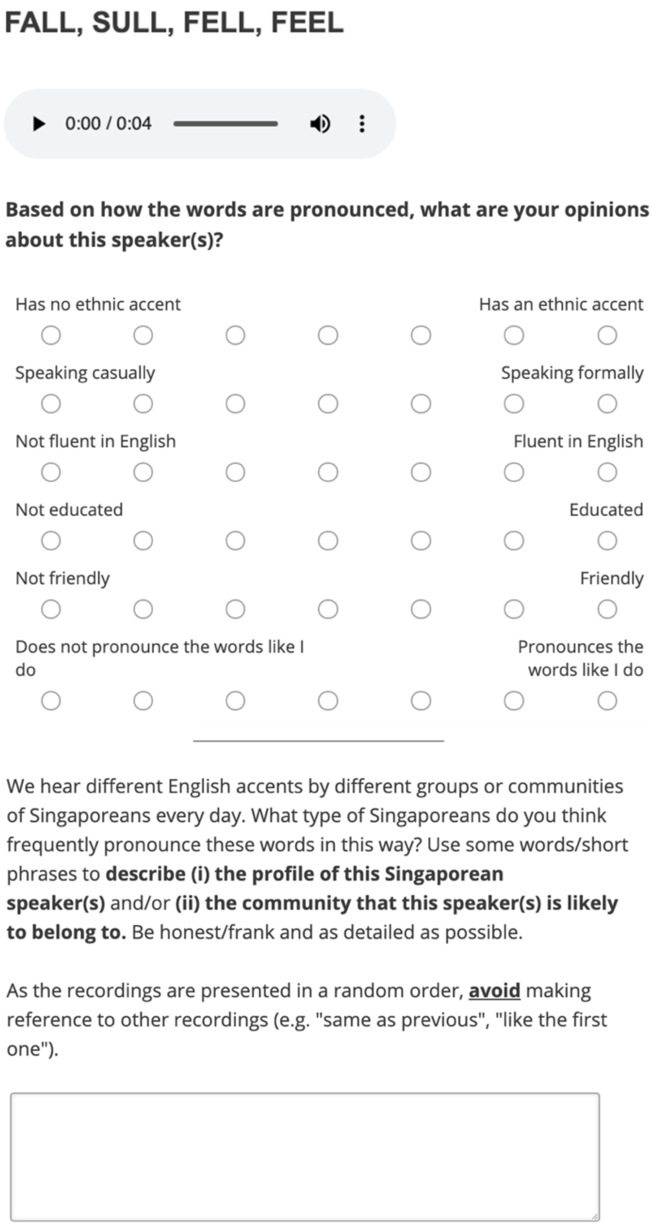


Figure 4.1 A sample item from the ethnic association task.

In the attitude judgement task, listeners were asked to rate the tokens according to five traits on a seven-point scale, namely ethnic-accentedness, formality, fluency, educatedness, and friendliness (Figure 4.2). The participants were also asked to rate how close they thought the pronunciation of the words was to theirs using the same scale. The selection of traits was limited by the nature of the one-word guises in this study, and therefore the informants were also asked to describe the profile of this Singaporean and/or the community that the speaker(s) is most likely to belong to in an open-ended response, in order to elicit other social meanings that could not be captured by these traits. The same tokens used in the ethnic association task were used in this task, but they were grouped according to the variant of /l/, and listeners could listen to the sets (one set per variant) as many times as they liked. The effect of speaker on the responses for the open-ended question, which are qualitative in nature, could not be controlled statistically, and this could affect the interpretability of the results especially for vocalised-l and clear-l, which are expected to have accrued more diverse social meanings. To avoid this potential issue, only the tokens of the Malay speaker were used in the set for clear-l, the tokens of the Chinese speaker were used in the set for vocalised-l, and the tokens of both speakers (Chinese first) were used for dark-l; these speaker(s) and their tokens for each set were chosen as they reflect the actual users of the variants.



FALL, SULL, FELL, FEEL

0:00 / 0:04

Based on how the words are pronounced, what are your opinions about this speaker(s)?

Has no ethnic accent — Has an ethnic accent

Speaking casually — Speaking formally

Not fluent in English — Fluent in English

Not educated — Educated

Not friendly — Friendly

Does not pronounce the words like I do — Pronounces the words like I do

We hear different English accents by different groups or communities of Singaporeans every day. What type of Singaporeans do you think frequently pronounce these words in this way? Use some words/short phrases to **describe (i) the profile of this Singaporean speaker(s)** and/or **(ii) the community that this speaker(s) is likely to belong to.** Be honest/frank and as detailed as possible.

As the recordings are presented in a random order, **avoid** making reference to other recordings (e.g. "same as previous", "like the first one").

Figure 4.2 A sample item from the attitude judgement task.

4.2.4. Metalinguistic interview

As clear-l as a variant in SgE is relatively under-researched, face-to-face metalinguistic talk between the author and 11 other Malay Singaporeans was conducted in order to understand more about its use, associations, and its significance to the Malay ethnic community. Brief demographic information about these informants is presented in Table 4.2. The duration of the interviews ranged from three to twenty minutes (*M* = 12). During the interviews, informants heard audio samples of word produced with clear-l and were invited to share their opinions about the /l/. They were first posed questions that were also asked in the online survey, for example, the ethnicity and profile of the speaker. The conversations were allowed to progress organically, and touched on topics regarding, for example, gender variation, within-group stigma, the use of clear-l in the home domain, its use with peers, and the use of other variants of /l/.

Table 4.2. Demographics of interview participants.

ID	Gender	Age	Education level	Language use	Cultural affiliation
F1	Female	22	Bachelor's	2	4
F2	Female	21	Undergraduate	3	4
F3	Female	19	Undergraduate	5	7
F4	Female	23	Undergraduate	3	5
M1	Male	21	Undergraduate	5	5
M2	Male	23	Undergraduate	4	5
M3	Male	22	Undergraduate	3	3
M4	Male	22	Undergraduate	1	2
M5	Male	32	Post-secondary	4	3
M6	Male	31	Bachelor's	3	4
M7	Male	35	Bachelor's	4	3

Note: language use/cultural affiliation: 0 (only English) to 10 (only Malay).

Results

4.3.1. Ethnic association task

A total of 1988 responses were recorded in the ethnic association task. The percentages of ratings for each variant of /l/ are presented in Figure 4.3, using the same categories shown in Figure 4.1. For reasons of clarity, only percentages greater than five are shown, and a bubble chart that reflects the relative proportion of ratings for each variant is superimposed. The plots reveal that most informants associated dark-l as a pan-Singaporean feature, although equally many regarded it as at least somewhat Chinese. The reverse is true for vocalised-l; more respondents perceived vocalised-l to be distinctly Chinese than ethnically neutral. In stark contrast, responses for clear-l fell almost exclusively along the MALAY–INDIAN scale.

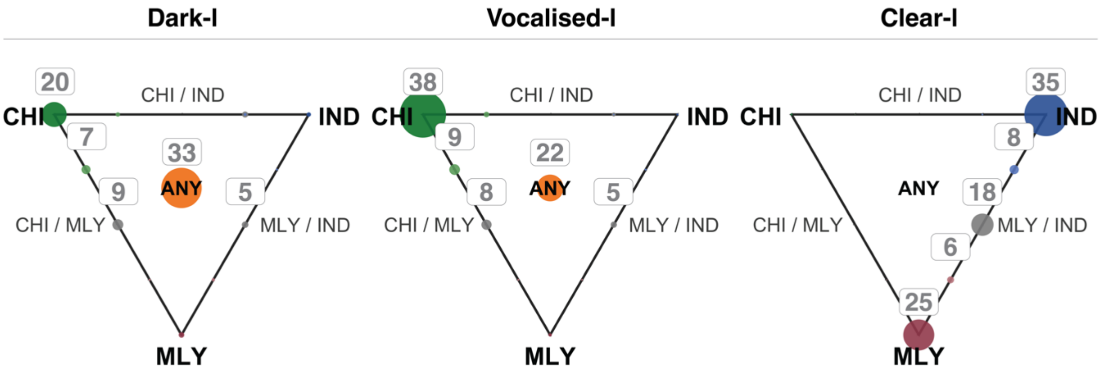


Figure 4.3 Percentage of responses for the ethnic association task by variant of /l/. Note: Percentages are rounded to the nearest percent and only percentages above five are shown. CHI = CHINESE, MLY = MALAY, IND = INDIAN, ANY = COULD BE ANY.

To further examine the associations of the /l/ variants with the three different ethnic groups, and to ascertain effects of listener attributes on the ratings, three separate mixed-effects ordinal regression models using the 'ordinal' package (Christensen, 2019) on R statistical software (R Core Team, 2020), each with CHINESE, MALAY, or INDIAN as the ordinal response variable, were run. With reference to Figure 4.1, ratings along the three-way scale (i.e. excluding COULD BE ANY) were first transformed to numerical values, starting at '4' for the end of the scale that corresponds to the ethnicity of interest of each model, to '0' at the other two ends, and ratings for categories in between were given the values '3', '2', and '1', according to numerical order; the magnitude of the ratings is thus positively associated with the ethnic affiliation of a variant. For the model with CHINESE as the response variable, for example, ratings along the CHINESE–MALAY and CHINESE–INDIAN scales were given values from '4' (CHINESE), '3', '2' (CHINESE–MALAY/CHINESE–INDIAN), '1' and '0' (MALAY/INDIAN). Responses along the MALAY–INDIAN scale were all converted to '0'. The fixed effects included variant (dark/vocalised/clear), speaker

(Chinese/Malay), and listener attributes, including ethnicity (Chinese/Malay/Indian), gender (female/male/unknown), age, education level (treated as a continuous variable), degree of interaction with Singaporeans of the ethnicity of interest, language use, and cultural affiliation. Two-way interactions between all main effects were also tested.

Some guises, in particularly those with dark-l, were more likely to be rated as pan-Singaporean. The response COULD BE ANY was modelled using mixed-effects logistic regression using the 'lme4' package (Bates et al., 2015) and the 'lmerTest' package (Kuznetsova et al., 2017), to ascertain the effect of variant and listener attributes on the likelihood of a guise being rated as pan-Singaporean. The same predictors and contrasts as the previous models were included in this model.

For all models, the random effects structure was kept maximal for subject and token, as justified by the data. To evaluate the contribution of each predictor, and to arrive at a more restricted model, pairwise model comparisons between a full model that included all the explanatory variables and a more restricted model that excluded the predictor under consideration were performed using likelihood ratio tests. Significant interactions were explored using plots of marginal means and pairwise comparisons (with Tukey adjustments) using the 'emmeans' package (Lenth, 2018). The results of the best-fitting models are presented in Table 4.3.

Table 4.3. Regression coefficients of best-fitting mixed-effects regression models fit to responses of the ethnic association task.

Response (*n*)	Fixed effect	Level	*B*	*SE*	*OR*	[95% CI]	*p*
Chinese (1625)	Variant	Clear	-5.80	0.62	0.00	0.00 – 0.01	**< 0.001**
		Vocalised	0.96	0.20	2.61	1.75 – 3.89	**< 0.001**
	Speaker	Malay	0.71	0.32	2.03	1.09 – 3.79	**0.03**
	Ethnicity	Indian	1.02	0.44	2.78	1.18 – 6.55	**0.02**
		Malay	0.05	0.21	1.05	0.70 – 1.57	0.81
Malay (1625)	Variant	Clear	0.80	0.30	2.23	1.24 – 4.01	**0.01**
		Vocalised	-0.35	0.23	0.71	0.45 – 1.12	0.14
	Ethnicity	Indian	-2.21	0.72	0.11	0.03 – 0.45	**0.002**
		Malay	0.32	0.26	1.37	0.83 – 2.26	0.21
	Variant × Ethnicity	Clear:Indian	2.70	0.82	14.81	2.98 – 73.49	**0.001**
		Voc:Indian	1.06	0.63	2.88	0.85 – 9.82	0.09
		Clear:Malay	-0.34	0.42	0.71	0.31 – 1.64	0.43
		Voc:Malay	-0.70	0.32	0.50	0.26 – 0.94	**0.03**
Indian (1625)	Variant	Clear	-0.36	0.82	0.69	0.14 – 3.44	0.66
		Vocalised	-0.76	0.65	0.47	0.13 – 1.65	0.24
	Speaker	Malay	-0.76	0.28	0.47	0.27 – 0.81	**0.007**
	Age		-0.03	0.02	0.97	0.94 – 1.01	0.13
	Variant × Age	Clear:Age	0.09	0.03	1.09	1.04 – 1.15	**0.001**
		Voc:Age	0.00	0.02	1.00	0.96 – 1.04	0.99
Malay–Indian (612)	Speaker	Malay	0.55	0.27	1.73	1.01 – 2.96	**0.04**
	Int_Malay		0.14	0.07	1.15	1.00 – 1.33	**0.04**
	Int_Indian		-0.09	0.08	0.91	0.78 – 1.06	0.21
	Age		-0.06	0.02	0.94	0.90 – 0.98	**0.01**
Any (1998)	Variant	Clear	-5.77	0.82	0.00	0.00 – 0.02	**< 0.001**
		Vocalised	-0.69	0.29	0.50	0.29 – 0.89	**0.02**
	Age		-0.09	0.03	0.91	0.87 – 0.96	**< 0.001**
	Education		0.45	0.21	1.57	1.05 – 2.34	**0.03**

Note: Reference category for variant is dark, speaker is Chinese, and ethnicity is Chinese.

Positive coefficients from the ordinal regression models indicate that rating in higher categories is more likely, i.e., more distinctly CHINESE/MALAY/ INDIAN. In the best-fitting model for 'Chinese', the main effects of variant, speaker, and listeners' ethnicity were significant predictors. Compared to dark-l, vocalised-l increased ratings of CHINESE, whereas clear-l decreased ratings. Interestingly, compared to the Chinese speaker, the Malay speaker was rated more CHINESE. In addition, compared to Chinese listeners, Indian respondents were overall more likely to give guises higher ratings of CHINESE. In the 'Malay' model, the main effects of variant, listeners' ethnicity, and their interaction were significant predictors. The analysis of their interaction revealed that clear-l was rated more MALAY than the other two variants by Chinese and Indian informants, but the difference between clear-l and dark-l for Malay listeners was not significant, which suggests that many Malay listeners gave dark-l similar ratings of MALAY as they gave clear-l. Finally, in the 'Indian' model, the main effects of speaker and the interaction between variant and age were significant predictors. The guises of the Chinese speaker were overall perceived to be more INDIAN than the Malay speaker. The interaction between variant and age was explored using spotlight analysis to ascertain how ratings of variant varied by three age levels: at the mean, +1 *SD*, and at –1 *SD*. The analysis revealed that, while clear-l was judged to be more INDIAN than dark-l for all informants, older listeners judged clear-l to be more INDIAN than younger listeners did.

Since clear-l was revealed to be strongly associated with both Malay and Indian Singaporeans, additional ordinal regression analysis with the same variables and contrasts was performed on only clear-l tokens and ratings along the MALAY–INDIAN scale. Ratings were changed from '4' (MALAY) to '0' (INDIAN). The reduced model ('Malay–Indian' in Table 4.3) revealed that the main effects of speaker, amount of interaction with Malays, and age were significant predictors. Compared to the Chinese speaker, the Malay speaker was perceived to be more MALAY. Regardless of their ethnicity, informants who reported higher degree of interactions with Malay Singaporeans judged clear-l to be more MALAY than INDIAN. Finally, age was negatively associated with the ratings; that is, older listeners judged clear-l to be more INDIAN than MALAY, an effect also observed in the previous 'Indian' model.

In the best-fitting model for ratings of COULD BE ANY ('Any'), the main effects of variant, age, and education were significant predictors. Compared to dark-l, both clear-l and vocalised-l were less likely to be rated COULD BE ANY. The likelihood of a token being rated as COULD BE ANY was negatively associated with the age of respondents, but positively associated with education level.

In sum, after controlling for effects of speaker, the findings from the ethnic association task revealed that vocalised-l was more strongly associated with Chinese Singaporeans, clear-l was associated with both Malay and Indian Singaporeans, and dark-l was more likely to be perceived as pan-Singaporean/ethnic-neutral. Listener attributes modulated the ratings. Whereas Chinese and Indian informants judged clear-l to be more representative of the Malays, Malay listeners associated both clear-l and dark-l with their ethnic group. Listeners' reported degree of interaction with Malay Singaporeans and their age influenced their judgement on whether clear-l was perceived as more 'Malay' or 'Indian'; regardless of their ethnicity, listeners who had more interactions with Malay Singaporeans were more likely to perceive clear-l as distinctly 'Malay', and older listeners were more likely to associate clear-l with the Indians.

4.3.2. Attitude judgement: rating task

The results of the attitude rating task are presented in Figure 4.4 in terms of relative proportions of the ratings, as a function of variant and trait. Rating of '7' is most positive (i.e. educated/has an ethnic accent/fluent/formal/friendly), while '1' is most negative. By visual inspection, dark-l appears to have been given greater proportion of ratings above '4' for educatedness, fluency and formality than the other two variants. Vocalised-l and clear-l did not seem to differ greatly in the ratings for these three traits, and listeners were divided in their opinions. Amongst all variants, clear-l was rated the most ethnic-accented and also the friendliest.

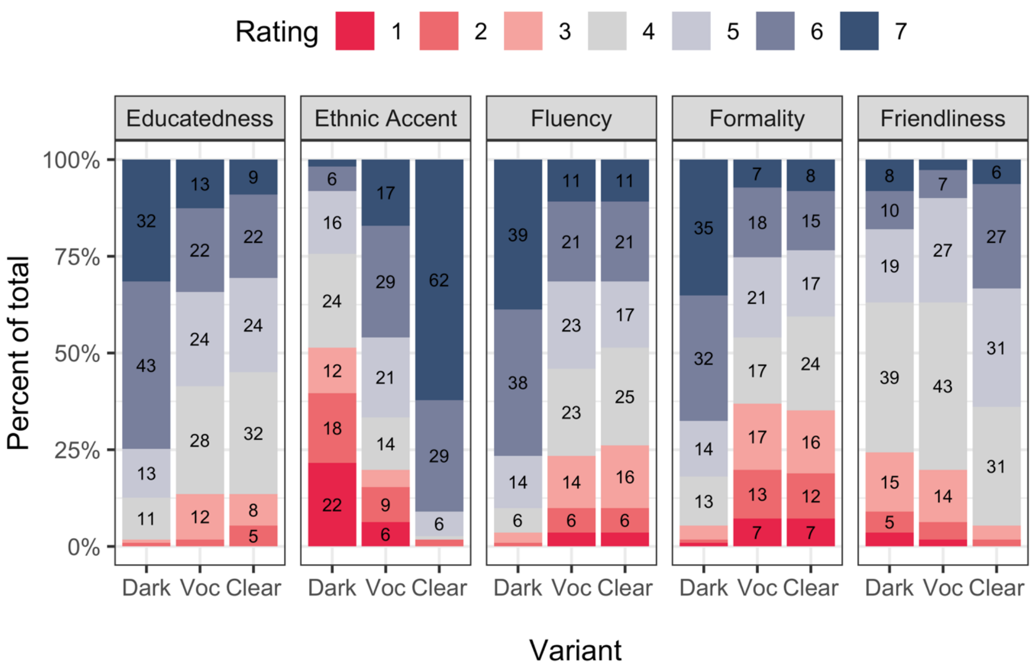


Figure 4.4 Percentages of responses for the attitude rating task as a function of trait and variant of /l/. Note: Percentages are rounded to the nearest percent and only percentages above five are shown.

Regression analysis was performed to confirm these observations and to ascertain effects of listener attributes. Considering that some traits may be correlated, principal component analysis was first conducted with orthogonal rotation (varimax) to create index variables. The components were evaluated using the Kaiser criterion and parallel analysis, and two factors met the criteria: a 'status' factor (loading for educatedness, fluency, formality, and ethnic accent) and a 'friendliness' factor, which consisted of friendliness alone. The two factors in combination accounted for 74% of the variance. For all regression models, the random effects structure was kept maximal for subject. The fixed effects included variant and listener attributes, including ethnicity, age, education level, gender, degree of interactions with Singaporeans of the three ethnicities (three separate scores), language use, cultural affiliation, perceived similarity, and two-way interactions between variant and other main effects. The results for the best-fitting models are presented in Table 4.4.

Table 4.4. Regression coefficients of best-fitting mixed-effects ordinal regression model fit to responses of the attitude rating task.

Response (*n*)	**Fixed factor**	**Level**	***B***	***SE***	***OR***	**[95% CI]**	***p***
Status	Variant	Clear	-2.11	0.66	0.12	0.03 – 0.44	**0.001**
(1332)		Vocalised	-2.72	0.66	0.07	0.02 – 0.24	**< 0.001**
	Education		-0.20	0.12	0.82	0.64 – 1.04	0.11
	Language use		-0.02	0.07	0.98	0.86 – 1.11	0.71
	Similarity		0.24	0.04	1.27	1.17 – 1.38	**< 0.001**
	Variant × Education	Clear:Edu	0.37	0.14	1.44	1.09 – 1.91	**0.01**
		Voc:Edu	0.32	0.14	1.37	1.03 – 1.82	**0.03**
	Variant × Language use	Clear:Use	-0.04	0.08	0.96	0.82 – 1.12	0.58
		Voc:Use	0.16	0.08	1.17	1.00 – 1.37	**0.04**
Friendliness	Variant	Clear	1.73	0.32	5.62	3.02 – 10.44	**< 0.001**
(333)		Vocalised	0.13	0.27	1.14	0.68 – 1.93	0.62
	Similarity		0.19	0.08	1.21	1.04 – 1.40	**0.01**
	Gender	Male	-1.12	0.38	0.33	0.16 – 0.68	**0.003**
		Unknown	-0.53	0.36	0.59	0.29 – 1.20	0.14

Note: Reference category for variant is dark, and gender is female.

In the model for 'status', the main effects of variant, similarity, and the two-way interactions between variant and education, and between variant and language use were significant predictors. Compared to dark-l, both clear-l and vocalised-l decreased status ratings. Perceived similarity was positively associated with status ratings. In the interaction between variant and education, plots of marginal effects revealed that informants who were more educated were more likely to give clear-l and vocalised-l higher ratings of status than listeners who were less educated, but the reverse is true for status ratings of dark-l. Spotlight analysis of the interaction between variant and language use revealed that overall across ratings, listeners who were less English dominant in terms of language use were more likely to give vocalised-l higher ratings of status.

In the 'friendliness' model, the main effects of variant, similarity and gender were significant predictors. Compared to dark-l and vocalised-l, clear-l was more likely to be given higher friendliness ratings. Friendliness ratings were also positively associated with perceived similarity. Finally, there was an overall tendency for male informants to rate the guises lower on the friendliness scale than female informants.

The key findings from the attitude rating task revealed that guises with dark-l were more positively evaluated along the status dimension, compared to the other two variants. Contrastingly, guises with clear-l were perceived to be the friendliest. Effects of listener attributes were attested; listeners who perceived the guises to be more similar to their own accents were more likely to give higher 'status' and 'friendliness' ratings. Those who were more educated or less English dominant were more likely to give non-dark variants higher status ratings.

4.3.3. Attitude judgement: open-ended question

The open-ended responses for dark-l are presented in Table 4.5, categorised according to the speakers it indexes, the contexts or practices in which it is thought to be commonly used or occur, and its associated qualities. Listeners across ethnicities were unanimous in their evaluations of dark-l: the speakers that dark-l indexed were the young, well-educated, English-dominant Singaporeans from higher social classes, and native speakers or *angmohs*, a mildly derogatory term to refer to Caucasians. It was considered correct/accurate and standard, and thought to belong to the style used in contexts where formal and careful speech is expected. However, a handful commented that the speaker was cold in her emotions or trying hard to speak good English.

Table 4.5. Open-ended responses for dark-l.

Speakers	Contexts	Qualities
Well-educated	Oral examination	Standard
Chinese	Interview	Accurate/careful
English-dominant	Presentation	Trying hard/cold
Any race		Dictionary pronunciation
Customer-facing jobs		Formal
Lived/studied abroad		
Indian/Malay		
Young		
High social class		
Educator/teacher		
English-dominant peers		
Caucasian/*Angmoh*/native speaker		

Listeners across ethnicities shared similar social opinions towards vocalised-l, but a sizeable minority had differing views. These opposing views are presented in Table 4.6. For many (Group A), vocalised-l indexed Singaporeans who are Chinese-dominant/L2 speakers, middle-aged, less educated, and using colloquial English. The variant was associated with similar social types, for example *auntie*, a local cultural term that may refer to middle-aged women who are often lowly-educated, Chinese-educated and old-fashioned in their ways of thinking (Wong, 2006). Vocalised-l also evoked even more specific social types like housewives or *caifan* (菜贩) *auntie*, who are aunties that sell 'economy rice' in hawker centres. For some others (Group B), vocalised-l was associated with young, middle-class, well-educated Singaporeans and working professionals. They also regarded the pronunciation to be good articulation and standard, and to belong to a style used in formal settings.

Table 4.6. Open-ended responses for vocalised-l.

Group	
A	**B**
Chinese-dominant	Chinese/Malay/Indian
Middle-aged	Young
Less educated	Well educated
L2 speaker	Good articulation/enunciation
Colloquial	Standard/Formal
Auntie/housewife/*Caifan auntie*	Working professional
Average Singaporean	Middle class

Responses for clear-l are presented in Table 4.7 according to the ethnicity of the listeners. Some traits and attributes were dependent on whether the speaker was perceived to be Malay (M) or Indian (I), as indicated in the table. Compared to vocalised-l, the responses for clear-l were less divergent. Chinese listeners generally associated clear-l with EMT-dominant/L2 speakers and less educated minorities from lower social classes. Malay respondents from both the online survey and metalinguistic talk, however, asserted that while many users of clear-l are Malay-dominant, it is not exclusively used by less educated Malays or those in lower social classes. Those interviewed pointed out that Malays who are highly educated and proficient in English may adopt a more ethnically distinctive style and use clear-l in casual situations or to index group membership:

> "…we only use it when talking to our friends, like casual…; among my group of Malay friends, that's how we talk to each other". (M3)

> "…some kid actually got mad at me because I sounded really English-sounding compared to him… I know if I were to be like be a stereotypical Malay…I need to speak differently…when I do hang out with the more Malay Malay, that's when the Malayness comes out". (M6)

When the speakers were perceived as Malay, listeners associated the variant with several related social types. One of which is *minah*, a Malay slang term for 'Malay girl'. This term is sometimes used wrongly by out-group members to refer to a subtype that Malays would recognise as *minah-rep*, a female Malay-dominant gangster/delinquent who is usually uneducated and unruly. Clear-l was also associated with *makciks* ('aunts'), who are the Malay equivalent of Chinese *aunties*, and again in some listeners more specific social types were evoked, such as housewife or *nasi briyani auntie*, which is loosely the Malay equivalent of a *caifan auntie*. To one of the Malay respondents interviewed (M7), his involvement in the Malay arts and cultural scene lets him to associate the use of clear-l with *jiwang*, a Malay expression to mean being overly sentimental or lovesick, as well as the multiple art forms that evoke this emotion, such as Malay love poems and soft-rock love ballads, or even personae like *mat/minah-jiwang*—a Malay boy or girl who is overtly romantic/sentimental. Interestingly, opinions were different when the speakers were perceived to be Indian in ethnicity. An Indian who uses clear-l was regarded by Chinese listeners to be well-educated and speaking in a formal setting. Similarly, Indian listeners thought that an Indian speaker who uses clear-l is EMT-dominant but is educated and middle class, although a few added that the speaker must either be a foreigner or have been raised abroad.

Table 4.7. Responses from open-ended question and metalinguistic interview for clear-l.

Ethnicity of listener		
Chinese	**Malay**	**Indian**
Indian/Malay	Indian/Malay	Indian/Malay
EMT-dominant	EMT-dominant	EMT-dominant—(I)
L2 speaker	Young	Foreigner/raised abroad—(I)
Thick accent—(I)	Thick accent	Speaking with family—(M)
Well educated—(I)	EMT-dominant peers	Educated—(I)
Less educated	*Minah-rep*—(M)	Middle class—(I)
Middle-aged	*Jiwang*—(M)	
Young		
Formal—(I)		
Low-middle class—(I)		
Minah—(M)		
*Makcik/*housewife*/nasi briyani auntie*—(M)		

Note: (I)(M) = only if speakers were perceived to be Indian (I) or Malay (M).

To summarise, the open-ended responses complement the findings above by revealing the specific social types and qualities that were evoked by each /l/ variant. The overwhelmingly positive evaluations of dark-l contrast with the other two in ways similar to how standard–nonstandard variants are typically characterised. Additionally, the processes by which the local variants were created and transmitted have resulted in numerous social meanings that are notably diverse and sometimes conflicting.

Discussion

In response to the three research questions that this study set out to answer, the findings from the ethnic association task confirmed that listeners were more likely to associate the two local variants that arose from language contact to the ethnic groups whose other language(s) may have had an influence on their emergence; vocalised-l was more likely to be regarded a feature of Chinese Singaporeans, and clear-l was exclusively associated with Malay/Indian Singaporeans. Contrastingly, dark-l, which is associated with prescriptive standards, was more likely to be regarded as a pan-Singaporean feature. The attitude judgement task revealed that dark-l was given higher ratings on status traits such as educatedness, fluency and formality, whereas clear-l was given higher friendliness ratings. As predicted, the evaluations of the variants were not uniform across hearers; several listener attributes were found to significantly modulate ethnic associations of and attitudes towards the variants, and open-ended responses revealed that each variant was associated with a variety of social groups/types, qualities and contexts. The following first discusses the social meanings of the variants and the meaningful predictors/listener attributes that have influenced their interpretations, before describing how the results of this study inform current approaches to studying variation that are based on indexicality.

That dark-l was unanimously accorded social prestige by the listeners in this study and evoked semiotic connections to education, high social status and formality is not unexpected; the findings are aligned with other studies that evaluated perceptions of standard/nonstandard features (e.g. Chappell, 2016). As mentioned earlier, social regularity of recognition of language ideals in Singapore is realised through the ideological process of enregisterment, similar to how public perceptions towards RP and Putonghua are shaped (Agha, 2003, 2007; Dong, 2010). This public awareness of the social value of standard English has been observed in the attitudes towards varieties of Singapore English in past research (e.g. Cavallaro & Ng, 2009; Cavallaro et al., 2014), and it is shown here that it extends to specific speech forms. In this study, the ratings of status traits were also found to interact with the education level of the informants; listeners who were more educated were more likely to give clear-l and vocalised-l higher ratings of status, and the reverse is true for dark-l. Cavallaro et al. (2014) reported similar findings. Based on their interview responses from 133 Singaporeans, they found that participants with university education expressed more favourable views towards colloquial Singapore English than those without university education. Cavallaro and colleagues surmised that those who had fewer opportunities to acquire proficiency in the standard variety might have more positive views towards it for the social mobility that it promises. Additionally, as pointed out by a reviewer, those who are less well-educated may also be more likely to experience linguistic evaluation of their speech, making them more attuned to dominant speech norms or prestige speech forms.

The sociohistorical processes that shaped vocalised-l and clear-l, which are variants that arose from language contact, have resulted in diverse social meanings, notably in how they indexed multiple social types from different age groups. Yet, their meanings may not have evolved in the same way. Clear-l still largely indexes the same profile of speakers from whom the variant may have originally emerged (i.e. EMT-dominant/L2 speakers) and evokes mainly less positive attributes (e.g. less educated/lower social class). While the same social meanings apply to vocalised-l, many perceived the variant to be a pan-Singaporean feature, less ethnic-accented, and associated with well-educated, middle-class Singaporeans and those speaking in standard English or formally. These divergent interpretations may point to an emerging local standard. This could be due to the hearers' inability to differentiate vocalised-l and dark-l, despite the efforts to ensure that the guises used in this experiment were adequately distinct and 'canonical'. One likely explanation is that vocalised-l has become a very common, if not the dominant variant over time by virtue of the number of local speakers who use it, even by educated Singaporeans and in formal contexts/careful speech (Deterding, 2007b; K. K. Tan, 2005), and had therefore gained new social meanings that were once exclusive to dark-l. This is not improbable; the two variants are acoustically similar, and further l-vocalisation occurs even in non-vocalising varieties due to phonetic factors (Scobbie & Wrench, 2003). L-vocalisation in British English varieties that have a long established clear–dark allophony is also becoming increasingly widespread, which has been argued to be natural sound change (Johnson & Britain, 2007; note, however, that l-vocalisation in SgE is more likely to be a result of language contact/acquisition). Against this baseline, clear-l became more salient/ethnically-marked and less mainstream/standard; inevitably, ethnic minorities who use clear-l are more likely to be prejudiced and negatively evaluated.

However, unlike the communities in which dialect levelling is observed or where the speech of minority or heritage speakers converges to the dominant norm, here, clear-l is preserved for socially purposeful work. It is still the unselfconscious variant used predominantly by older generation of Malays who are L2 speakers and younger generation of L1 speakers of English who have acquired it from the input of caregiver or peers (Sim, 2019). Metalinguistic talk with the 11 Malay respondents revealed that clear-l is also used variably by Malay non-users, especially males, as part of their ethnolinguistic repertoire to signal group membership, in ways similar to British Asians (Kirkham, 2017; Sharma, 2011). That different variants of /l/ are used within the ethnic community is recognised by Malay listeners in this study, who gave clear-l and dark-l similar ratings of 'Malayness', which reflects actual production data (Sim, 2019, 2021c). This awareness, however, was not shared by listeners of other ethnicities, who gave significantly lower ratings of MALAY for dark-l. Likewise, while English-dominant and/or educated Malays do use clear-l, the variant was only stereotypically associated with the Malay-dominant and less educated. These findings show how the interpretation of social meanings is dependent on and shaped by individual experiences with the sociolinguistic world, a point that will be revisited in the next section. Another finding related to clear-l supports previous findings that showed that social perceptions are context dependent (e.g. Pharao, Maegaard, Møller, & Kristiansen, 2014; Walker et al., 2014). Campbell-Kibler (2009), for example, found that the use of *-in* decreased speakers' ratings of education and intelligence only when they were perceived to be from a working-class background. Here, it was revealed that the speakers of clear-l were regarded as less educated and informal if they were perceived to be Malays, but well-educated, middle-class, and formal if perceived to be Indians. It is uncertain, however, whether Indians do indeed use clear-l, given that at present little is known about the /l/ used by Indian Singaporeans. In fact, those who rated clear-l as INDIAN may have made generalisations based on their prior, vague linguistic knowledge of other attributes of the speech of Indian Singaporeans (e.g. "The way Indian…speaks has a certain twang and slang to it."). Some findings of this study may suggest that the /l/ used by Indian Singaporeans is different. First, the clear-l guises of the Malay speaker were rated as more MALAY than the Chinese speaker, which may reflect subtle but perceivable differences in their realisations. This is supported by how informants who reported higher degree of interactions with Malay Singaporeans thought that clear-l was more MALAY. Second, older Singaporeans were found to be more likely to give higher ratings of INDIAN for clear-l, and this may suggest that older-generation Indians might have used clear-/retroflex-l more frequently than is the case now. Further empirical work can be done to confirm these postulations.

4.4.1. Meanings through different lenses

Hearers in this study were revealed to have different and sometimes conflicting evaluations of the variants. This may be due to hearer biases; in this study, for example, ratings of perceived similarity were positively associated with status and friendliness ratings. Those who were less English-dominant, and therefore presumably more likely to use vocalised-l, gave vocalised-l higher status ratings. Differences could also be due to hearers' individual experiences. Meaning–form associations are created and reinforced in different ways, to different extents, and for different people (Agha, 2007; Campbell-Kibler, 2008; Johnstone & Kiesling, 2008). For some hearers in this study, these experiences lasted only very briefly, with a limited group of individuals, and in restricted contexts. But for others, their experiences may occur in more wide-ranging contexts, and over longer periods of time. Vocalised-l, for instance, evoked very specific encounters with the variant for some hearers (e.g. "Reminds me of my Chinese colleague."), but elicited broader generalisations and stereotypes for others (e.g. "I think it is typical of Chinese people, no matter how educated they are."). The ways Singaporeans are socialised to these variants are further modulated by variation in speaker attributes, such that each /l/ variant can index multiple social types/groups, thereby evoking very diverse attributes and values associated with them.

However, it is proposed here that these seemingly diverse or even conflicting meanings can be described to be interrelated in a highly complex network and linked by various social factors as they are created, and the myriad interpretations are but fragments of a whole sociolinguistic reality, as observed through the lenses of the hearer. Figure 4.5 is an example of how some of the Malay-related indexical meanings that were observed for clear-l can be connected. In this network, social groups/types are linked by increasingly broader, super-ordinate categories (e.g. *nasi briyani auntie* < *makciks* < Malay-dominant < Malays < …), and distinct or conflicting traits and qualities associated with higher-order categories are reconciled by lower-order categories that are shared (e.g. *minahs* and *makciks* are linked by their being Malay-dominant). Meanings that are not directly linked may also be evoked based on their distant associations; *minahs* may be assumed to be raised by *makciks* in Malay-dominant families, for instance, and they are associated with expressions of *jiwang*. The interpretation of a variant is dependent on and reinforced by the hearer's experiences with the various parts of the network and its user(s) and contexts, which may change or expand according to the other speakers and different contexts in which the variant is again encountered. For one, the social perception of clear-l may be limited to the *nasi briyani auntie* that they buy food from, but for another, the meanings of clear-l accumulate from the day-to-day interactions with their Malay neighbours. Therefore, in the same way that hyperarticulated /t/ release can index different social types and semantically related qualities in different communities (Eckert, 2008b), alternative variants of a feature in sociolinguistically and socioculturally complex societies like Singapore can index diverse social meanings that are socially related *within* the community. This has far-reaching implications for a plural society, as one's experiences with the social world or a lack thereof can result in accent-based prejudices or stereotypes against particular groups, an example being the predominantly negative evaluations of clear-l by Chinese listeners in this study, which do not reflect the true reality of use by the Malay community.

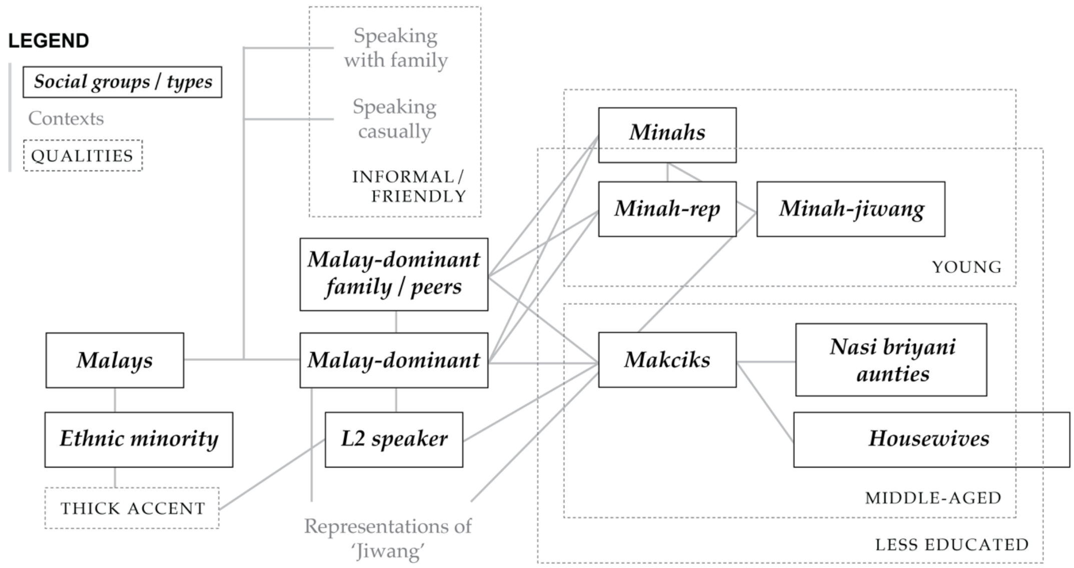


Figure 4.5 An example of how Malay-related social meanings of clear-l are connected.

4.4.2. A shared indexical field

By expanding on Eckert's (2008a) notion of an indexical field, the meaning network of each variant of /l/ can be further combined to form a coherent view of social meanings, as presented in Figure 4.6. In this approach, social meanings are relative; they can be closer to/further from each variant. While some are more distinct to each variant, such as social types *angmohs* and *minahs*, some are equally shared between two or more variants, such as 'middle-aged' and 'young'. Again, social meanings are inter-related (only a few connections are shown, for the sake of clarity). The index of 'migrant' for clear-l, for instance, is accessible through the index of 'Indian', and so are the associated qualities of formality and educatedness, which speakers who were perceived to be Malay did not evoke. By describing the relationship of social meanings in this way, and based on how indexical fields are intended to be fluid, the model can be useful in comparing how meanings are organised differently or are absent/present between groups of individuals (e.g. old versus young). It can also be useful to reflect change in a community; meanings can be constantly updated based on changes to the social world, where indices can gain or lose affinity with each variant. An example is how status traits like 'fluent', 'formal' and 'standard' might have been very far from vocalised-l for the generation of Singaporeans who were mainly L2 speakers, but are here positioned closer to vocalised-l to reflect the diversity in present views that may point to an emerging local standard.

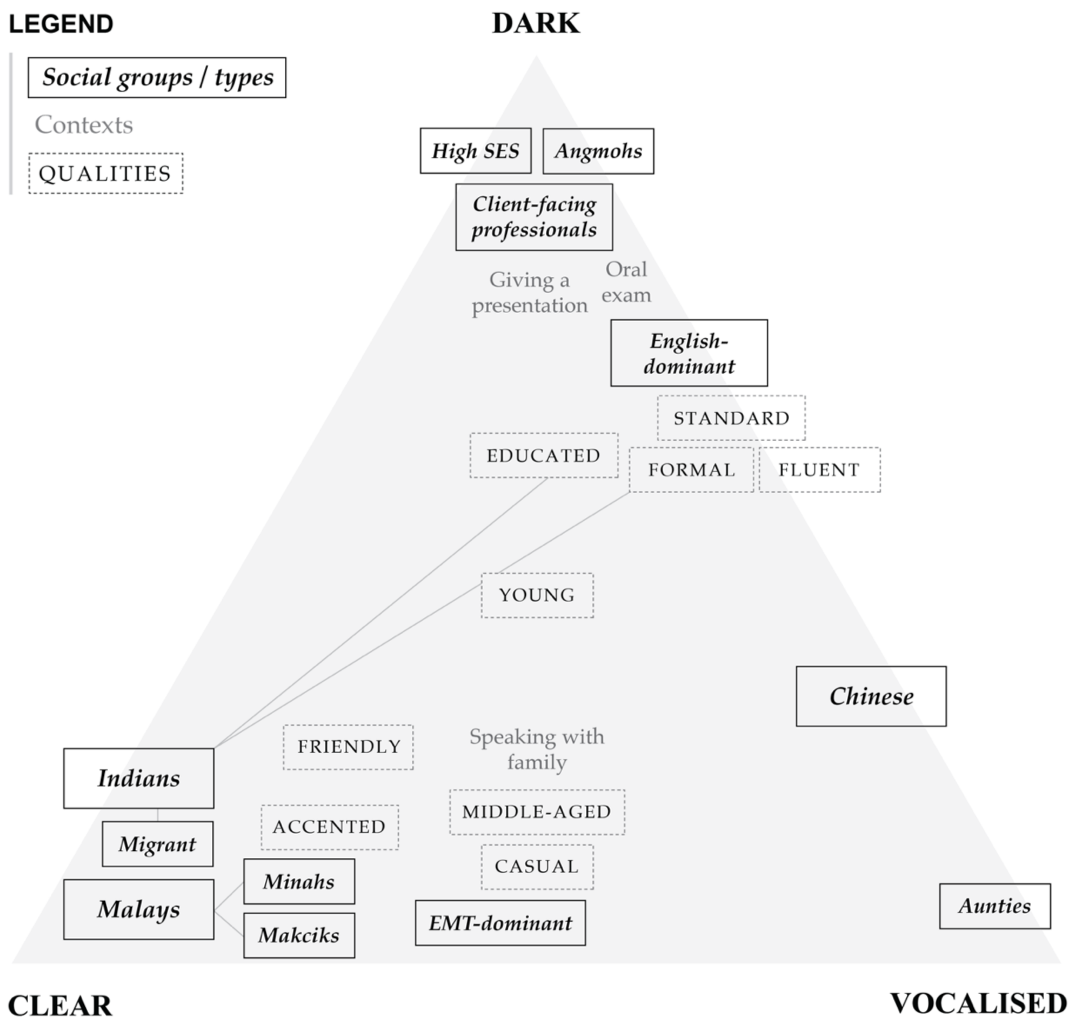


Figure 4.6 A shared indexical field of three variants of /l/ in Singapore English.

Conclusions

This study has shown how differential speech features that arose from language contact and acquisition, specifically vocalised-l and clear-l in Singapore English, can come to index very diverse social meanings, but are connected by the social factors that have shaped them, to form an intricate network of inter-related signs that reflect the fabric of a plural society. The findings also showed how the meanings associated with the variants of /l/ can evolve with the changing sociolinguistic landscape, in different ways, and in response to socio-political forces that regulate social perception. The resulting myriad interpretations reflect the very unique individual experiences, but also show that limited experiences with the social world may contribute to accent-based prejudice towards others in the plural society.

CHAPTER 5

Sociophonetic variation in English /l/ in child-directed speech

Original abstract: Three realisations of syllable-final /l/ have been described in previous work on Singaporean English: vocalised-l (or deleted-l in some phonetic contexts; the local norms), dark-l (a form associated with the exonormative standards), and clear-l (a Malay-derived phonetic trait observed in the speech of some English-Malay bilinguals). This study examined whether, how and why Singaporean English-Malay bilinguals vary their English /l/ in their child-directed speech, and whether the phonetic variation, if any, could be socially-conditioned. The laterals in the English child-directed speech of ten father-mother dyads with their preschoolers were analysed using auditory and acoustic methods. All participants were simultaneous or early English-Malay bilinguals. The findings revealed that in informal contexts, both mothers and fathers used a relatively clearer /l/ in all syllable positions. Contrastingly, in formal contexts that involved teaching and learning, the coda laterals of mothers were significantly darker, thereby exhibiting positional contrast between onset and coda laterals. They also produced significantly more vocalised-l in these contexts. Fathers, however, did not show differentiation in the darkness of the laterals, nor did their laterals show significant positional differences in formal contexts, although some fathers of younger children did produce more vocalised-l than they did in informal contexts. The variation observed was discussed by exploring the potential socio-indexical meanings of these variants of /l/ within the context of variationist accounts of Singaporean English and by drawing parallels with socially-conditioned variation in bilectal monolinguals and ethnolect speakers. Differences between maternal and paternal CDS patterns could be attributed

to gender roles and cultural expectations of mothers' dominant role in child-rearing, and may also be a result of and enabled by Malay women's potentially more complex repertoire range.

Article: Sim, J. H. (2021). Sociophonetic variation in English /l/ in the child-directed speech of English-Malay bilinguals. *Journal of Phonetics*, 88. https://doi.org/10.1016/j.wocn.2021.101084. (with minor changes made following examiners' comments).

Introduction

Adults often modify their speech when interacting with very young children. In contrast with adult-directed speech (ADS), child-directed speech (CDS) is generally characterised as having shorter, syntactically simpler utterances, with many repetitions and isolated words and phrases. Speaking rate is also reduced, and there are more prosodic repetitions, longer pauses, and a higher average pitch and wider pitch range (see Saint-Georges et al. [2013] for a review). One of the roles of CDS is to engage the attention of the child and convey emotional affect through acoustic exaggerations (e.g. Singh et al., 2002). CDS also facilitates language learning as it conveys language-specific phonological information, and caregivers enhance phonetic contrasts to provide more canonical input and reduce variability in their production (e.g. Cristià, 2010; Kuhl et al., 1997; Werker et al., 2007). Modifications in CDS may also be socially-conditioned and involve the use of alternative phonetic forms, thereby encoding indexical information (Foulkes & Hay, 2015; Nardy et al., 2013). This study examines whether, how, and why English-Malay bilingual caregivers in Singapore vary their use of variants of /l/ in their English CDS towards their preschoolers.

Segmental modifications in CDS have been found to vary with the age and gender of the child, and communicative context. Foulkes et al., (2005) examined the use of standard versus other less prestigious and stigmatised local variants of (t) by mothers of children aged 2;0–4;0 living in Tyneside, England. They found that, not only did mothers in general use more standard [t] in CDS than in ADS, but more standard [t] was also used by mothers of girls and with younger children. Some evidence, however, showed that men made fewer modifications in their CDS. In other studies, Smith and colleagues (Smith et al., 2007, 2013) examined the use of several sociolinguistic variables in Buckie, Scotland in adults and children aged 2;6–4;2. One of the features studied was the lexically-conditioned *hoose* variable, which involves the alternation between standard diphthong [ʌʉ] and the monophthong [u:] in the MOUTH lexical set of words like *house*, *down*. The latter variant is stereotypical of Scots or northern varieties of English and used most by working-class males in spontaneous informal speech. They found that, not only was there more use of the standard variant in CDS than ADS and in CDS towards younger children, but there were also stylistic constraints on use. According to one of Labov's (2006) principles of transmission that linguistic variation is transmitted to children as stylistic differentiation on the formal-informal dimension (p. 437), Smith and colleagues found that caregivers used more of the local variant in contexts of play/routine than in those of teaching/discipline. However, they found that the same effects were not observed for most of other variables; some variables mirrored community norms very quickly while others remained variable in the early stages of language acquisition. This led Smith and colleagues to conclude that variables have different 'sociolinguistic value' in CDS. Roberts (2013), who investigated mothers' variable use of monophthongal long (ay) variable, as in [ka:t] for kite in Southern American English, also found that mothers used more diphthongal (ay) when talking to their children (aged 1;6–1;7) than when talking to an interviewer. One mother also emphasised and exaggerated the diphthongal glide when teaching new vocabulary to her child. Roberts explained that the use of the more standard variant was in part due to their role as teachers of language. As Foulkes et al. (2005) pointed out, segmental choice in CDS must be 'viewed with one eye on the social-indexical values of the alternatives' (p. 198); caregivers in these studies used both standard and nonstandard forms in CDS according to the norms of the community, and this was argued to be important in helping children construct a full sociolinguistic repertoire.

CDS in bilingual contexts involves even more variability. Compared to monolinguals, bilinguals vary greatly in their language experiences and background, and so do the specific phonetic and phonological properties of their CDS, which can differ from one bilingual to another, and from their monolingual counterparts, to varying degrees. Differential features in CDS may be due to caregivers being non-native speakers or late learners of the L2 (e.g. Fish et al., 2017). Khattab (2002, see also Khattab, 2011), for example, reported that the Lebanese caregivers in her study who had lived in Yorkshire for over 10 years used clear-l syllable-finally instead of dark-l in their English CDS, possibly due to the influence of their Arabic L1. In some communities, distinctive features that emerge from language contact and acquisition are transmitted to and retained by later generations to become associated with particular socio-demographic groups, and further become reallocated with social functions (e.g. Sharma & Sankaran, 2011). The social-indexical meanings of these features allow them to be strategically used as part of one's ethnolinguistic repertoire, such as to index their ethnic identities or cultural affiliations (Benor, 2010; Eckert, 2008; Hoffman & Walker, 2010), even if they are not dominant in or no longer bilinguals of the substrate or ethnic community language (e.g. Kirkham, 2017). Sharma (2011), for example, examined the use of ethnically-marked variants in the production of /t/, coda /l/, and the FACE and GOAT vowels in second generation British-born Asians (younger and older males and females) towards different interlocutors. She found that the older men and younger women were more strategic and differentiated than others in their use of the different variants; they were generally more ethnic in their use of variants with Asian speakers and with their direct family, and more mainstream with Anglo interlocutors. She argued that the differences in the diversity of the social networks of the participants, the socio-political context that the speakers grew up in, and their cultural orientation could explain why some speakers commanded a more complex repertoire range.

In the same way that bilectal monolinguals and ethnolect speakers vary their speech styles, Singaporeans may choose from their English repertoire features belonging to established standards (the prescriptive norms) and local forms, some of which more ethnically marked than others (see Leimgruber, 2013, pp. 26-63, for a discussion). Recent descriptions of variation in Singaporean English (SgE) that are aligned with third-wave variationist sociolinguistics examined language use based on the socio-indexical meanings of these linguistic resources (e.g. Alsagoff, 2007; Leimgruger, 2013). Depending on the context of use, variants that are associated with standard varieties of English may index formality, authority, and educational attainment. Contrastingly, local features, which include 'Singlish' and ethnic markers, embody sociocultural capital and may index informality, camaraderie, and group membership. In terms of segmental modifications, Moorthy & Deterding (2000), for example, found that Singaporean undergraduates used more dental fricatives in a formal conversation with a British lecturer compared to speaking with a Singaporean student that they were familiar with, where th-stopping was more frequent. Leimgruber (2013, p. 66) also described the release or aspiration of coda stops, which are usually not released in SgE, to index a pretentious or pedantic stance in some contexts. In formal styles, Singaporeans were also found to be less ethnically accented (e.g. Deterding & Poedjosoedarmo, 2000; Sim, 2019). As a result of significant language shifts since the 1960s, Bolton & Ng (2014) described the various ethnic groups in

Singapore to be in a similar situation to immigrant groups elsewhere in the world, in that the third generation of Singaporeans is increasingly more competent in English than their ethnic languages. Like the second-generation speakers in Sharma (2011) and Sharma & Sankaran (2011), therefore, language choices that the current generation of Singaporeans make, including the use of ethnically distinct features, are less likely to be related to English proficiency, imperfect learning or cognitive constraints, but more so to be as a result of and motivated by socio-cultural factors.

This study aims to find out whether and how Singaporean English-Malay bilingual caregivers make segmental modifications in their CDS towards their young children, and the possible socio-indexical factors that modulate its variation. The feature of focus is syllable-final /l/. This presents an interesting case as there are potentially three forms that have been described in previous SgE studies that may be used by these caregivers: vocalised-l (or deleted-l in some phonetic contexts; the predominant local forms), dark-l (the variant associated with exonormative standards), and clear-l (a Malay-derived variant used by some English-Malay bilinguals).

5.1.1. L-allophony and variants of /l/ in Singaporean English

Cross-linguistically, alveolar laterals differ with regard to their degree of velarisation and/or pharyngealisation, with some languages having a darker (more velarised/pharyngealised) variant than others. Articulatorily, darker /l/ is characterised by a greater degree of tongue predorsum lowering and of postdorsum retraction towards the uvular area or upper pharyngeal wall, and the alveolar closure may also be more anterior (see Recasens & Espinosa, 2005). While the darkness of /l/ is a scalar phonetic property, language varieties can be categorised according to whether they exhibit a clearer or a darker /l/ variant (Recasens, 2012). In addition, some languages exhibit a clear or dark variant in all syllable positions, while others exhibit both that are syllabically conditioned (Recasens, 2004, 2012; Recasens & Espinosa, 2005). Southern varieties of British English and American English, for instance, are typically described to have a clearer lateral in the syllable onset and a darker lateral in coda position (Sproat & Fujimura, 1993; Wells, 1992). Coda laterals may also be vocalised in some language varieties, where the tongue tip contact with the alveolar ridge is lost, and the lateral is replaced by either a (labial-)velar approximant or a back vowel or semivowel. Further, for some varieties of English (e.g. Hong Kong English [Wee, 2008] and African American English [Thomas, 2007]), coda /l/ is argued to be deleted in certain phonetic environments, such as after a back, rounded vowel.

Syllable-final /l/ in SgE tends to be vocalised. Deterding (2007b) added that coda /l/ may also be deleted after back vowels (e.g. *ball* [bɔː], *pull* [puː]) or when it follows a schwa (e.g. *little* [lɪtə]; syllabic [l̩] does not occur in SgE). Using a generative approach, Wee (2008) argued that the underlying representation for lateral-final words in SgE is similar to Standard English, and the surface forms are derived from l-vocalisation rule and not l-deletion. He further explained that laterals that are preceded by back vowels also undergo the vocalisation rule, but the vocalised /l/ may assimilate to the respective preceding back vowel due to ease of articulation, thereby lengthening the vowel. As with past descriptions of and studies on coda /l/ in SgE, syllable-final /l/ vocalisation and deletion are treated as forms of one dialectal feature in this study, which is referred to here as l-lessness, following studies on African American English (see Thomas, 2007). Tan (2005) examined the production of syllable-final /l/ in conversational speech and read speech of educated Chinese Singaporeans. Based on listening judgement tests by ten Chinese Singaporeans and four British listeners, he found that while no speakers consistently used dark-l or vocalised-l in all their speech, the percentage of vocalised-l varied significantly between speakers, ranging from 39% to 89%, but reported no significant gender effects. There were also significantly more incidences of vocalised-l in faster read speech, though no effect of style between read speech and conversational data was observed. However, as he pointed out, the conversational speech and read speech data were not matched, and therefore linguistic factors such as phonetic environment could not be controlled.

Some studies have found that there are ethnic differences in the speech of Singaporeans, such that their ethnicity could be identified from their speech alone (e.g. Deterding & Poedjosoedarmo, 2000). Sim (2015, 2019) found differences in the production of /l/ by Singaporean English-Malay bilinguals. Malay /l/ is typically realised as a voiced alveolar lateral, and laterals are always clear, in all word positions (Clynes & Deterding, 2011; Yunus Maris, 1980). The distribution of Malay /l/ is also similar to English /l/: it occurs word-initially (e.g. *lima* ‘five’), word-finally (e.g. *muncul* ‘appear’), syllable-finally (usually forming a consonant cluster across morpheme boundaries before suffixes; e.g. *meninggalkan* 'to leave behind'), and intervocalically (e.g. *tilam* 'mattress'). Sim measured the production of /l/ by ten Singaporean English-Malay early sequential bilinguals between the ages of 19 and 28 (M = 23.1, SD = 2.51) in spontaneous speech using F1 and F2 as acoustic cues. He found that the Malay participants preserved 54.8% of all absolute word-final /l/, and the rest were vocalised or dropped. He also noted that the coda laterals of English-dominant Malays were darker, whereas almost all produced by the Malay-dominant Malays were much clearer, with a statistically significant difference in the F2 but not F1. All participants were early or simultaneous bilinguals, however, and should have formed separate phonetic categories for their two languages or at least show distinct production patterns for the two languages (Barlow et al., 2013; Khattab, 2002, 2011). Sim posited that, rather than this being an effect of cross-linguistic influence, clear-l could have been learned through the input, similar to how British Asians acquired ethnically-marked features (e.g. Kirkham, 2017; Sharma, 2011). The retention and use of coda clear-l could have been motivated by socio-indexical reasons; based on the results from the language background survey, his Malay-dominant participants were associated with more Malay-dominant families and social circles, and identified more with a Malay-speaking culture.

5.1.2. Socio-indexical meanings of /l/

Several studies show how the use of allophones of the alveolar lateral can be socially conditioned. British Asian English, for instance, is often characterised as having clearer allophones of coda /l/, due to likely effects of languages with clearer /l/ variants such as Panjabi, Urdu or Arabic, and is used variably to signal group membership or to index social distinctions among peer groups (e.g. Khattab, 2002; Kirkham, 2017; Sharma, 2011). The use or avoidance of distinctive features can also be attributed to other social meanings that emerged from various sociohistorical processes. One such example is Simonet's (2010a, 2010b) study of the alveolar laterals of Catalan-Spanish adult bilinguals. Majorcan Catalan has dark-l in all positions, while Spanish has clear-l in all positions. Simonet revealed that, especially in Majorca, dark laterals seemed to index local and rural origin of a speaker and used stereotypically by native Spanish speakers and Spanish-dominant bilinguals when joking about Catalan-accented Spanish. He further explained that this was perhaps so because Spanish monolingual speakers settled mostly in the main Majorcan metropolitan areas during the mass migratory waves in the 1950's and 1960's, when Majorcan Catalan had a low level of social prestige for socio-political reasons. This led Simonet to posit that a reason why his Spanish-dominant female participants had a merged L1+L2 lateral category could be because they may have distanced themselves from what they might have perceived as Catalan-accented Spanish, which could also explain why they also produced clearer laterals than older females of similar linguistic background. A few studies have also reported gender effects. Mackenzie et al. (2015), for instance, studied the English speech of speakers in Irish-settled areas of Newfoundland, Canada, which was reported to exhibit clear-l in all positions. They found that, like the pattern in standard North American English, darker /l/ was used word-finally. However, they observed acoustic differences between women and men, where women made a significantly greater difference in terms of lateral darkness between initial and final /l/. They interpreted this as indicating that men were preserving more traditional variants than women. In another study, Clothier (2019) compared the production of /l/ between Australians with Lebanese ethnic identities that had parents and/or grandparents who were born in Lebanon, and Australia English speakers of Anglo-Celtic Australian heritage. He found that Lebanese Australian women with stronger, denser ties with the Lebanese community made a sharper distinction between dark-l in final position and clear-l in initial position, showing no substratum transfer, illustrating how men and women can be socialised into their ethnicities differently.

5.1.3. Objectives of this study

The above studies have shown how social factors modulate the linguistic choices of bilectal monolinguals in their CDS, and also described how alternative speech forms, in particular the variants of /l/, can be used strategically by bilinguals or speakers of ethnolects based on their socio-indexical meanings. Many of the same social factors influence the linguistic choices that Singaporeans make, as they choose from their repertoire alternative forms belonging to standard varieties and local dialect features, the latter including features that are ethnically distinct, based on their communicative needs.

This study aims to find out whether and how Singaporean English-Malay bilingual caregivers vary their use of variants of /l/ in their English CDS towards their preschoolers, and the possible social factors that modulate its variation. To this end, it aims to answer these research questions:

1. What syllable-final /l/ variant(s) do English-Malay bilingual caregivers use in their CDS?
2. Do the variants of /l/ used in CDS vary according to situational context?
3. Are there differences in the production patterns between mothers and fathers?
4. Is the phonetic variation, if any, socially conditioned?

METHODOLOGY

5.2.1. Participants

The corpus used in this study comprises ten Singaporean English-Malay bilingual families that included the father, mother and their firstborn of ages 3;1 to 6;4 (*M* = 55.8 months, *SD* = 12.43). The child participants had not started attending primary school; children in Singapore only enter primary school upon the year they turn seven. The children were all simultaneous bilinguals, having been exposed to both languages by the age of three (Genesee & Nicoladis, 2007). The families were recruited through friends of friends, while families Mi1 and Mi21 were recruited through a local preschool. All participants were born and raised in Singapore and spoke the same ethnolect. The details of the participants, including their age, age of acquisition (AoA), language dominance, socioeconomic status (SES) and gender of the children are presented in Table 5.1.

The adults were between 29 and 37 years of age (*M* = 32.8 years, *SD* = 2.41) and were all simultaneous or early sequential bilinguals, having learnt both languages by five, except for the father of family M11, who only started learning Malay in primary school at around seven years of age. Despite learning Malay late, his English accent was perceptually distinctively Malay. He attributed this to the influence of his Malay peers in school and his Malay-speaking friends in the army, where he served the compulsory conscription at about 18–19 years old. The language dominance of the adults was measured using the Bilingual Language Profile (BLP; Birdsong et al., 2012), a self-reported measure of their language history, proficiency, use and attitudes. The dominance scores were automatically tabulated, and possible scores ranged from −218 (Malay-dominant) to +218 (English-dominant). The mean BLP score for the mothers was 45.16 (*SD* = 47.14, *Mdn* = 56.81, range = -30.78–127.77) and 24.64 for the fathers (*SD* = 58.78, *Mdn* = 35.38, range = -32.24–147.66). Given that social class/socioeconomic status (SES) may have an effect on the language patterns of parents (Hoff, 2006), their SES was also ascertained using the established Family Affluence Scale (FAS; Currie et al., 2008) that was modified to fit the Singaporean context[8]. The FAS assesses SES by aggregating information on material affluence based on the material condition of the household. This study also included education level and profession of the parents as part of the measure. These items in the survey generated a composite score, with the highest possible SES score being 35; the mean SES score of the participants was 21.5 (*SD* = 2.63).

Table 5.1. Description of the participants, including their age, age of acquisition (AoA), the Bilingual Language Profile (BLP) score of the adults, socioeconomic status (SES) score and the gender of the children.

Family ID	Age			AoA English			AoA Malay			BLP		SES	Gender of child
	M	F	C	M	F	C	M	F	C	M	F		
M6	31	37	5;1	4	4	1	0	1	0	-8.35	-32.24	23	Male
M7	30	32	4;6	0	0	0	0	0	1	68.57	46.32	21	Male
M9	31	32	3;1	0	5	0	0	0	0	57.40	34.33	20	Female
M10	29	32	3;2	0	0	0	0	0	0	127.77	36.42	17	Male
M11	36	36	5;8	0	0	0	4	7	0	87.27	147.66	25	Male
M17	35	36	4;11	0	0	0	0	0	1	60.76	61.03	21	Male
M18	33	35	5;7	0	5	0	0	0	0	56.22	37.15	24	Male
M21	35	37	6;0	5	5	1	0	0	0	-30.78	-17.71	24	Female
Mi1	31	33	3;8	0	5	0	0	0	0	11.35	-65.20	23	Male
Mi21	32	34	4;10	3	0	0	0	0	0	21.34	-1.36	16	Female

Note: M = Mother, F = Father, C = Child. Age and AoA are measured in years. The data used in this study belong to a larger corpus and their original Family ID and the coding used to identify subgroups in the corpus (i.e. “M” or “Mi”) are retained.

[8] The question in the original FAS, ‘Do you have your own bedroom for yourself’ was replaced with ‘What type of home does this child live in?’. The question “Do you pay people from outside the family to work at your home on a regular (that is, on a daily or weekly) basis?” was also added.

5.2.2. Materials

Naturalistic data from unstructured play and semi-structured interaction between each parent-child dyad, which lasted approximately 30 to 40 minutes, were used in the analysis. Following Smith et al. (2007), casual conversation and unstructured play were defined as informal, while teaching and reading were formal. Informal activities during unstructured play and interaction included but were not limited to playing with toys, puzzle play, sketching/drawing, or a casual conversation about people or past events. The activities that constituted formal interaction included a picture description task. The parents were given a large picture card that featured a park scene with many animals, food, objects and people engaged in leisure activities and were told to describe and teach the child the names of the items. Mothers were also tasked to read to the child a book titled 'Duck and Goose' (Hills, 2006), while fathers were asked to read a book of their choice. As this study focuses on the variation in CDS, only the recordings of adult speech were analysed. Parents were also instructed to use only English to interact with their children, in order to avoid a bilingual mode (Grosjean, 2011); very minimal use of Malay, if at all, was found in their interactions in the recordings.

5.2.3. Recording procedures

The recording took place in a quiet room with minimal reverberation in their respective homes, without the presence of the researcher or any other person other than the parent and the child during each session. To ensure that the recordings were of adequate quality for acoustic analysis of fine phonetic details, they each had pinned on their collar an omni-directional lapel microphone, which was connected to a NAGRA ARES-MII recorder recording at a sampling rate of 44.1 kHz at 16 bit. The mothers were also given instructions to ensure a good recording; they were instructed on the optimal position of the microphones if adjustments were needed and were made aware of potential noise that could arise from the activities that would affect the recording. They were also reminded to speak as how they would normally with the child, and to avoid talking at the same time as the child. Noise from various sources such as traffic and electric fans was attenuated and kept to a minimum.

5.2.4. Auditory and acoustic analysis

To avoid coarticulation effects and ambisyllabicity of intervocalic /l/ in various morphosyntactic environments (e.g. Lee-Kim et al., 2013; Yuan & Liberman, 2011), only tokens from the following environments were included in the analysis: syllable-onset /l/ that were preceded by a pause or a stop and followed by a vowel (i.e. C_V and #_V positions), such as *look*, *blue*, and *exclaimed*. Syllable-coda /l/ were those that were preceded by a vowel and followed by a pause or consonant (i.e. V_# and V_C# positions), such as *ball*, *called* and *shelter*. Syllabic /l/ does not occur normally in SgE. Laterals next to another lateral were excluded. Tokens that could not be analysed due to devoicing or external noise were also excluded. The analysis yielded a total of 1770 tokens. The number of tokens according to parent, formality and syllable position is presented in Table 5.2.

Table 5.2. Number of tokens according to parent, formality, and syllable position.

Parent	Formal		Informal	
	Onset	**Coda**	**Onset**	**Coda**
Mothers	197	509	87	167
Fathers	195	408	81	126
Subtotal	392	917	168	293

Tokens were segmented and analysed aurally and acoustically using Praat (v. 6.1.6; Boersma & Weenink, 2019). In the first part, coda /l/ tokens were coded according to whether they were (1) retained (i.e. clearer and darker /l/) or (2) l-less (vocalised or deleted). Representative spectrograms of the word *ball* for the various realisations are shown in Figure 5.1. Very clear /l/ can be easily identified both aurally and also acoustically by the high F2 in the lateral steady-state in the spectrogram, as shown in spectrogram (a) in Figure 5.1. Distinguishing between darker /l/ and vocalised-l was more challenging, as acoustically dark-l and [w, o, u] have almost identical acoustic signals (as shown in (b) and (c) in Figure 5.1 respectively). An acoustic cue of a dark-l may be a fainter F3 (E. R. Thomas, 2011), but this method was highly unreliable, as F3 was not always clearly present, as can be seen in (b). F2 of a vocalised-l may also be lower, as seen in (c), but this acoustic cue requires the comparison of words with similar phonetic environments, and such a difference can be subtle. Due to the difficulty in acoustically distinguishing the two variants reliably, their identification was based largely on auditory methods. In the case of l-vocalisation, the main auditory cues were the transition from the nucleus to a more back and/or close vowel, giving a percept of a diphthong, and this was often accompanied by some degree of lip-rounding. For dark-l, the main auditory cues were those indicating apical contact and velarisation/pharyngealisation. Most sociolinguistic studies on l-vocalisation have employed perceptual coding techniques, which have been found to be reliable, especially for laterals that are most consonantal or most vocalised (Hall-Lew & Fix, 2012). Finally, in a token where /l/ was deleted, there was no change in quality in the nucleus that would indicate any kind of residual consonantal gesture aurally, as can also be seen acoustically in (d). Coda /l/ of these tokens was found to be preceded by a back vowel or schwa, as reported by Deterding (2007b). A second rater who was a sociophonologist was trained in the coding and asked to rate about 10% of all coda /l/ tokens (n = 120). As very clear-l is easy to identify, tokens that were coded as consonantal and had an F2 of above 1000 Hz were excluded from the random selection of the 120 tokens. The rater was asked to rate whether tokens were consonantal or l-less. 80% of all tokens were in agreement. Of the 120 tokens, 48 were coded as consonantal, and 87.5% of them were in agreement.

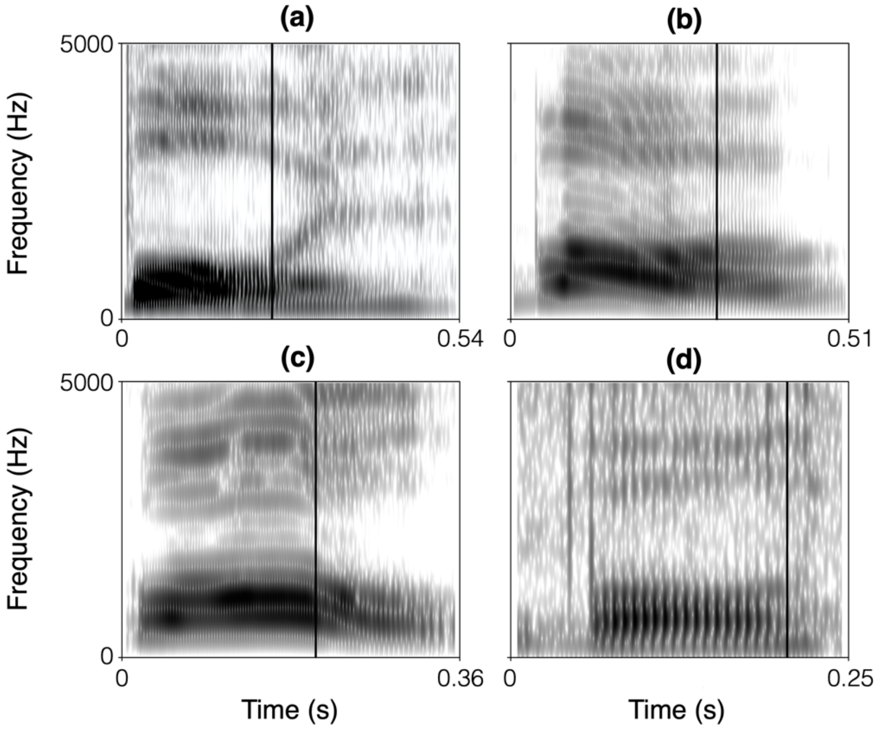


Figure 5.1 Representative spectrograms for the word *ball*. (a) clear-l, (b) dark-l, (c) vocalised-l, (d) deleted-l by the mothers of M9 and M10. Vertical black line represents end of the vowel interval.

In the second part of the analysis, only consonantal laterals (in both onset and coda positions) were further analysed. Figure 5.2 shows how the laterals were further hand-segmented for landmarks indicating the onsets and offsets of the (i) laterals and (ii) vowels for word-initial /l/ (left) and word-final /l/ (right). The onset and offset of the lateral was defined as the first and last pitch period where there is a change in F2 intensity compared to the neighbouring vowel, and this is usually accompanied by a change in the amplitude of the waveform (Amengual, 2018; Carter & Local, 2007; Simonet, 2015).

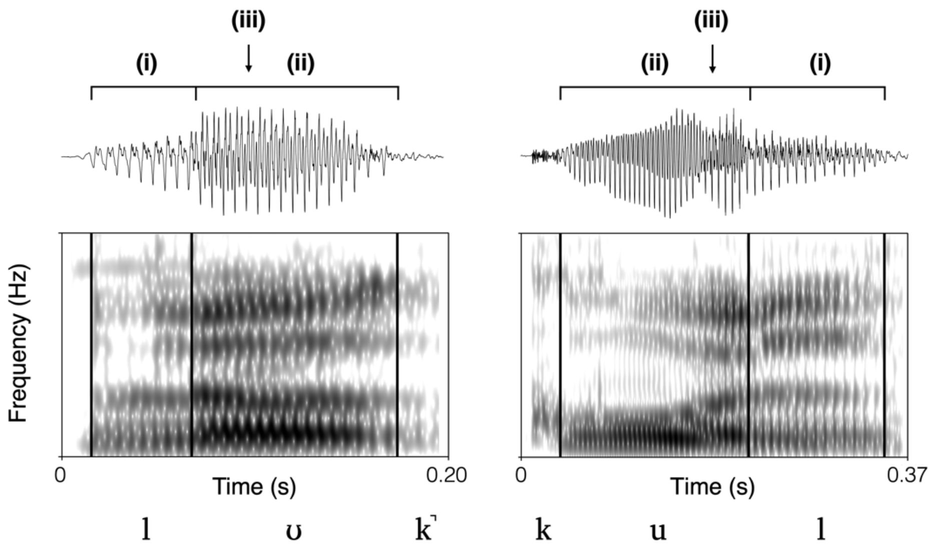


Figure 5.2 Representative waveforms and spectrograms of *look* (left, word-initial /l/) and *cool* (right, word-final /l/). (i) lateral, (ii) vowel, (iii) 30 ms mark into onset (left spectrogram) or offset (right spectrogram) of vowel.

The primary acoustic correlate of velarisation or pharyngealisation is regarded to be F2, though F1 has also been shown to vary between the two variants. Clear-l has a relatively high F2 and low F1, whereas dark-l has a low F2 and higher F1. Many studies have used the F2–F1 metric to capture the relationship between the two formants; clearer /l/ has a higher F2–F1 (e.g. Amengual, 2018; Clothier, 2019; Holmes-Elliott & Smith, 2018), which was also used in this study. Formant tracks were calculated with the built-in Burg algorithm in Praat. All tokens were measured manually. The effective window length was set at 25 ms, and the maximum number of formants was kept at five (1.0 mm dot size, 5.5 kHz ceiling) as default. However, adjustments to the number of formants and formant ceiling were made according to the speaker and to rectify tracking errors. Formant measurements were taken at the midpoint of the lateral steady state, in order to minimise effects of coarticulation. Following previous studies (e.g. Amengual, 2018; Clothier, 2019; Kirkham, 2017), formant values were extracted in Hertz and were converted to Bark, a psychoacoustic scale, to reflect darkness of /l/ as a perceptual phenomenon. Outliers were detected using the interquartile range method. 18 coda /l/ tokens had an F1 (Bark) or F2 (Bark) that fell below the first quartile or above the third quartile of 1.5 times the interquartile range of all tokens. 14 of these tokens were produced in the formal contexts. Many of these outliers were a result of exaggerated speech that is characteristic of CDS. Others were due to stronger coarticulatory effects with the neighbouring consonants that is typical of fast spontaneous speech, and a few were spoken much slowly and in isolation which resulted in a 'canonical' dark- or clear-l. As none of these tokens were deviant from what would be expected of spontaneous speech or CDS, nor due to mismeasurement, they were not excluded from the analyses.

Several linguistic factors were considered to account for the variability in phonetic contexts in spontaneous speech data and the potential inter-speaker variability that may exist. The duration of the lateral defined by the temporal-acoustic landmarks was recorded, to account for phonetic effects of duration, which has been found to positively correlate with darkness of /l/ (Sproat & Fujimura, 1993; Yuan & Liberman, 2009). Neighbouring vowels have also been shown to influence darkness of /l/; studies of a few language varieties including but not limited to American English (Oxley et al., 2007), African American English (van Hofwegen, 2010), Majorcan Spanish and Catalan (Simonet, 2015), and Welsh and Welsh English (Morris, 2017) have found that /l/ tended to be lighter with fronter vowels and darker with backer vowels, but dark-l was strongly resistant to coarticulation. The potential coarticulation effects of vowels were considered by taking into account the F2 of the neighbouring vowel, as indicated by (iii) in Figure 5.2. To achieve this, Morris (2017) and van Hofwegen (2010) used the arithmetic difference between F2 (Bark) of the /l/ midpoint and the F2 (Bark) of the 30 ms into the offset or onset of the preceding or following vowel respectively; 30 ms was an arbitrary value that allowed for some transition into the next segment. However, as this study is concerned with within-speaker variation that involved the use of both allophones syllable-finally, only the F2 (Bark) of the vowel was used in the analysis. Finally, adjacent consonants may also affect /l/-darkening, although these effects may be language- or variety-specific. For instance, Davidson (2012) reported that in Catalan, velarisation is stronger when the lateral consonant precedes a velar or bilabial consonant. Morris (2017), who examined /l/ in Welsh and Welsh English, did not find a difference in darkness between /l/ before coronals and those before other consonant types, but found that tokens of word-final /l/ that preceded coronal consonants were lighter than those before a pause. The phonetic contexts that follow the laterals may also condition l-vocalisation. Scobbie & Wrench (2003) examined the word-final /l/ of English speakers of non-vernacular varieties of British English, Scottish English and American English, and found that word-final /l/ was vocalised more often in prelabial context than in prepausal context, and more often in these two contexts than prevocalically. In prepausal /l/, vocalisation occurred more often if the /l/ was in a metrically weak syllable, although some of these patterns were highly speaker-specific. Therefore, the place of articulation or type of neighbouring consonant (or stated as 'pause', in the case of an /l/ at utterance boundary) and whether the lateral consonant was in a lexically stressed or unstressed syllable were also recorded. Following Davidson (2012) and Morris (2017), the types of consonant included coronal (/t, d, tʃ, dʒ, s, z, ʃ, n, r, ð, θ/), glottal (/h/), labial (/m, f, v, p, b/), velar (/k, g/), and also glides (/w, j/).

5.2.5. Statistical analyses

Mixed-effects regression analyses were conducted using the R statistical software (R Core Team, 2020), the 'lme4' package (Bates et al., 2015), and the 'lmerTest' package (Kuznetsova et al., 2017). For all models, the random effect structure included random intercepts for subject and word, and for variables of interest only, by-subject and by-word random slopes, as justified by the data. Random effects structures were simplified (but random slopes of variables of interest were not removed) when they were of a significantly worse fit than a simpler model and/or when convergence issues could not be resolved. Interactions between variables were further investigated using the 'emmeans' package (Lenth, 2018). For ease of reference, the specific linear models used for each part of the analysis, variables that were included in the full models, and the model selection technique are described in the results section.

RESULTS

5.3.1. L-less versus retained coda laterals

The proportions of coda /l/ tokens that were l-less (i.e. vocalised/deleted) and retained according to parent and formality of situational context are shown in Figure 5.3. By visual inspection of the figure, overall, both fathers and mothers share the same production patterns: the proportions of retained /l/ were greater in informal contexts, but in formal contexts, more /l/ tokens were l-less.

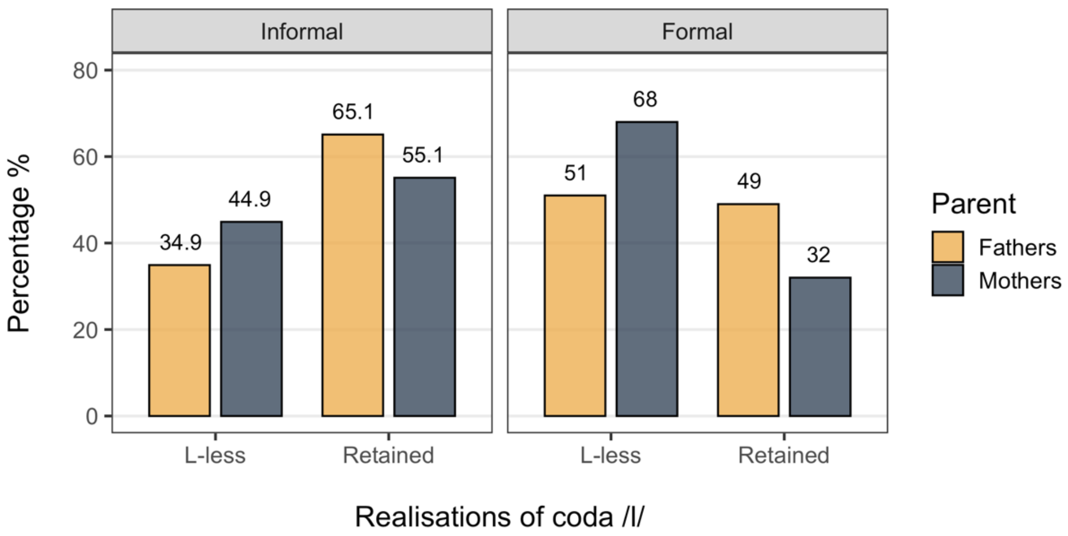


Figure 5.3 Percentages of realisations of coda /l/ as a function of formality of situational context and parent.

Mixed-effects generalised linear regression was run to model the binary outcome of a coda lateral being l-less or retained for mothers and fathers separately. In the full models, the random effects structures included random intercepts for subject and word and by-subject and by-word slopes for formality. Fixed effects that were linguistic factors included the neighbouring consonant (coronal, glottal, labial, velar, glide or pause), lexical stress (stressed/unstressed), and the categorical variables of vowel height and vowel advancement of the preceding vowel. Vowels were categorised according to the vowel system of SgE (see Deterding [2007] and Leimgruber [2013, pp. 64-65]). Compared to Standard Southern British English, the vowel inventory of SgE is much reduced; there is an absence of phonemic length and quantity distinctions between tense-lax pairs (e.g. *beat* and *bit* are homophones), /æ/ is merged with /ɛ/, and /eɪ/ and /oʊ/ are monophthongised to [e] and [o] respectively. Diphthongs were categorised according to their offset (e.g. /aɪ/ was grouped with /i/). Therefore, the vowel height categories were close [i, u], close-mid [e, ɘ, o], open-mid [ɛ, ɔ], and open [ʌ], and the vowel advancement categories were front [i, e, ɛ], central [ɘ, ʌ], and back [u, o, ɔ]. Non-linguistic or social factors that were included as fixed effects were formality (formal/informal), gender of child (male/female), age of child (in months), SES score, and BLP score. Continuous independent variables were mean centred. Finally, two-way interactions between formality and SES, BLP, age of child and gender of child were added as fixed effects. To evaluate the contribution of each predictor, pairwise model comparisons between the full model that included all the explanatory variables and a more restricted model that excluded the predictor under consideration were performed using likelihood ratio tests.

The results for the full model and further information about the reduced model for mothers and fathers can be found in Appendix 3 (§1) and Appendix 3 (§2), respectively. In the reduced model for mothers, neighbouring labials, $B = -0.99$, $OR = 0.37$, $p = 0.01$, 95% CI [0.17, 0.81], and formality, $B = -0.84$, $OR = 0.43$, $p = 0.04$, 95% CI [0.20, 0.96], were significant predictors. That is, laterals that preceded labials were significantly more likely to be l-less compared to those before a pause, and coda laterals of mothers in formal contexts were more likely to be l-less. In the reduced model for fathers, by-subject slope of the interaction between formality and age of child, and by-word slope of age of child were added, as the interaction term as a fixed effect was found to significantly improve model fit in the modelling. The effects of the neighbouring consonant, specifically labials, $B = -1.35$, $OR = 0.26$, $p = 0.001$, 95% CI [0.12, 0.58], and velars, $B = -1.47$, $OR = 0.23$, $p = 0.02$, 95% CI [0.07, 0.79], were significant; coda laterals that preceded these two consonant types were significantly more likely to be l-less compared to those before a pause. The advancement of preceding vowel was also a significant predictor; laterals after front vowels, $B = -1.57$, $OR = 0.21$, $p < 0.001$, 95% CI [0.09, 0.46], and after central vowels, $B = -1.63$, $OR = 0.20$, $p < 0.001$, 95% CI [0.09, 0.42], were more likely to be l-less compared to those after back vowels. Inspection of tokens by individual vowels revealed that the high occurrence of three specific words that shared the rime /ɔl/ – *ball*, *all* and *small*, which were almost always pronounced with a retained /l/ by fathers, could have contributed to the significant differences. Finally, the interaction between formality and age of child was a significant predictor, $B = 0.07$, $OR = 1.07$, $p = 0.02$, 95% CI [1.01, 1.14]. Spotlight analysis was performed to examine how formality and position varied by three levels of age of child: at the mean level, +1 SD of the mean, and a third at -1 SD of the mean. Based on plots of marginal means and estimates of simple effects, as age decreases, more l-less tokens were produced in formal contexts than informal contexts, and only for the younger group, the contrast was significant ($OR = 0.31$, $p = 0.02$). Pairwise comparisons (with Tukey adjustments) for age levels by situational contexts (e.g. older versus younger in informal context) revealed that differences between age levels were not significant ($ps > 0.1$). Inspection of individual raw data indeed revealed that the fathers of two youngest children, M9 (3;1) and M10 (3;2) produced a considerably higher proportion of l-less tokens in formal situations, but the increase in the use of l-less tokens by the father of the next youngest child, M11 (3;8) was only marginal.

In short, with linguistic factors considered, mothers overall produced significantly more l-less tokens in formal contexts, while only some fathers of very young children did so.

5.3.2. Darkness of consonantal laterals

Only onset laterals and coda laterals marked as retained ($n = 1096$) were included in the following analyses. Variation in the darkness of the laterals was first investigated by plotting the Bark-transformed F1 values of the laterals against their F2 values (Figure 5.4). To reiterate, clearer /l/ is associated with higher F2 and lower F1 values. Individual observations, which were grouped by context according to the formality and syllable position, are included in the plot, together with ellipses that show their spread at ±1 standard deviation. The laterals of the fathers and mothers were also plotted separately, in order to uncover potential gender differences.

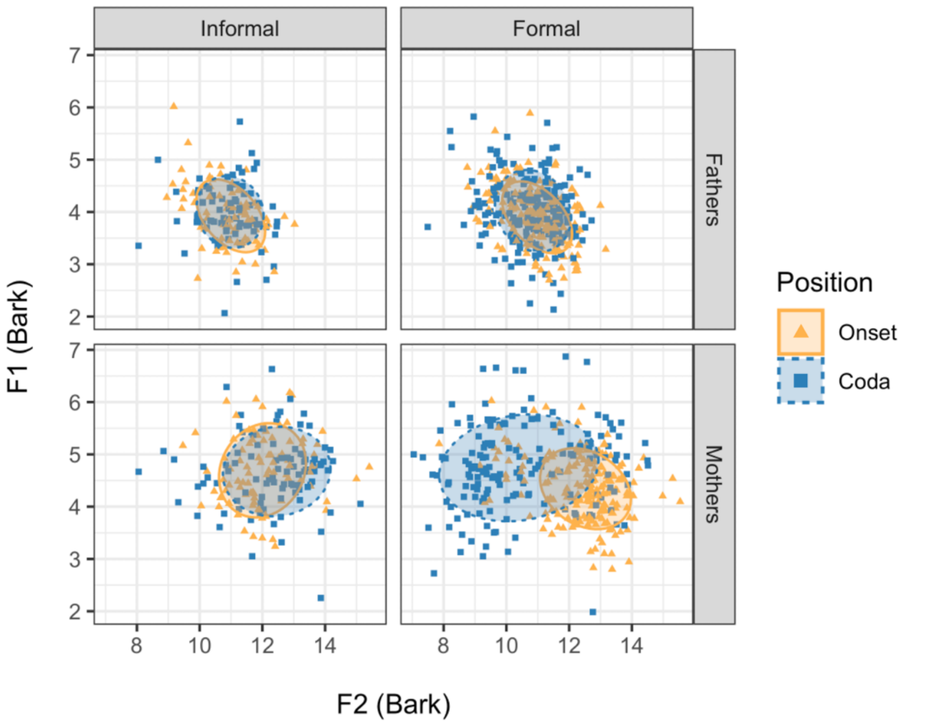


Figure 5.4 Scatterplot of formant values of laterals as a function of formality of situational context, syllable position and parent with ellipses of ±1 standard deviation.

The figure shows that fathers and mothers exhibited different production patterns. The ellipses of the laterals of fathers (top row) in all four contexts coalesced, suggesting that little distinction was made if at all in the allophones of /l/ according to situational or positional context. Contrastingly, for mothers (bottom row), many tokens of coda /l/ in the formal context were comparatively darker than all other /l/. This suggests that in informal contexts, mothers exhibited the same /l/ pattern as fathers, but in formal contexts, many tokens of coda /l/ were made darker, reflecting the clearer onset and darker coda pattern that speakers of more established standard varieties of English exhibit. However, the relatively larger ellipse also suggests that not all tokens of /l/ were made darker in the formal contexts or that there was some inter-speaker variation, but this could also be due to more general linguistic factors, such as coarticulatory effects. Possible inter-speaker variation in mothers was further explored by conducting a visual inspection of individual scatterplots. Six of the mothers clearly distinguished onset and coda /l/ in the formal context, M10, M17 only partially, and M6 and M11, who had two of the lowest BLP scores, hardly distinguished all laterals in their darkness, which suggests that BLP may have an effect on their lateral production. However, M21, despite being the most Malay dominant of all mothers, had clearly distinguished the laterals in formal contexts, but she had only retained 13.8% of /l/ in the formal context as the rest were vocalised (86.3%). Although mothers M6 and M11 did not differentiate the darkness of their laterals, individual production patterns revealed that in formal contexts, they still produced more l-less tokens than in informal contexts (M6 produced 30.5% more l-less tokens and M11, 30%). Interestingly, the increase in the use of l-less tokens in formal contexts by M21, M6 and M11 was greater than that of most mothers.

The darkness of the laterals was further examined visually using mean F2–F1 (Bark) values (recall that a higher difference indicates a clearer /l/), plotted according to formality, parent and syllable position (Figure 5.5). For fathers, in the informal contexts, there was little difference in the mean F2–F1 (Bark) values of onset and coda /l/. The mean of onset /l/ in the informal context was 6.97 (SD = 1.21, n = 81) compared to 6.95 (SD = 1.06, n = 82) for coda /l/. In the formal context, coda /l/ was slightly darker; the mean was 6.76 (SD = 1.22, n = 200), compared to 7.03 (SD = 1.19, n = 194) for those in the onset, with a very small mean difference of 0.27 Bark. In contrast, mothers used a much darker /l/ in the formal context. The mean of onset /l/ was 8.02 (SD = 1.50, n = 197) compared with 5.78 (SD = 1.93, n = 163) for coda /l/—a mean difference of 2.24 Bark. Interestingly, the figure shows that in the informal context, mothers' onset /l/ was darker than those in the formal context, and coda /l/ was slightly clearer than onset /l/. The mean of onset /l/ was 7.35 (SD = 1.22, n = 87) and the mean of coda /l/ was 7.64 (SD = 1.51, n = 92). These differences suggest a three-way interaction between formality, parent, and syllable-position, and this was considered in the regression models.

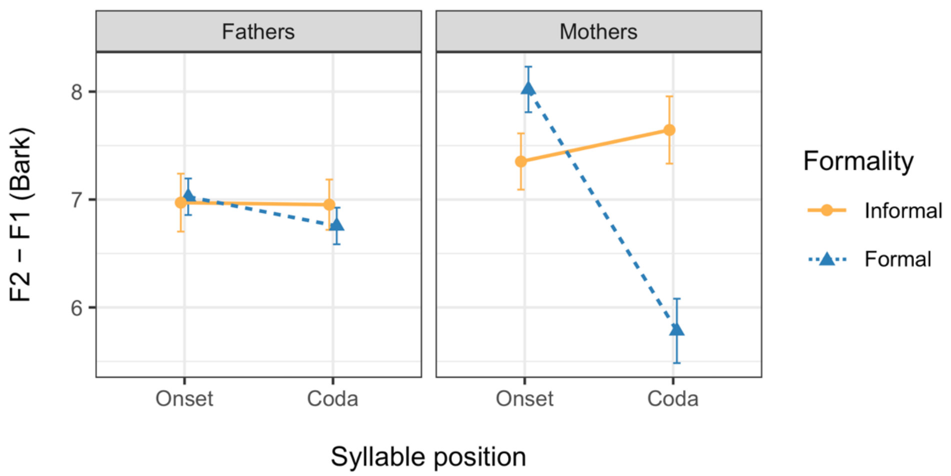


Figure 5.5 Means (+95% CIs) of F2–F1 Bark of laterals as a function of formality of situational context, syllable position and parent.

Mixed-effects linear regression analysis was conducted to examine the relationship between the darkness of the laterals and various potential predictors. The response variable was the Bark-transformed F2–F1 values. The random effects included random intercepts for subject and word as well as by-subject and by-word slopes for formality, position and parent. The fixed effects in the full model that were categorical included formality of situational context (formal/informal), parent (mother/father), syllable position (onset/coda), lexical stress (stressed/unstressed), neighbouring consonant (coronal, glottal, labial, velar, glide, or pause) and gender of child (male/female). The fixed effects that were continuous included F2 (Bark) of the 30 ms mark of the neighbouring vowel, duration of the lateral, BLP scores, SES scores, and the age of the child. Finally, a three-way interaction term between formality, parent, and syllable position was added. The duration of the lateral was log-transformed to resolve the skewness of the data. The age of acquisition of the parents was measured in the BLP survey, and so it was not added as a separate variable, in order to avoid issues with multicollinearity. Continuous independent variables were mean centred. A series of models was fitted for model selection using the process outlined in Zuur (2009, pp. 121-122). All the explanatory variables above were included in a full model initially. The optimal random effects structure was first explored with the full model using the likelihood ratio test with restricted maximum likelihood tests (REML) estimation. The optimal fixed effects structure with the selected random effects was then evaluated by maximum likelihood (ML) estimation by removing fixed factors one by one, while using the Akaike Information Criteria (AIC) as measure of model fit. The reduced model is then presented using REML estimation. The results of the reduced model are presented in Table 5.3 while the results for the full model can be found in Appendix 3 (§3). The optimal random effect structure of the reduced model included subject and word as random intercepts, by-subject random slopes for parent and the two-way interaction between formality and position, and by-word slopes for formality, position and parent.

Table 5.3. Regression coefficients of a reduced mixed-effects linear regression model fit to the consonantal laterals across entire dataset with F2–F1 (Bark) as response.

Fixed factors	**Level**	***β***	***B***	***SE***	***t***	***p***
(Intercept)		0.12	7.22	0.18	40.01	**< 0.001**
Formality	Formal	0.02	0.03	0.19	0.14	0.89
Position	Coda	0.02	0.03	0.24	0.12	0.90
Vowel context		0.48	0.39	0.03	15.29	**< 0.001**
Nbr. consonant	Coronal	0.04	0.06	0.10	0.60	0.55
	Glottal	0.01	0.01	0.22	0.05	0.96
	Labial	-0.30	-0.46	0.13	-3.60	**< 0.001**
	Glides	0.19	0.30	0.21	1.43	0.15
	Velar	-0.15	-0.24	0.17	-1.43	0.15
Parent	Mothers	0.09	0.14	0.24	0.60	0.55
Formality × Parent		0.17	0.27	0.28	0.99	0.32
Formality × Position		-0.20	-0.31	0.34	-0.89	0.37
Parent × Position		-0.22	-0.34	0.34	-0.98	0.33
Formality × Parent × Position		-0.72	-1.13	0.50	-2.22	**0.03**

Note: Reference category for formality is informal, syllable position is onset, neighbouring (nbr.) consonant is pause, and parent is fathers. Observations = 1096, marginal R^2 = 0.37, conditional R^2 = 0.70, AIC = 3385.19.

The results show that coarticulatory effects of neighbouring vowels and consonants that were found in previous studies were also significant in predicting the darkness of the laterals in this study. For vowel context, the fronter the neighbouring vowel, the clearer the /l/ was. The neighbouring consonant also had an effect on the laterals. Laterals next to labials were significantly darker than those next to pauses. Finally, the three-way interaction between parent, formality and syllable position was a significant predictor. The non-significance of all two-way interaction terms reflects the considerable variability in the levels of the factors without the moderation of the levels of the third term. Inspection of plots of marginal means and pairwise comparisons of simple effects (with Tukey adjustments) reflect the observations in Figure 5.5; in informal contexts, the darkness of onset and coda laterals did not significantly differ within and between mothers and fathers (*ps* > 0.05). In formal contexts, there was no significant change in darkness of onset laterals of mothers (B = 0.29, t = 1.39, p = 0.52), but their coda laterals were significantly much darker than informal codas (B = -1.12, t = -3.74, p = 0.006), and therefore also significantly darker than formal onset laterals (B = -1.73, t = -6.00, p < 0.001). In contrast, for fathers, there was no significant change in darkness of both onset and coda laterals, and the positional contrast in both situational contexts remained insignificant; unlike mothers, fathers' codas were not significantly darker than onsets in formal contexts (B = -0.28, t = -1.13, p = 0.68). The main effects of age and gender of the children, BLP and SES did not significantly influence the darkness of the laterals.

To further understand how the interaction between formality and position differed across the levels of parent, as well as their three-way interactions with the other external factors, two separate linear mixed-effects models, one for fathers and one for mothers, were run. In addition to their main effects, the two-way interaction between formality and syllable-position, as well as their three-way interactions with SES, BLP, and age and gender of child, were added as fixed effects. The same linguistic factors, namely neighbouring consonant, lexical stress, vowel context (F2 of the neighbouring vowel at the 30 ms mark) and (log-transformed) duration of the laterals were also added as fixed effects in the full model. The results for the full model and further information on the reduced model for mothers and fathers can be found in Appendix 3 (§4) and Appendix 3 (§5), respectively.

In the reduced model for mothers, the random effects structure included random intercepts for subject and word, by-subject random slopes for the interaction between formality and position, and by-word slopes for formality and position. The main effects of vowel context (β = 0.45, t = 11.38, p < 0.001) and (log-transformed) lateral duration (β = 0.08, t = 2.61, p = 0.01), and the two-way interactions between formality and syllable position (β = -0.91, t = -3.03, p = 0.002) were significant predictors; that is, longer laterals were (marginally) clearer, and the fronter the neighbouring vowel, the clearer the /l/ was. Inspection of plot of marginal means and pairwise comparisons of simple effects (with Tukey adjustments) of the interaction term again revealed that onset and coda laterals were not significantly different in darkness in informal contexts (B = -0.03, t = -0.06, p = 0.99), but coda laterals were significantly darker than onset laterals in formal contexts (B = -1.72, t = -5.14, p < 0.001).

In the reduced model for fathers, the random effects structure included random intercepts for subject and word, and by-subject random slopes for the interaction between formality and position. Only the main effects of vowel context (β = 0.48, t = 10.11, p < 0.001) and neighbouring labials (β = -0.37, t = -2.99, p = 0.003) were significant predictors; that is, the fronter the neighbouring vowel, the clearer the /l/ was, and laterals next to labials were significantly darker than those next to pauses. The main effects of formality (β = -0.01, t = -0.08, p = 0.94), position (β = 0.02, t = 0.13, p = 0.90) and their interactions (β = -0.26, t = -1.51, p = 0.13) were not significant predictors. Language-external factors also did not significantly modulate the darkness of the laterals of fathers.

In sum, with linguistic factors considered, the darkness between onset and coda laterals of mothers in informal contexts was not significantly different, but in formal contexts, coda laterals were significantly darker than onset laterals. By contrast, the darkness of laterals of fathers did not significantly differ across formality, nor was it modulated by other language-external factors.

Discussion

This study set out to find out whether and how Singaporean English-Malay bilingual caregivers vary their use of variants of /l/ in their CDS towards their preschoolers according to situational context, and the possible socio-indexical reasons that could explain the phonetic variability. To remind the reader, there are three forms of syllable-final /l/ that have been described in previous SgE studies: l-lessness (vocalised-l or deleted-l, the predominant local forms), dark-l (the variant associated with exonormative standards), and clear-l (a Malay-derived variant used by some English-Malay bilinguals). The findings revealed that in informal contexts that involved unstructured play and casual conversation with their child, both mothers and fathers used a relatively clearer /l/, in all syllable positions. Contrastingly, in formal contexts that involved teaching and learning, mothers used a significantly darker coda, reflecting the clear-l onset and dark-l coda pattern that speakers of more established standard varieties of English exhibit. In addition, mothers used significantly more l-less tokens in the formal contexts. For fathers, there was no significant differentiation in the darkness of the laterals according to situational context, and positional contrast remained insignificant. Some fathers of younger children, however, did produce considerably more l-less tokens in the formal contexts. In addition to these findings, two linguistic factors were found to significantly predict the likelihood of l-vocalisation. First, coda /l/ that preceded labials (and also velars for fathers) was significantly more likely to be l-less compared to those before pauses, which supports previous findings that preconsonantal /l/ was more likely to be vocalised than prepausal

/l/ (e.g. Scobbie & Wrench, 2003). Second, for fathers, laterals after back vowels were more likely to be retained, but as previously explained, the effect may be attributed to the high occurrence of specific lexical items with the rime /ɔl/ that were almost always pronounced with a retained /l/ by the fathers. Two main linguistic factors also predicted the darkness of the retained laterals. First, /l/ was found to be significantly lighter when neighbouring fronter vowels, as also has been found in previous studies (e.g. Oxley et al., 2007; Recasens & Espinosa, 2005). Second, especially for fathers, /l/ was darker when neighbouring a labial consonant, supporting other studies that reported effects of adjacent consonants on l-darkening (e.g. Davidson, 2012; Morris, 2017).

The use of a clearer variant of English coda /l/ that is as clear as onset /l/ by the Malay caregivers contrasts with the norms of Chinese Singaporeans, whose laterals, if not l-less, typically show positional differences due to a relatively darker coda /l/. This can be attributed to their bilingual experiences. Participants in this study might have been raised in a more Malay-dominant environments, by significant adults who spoke little English or were late learners, and/or were a part of more Malay-dominant social circles. This is considering that the bilingualism policy was still in development in the 1960's, and for many Singaporeans then and even today, English is not acquired as their first language (see Bao, 2015, pp. 15–36, for an overview of Singapore's linguistic ecology, and Cavallaro & Serwe, 2010, for a description of the Malay speech community in Singapore). The use of clear-l, however, is unlikely the result of cross-linguistic influence. The participants in this study were early if not simultaneous bilinguals, having been exposed to both languages by five (with the exception of the father of family M11 who acquired Malay later, as mentioned previously), and should have formed separate phonetic categories for clear- and dark-l (e.g. Barlow et al., 2013; Khattab, 2002, 2011). Further, there is some evidence that even those who learnt the L2 later in school had maintained two separate acoustic distributions for the laterals in their two languages, despite showing evidence of phonetic assimilation to their dominant language (Simonet, 2010a). Those who have been raised in environments where more Malay is used, however, may have had more influence of Malay on their English phonology (En et al., 2014). The primary source of influence is likely to be the phonetic details in the input. It has been shown that children are sensitive to even non-contrastive phonetic information in the input, and further these properties are reflected in their production (e.g. Mayr & Montanari, 2015; Sim & Post, 2021a; Stoehr et al., 2019). Similar to second generation British Asians (e.g. Kirkham, 2017; Sharma, 2011), the use of clearer coda /l/ by participants of this study, who were mostly English-dominant at the time of the study, could have been a result of the acquisition of accented English L2 from their parents or peers, or ethnic features in the repertoire of L1 speakers in their community.

The maintenance and use of a clearer variant of coda /l/ by the English-Malay caregivers is therefore similar to the use of local or nonstandard forms by bilectal monolinguals in their CDS, or the use of exogenous forms by ethnolect speakers with family members or with peers who share the same ethnic affiliation, in that although they may not be standard nor mainstream forms, they are used in informal CDS and with family members because it indexes group membership. As mentioned, the use of local features or a more ethnically distinctive repertoire for their sociocultural capital is not uncommon among Singaporeans (Alsagoff, 2007). Preliminary findings of a perception study by Sim (2021a) that involved a matched-guise test revealed that guises with clear-l were 'stereotyped' (Labov, 1991) by Singaporeans and perceived to be the most ethnic-accented of all three variants, but were regarded as the friendliest and used variably by Malay non-users to signal group membership. An appreciation of the significance of the Malay ethnic repertoire requires an understanding of the Malay community. The Malays[9] constitute an ethnic minority in Singapore (about 15% of the citizen population). They are especially close-knit and have, by and large, strong, dense ties with other members. Almost all Malays in Singapore are Muslims, and so their shared customs, traditions and values are extensively shaped by the Islamic religion. Their identity is further strengthened by speaking a common ethnic mother tongue, the Malay language, which is strongly associated with and forms an integral part of the Malay ethnic, cultural and religious identity in Singapore (Kassim, 2008). Being in a multicultural society and one that is increasingly English dominant did not erode their Malay identity. In a survey involving over 400 Malay Singaporeans, Mathews & Selvarajan (2020) found that while the participants had a strong multicultural identity, they still held a strong sense of Malay

[9] The Malays include subgroups such as Bugis, Boyanese, Banjar, and Javanese, but most identify themselves as Malays and follow the same religious faith and social norms.

ethnic and cultural identity; 96.9% of the participants identified with Malay culture and 95.7% indicated a strong affinity to the Malay language. Even young people who are becoming more English dominant still showed a strong sense of ethnic group-belonging as well as a sense of inheritance and affiliation for the Malay language (E. L. J. Chong & Seilhamer, 2014). Most of the participants in this study can be said to be archetypal Malay families who were closely affiliated to the ethnic community. They observed Malay traditions and customs and practised the Muslim faith. Many of them also sent their children to Islamic preschools and kindergartens that offered Islamic studies and the Malay language in addition to the mainstream curriculum. As Mathews & Selvarajan (2020) highlighted, "intangible boundaries carved out to demarcate Malayness do exist (p. 732)", and it is argued here that a distinctly Malay-influenced English repertoire, with coda clear-l being one of the many distinctive features, is maintained and may be used variably by members of the Malay community for such an endeavour. Its use in CDS is essential in helping children construct a full sociolinguistic repertoire (Foulkes et al., 2005).

Mothers' use of darker coda /l/ and/or producing more l-less tokens in formal contexts is not unexpected. It was previously mentioned that Singaporeans have in their English repertoire alternative forms associated with standard and local varieties. Standard forms are often regarded as prescriptively correct in Singapore, and there is public awareness of their social value; they are accorded social prestige and their use evokes semiotic connections to education, high social status, formality, and 'correctness' (e.g. Cavallaro et al., 2014; Sim, 2021a). The shift from using a clearer variant of coda /l/ to other variants in contexts of teaching and reading, therefore, can be interpreted as the adoption of a more mainstream/standard repertoire, a style that mothers deemed as most appropriate for teaching and learning, which also coincides with the style that is preferred in formal language classrooms. Although mothers M6 and M11, who were more Malay dominant, did not show positional contrasts in their laterals by producing darker /l/, they showed the highest percentage increase of l-less tokens in formal contexts, and therefore it seems that mothers were using different strategies for the same aim, based on their individual linguistic repertoire. This perspective is supported by findings from previous studies in which more standard forms were used by mothers with children in formal contexts (e.g. Smith et al., 2007) and/or for pedagogical reasons (e.g. Roberts, 1999, 2013), and also mirrors the shift from a more ethnic to a more mainstream repertoire by some ethnolect speakers when speaking to their children (e.g. 'Anwar' in Sharma, 2011). Further, this shift in style was not limited to segmental modifications. Perceptually, mothers in this present study, and sometimes fathers, approximated a hybrid accent that was not purely colloquial when teaching or reading, with the differences most noticeable in its prosody.

Fathers in this study were found to make little adjustments to their use of /l/ in their CDS relative to mothers. The findings tie well with what was previously reported in Foulkes et al. (2005) based on the limited data of three male adults, and provide further insights into the grossly understudied area of socially-conditioned phonetic variation in paternal CDS. Social forces such as cultural or societal norms that constrain or influence language choices may offer a more satisfactory account, since the language-external/social factors that were considered in this study failed to correlate with gender. One explanation could be the differentiation of gender roles. The traditional Malay family is patriarchal; the husband is the breadwinner, while the wife manages the household and takes on the primary role of the caregiver. Despite the rise in Malay women's participation in the workforce, such rigid gender roles remained dominant (Sumartono & Sumartono, 2017). In her qualitative study of ten dual-income Malay families in Singapore, Suratman (2011) found that while there was more sharing of child care and household tasks between husbands and wives, women 'gate-keep' by managing the delegation of family work based on their evaluation of the ability or efficiency of their husbands in performing these tasks. Such segregation of roles was also observed in the husbands, as they delegated child caring responsibilities to their wives. In the Malay community, gender roles such as women's duty in child-rearing do not only have a cultural underpinning, but also a religious one. Mothers therefore take on the mantle of role model and teacher of language at home. The use of a darker variant of /l/ by mothers but not fathers is consistent with the 'gender pattern' that has been widely reported across different cultural and linguistic contexts, in which women generally use more standard variants and conform more closely than men to sociolinguistic norms that are overtly associated with prestige (Labov, 2006). This suggests that the gendered differences observed could have been a result of and enabled by mothers having a wider overall repertoire range compared to fathers. In her study of second generation British-born Asians, Sharma (2011) found that gender was not directly correlated with how varied her participants' repertoires were, but a more varied repertoire was in part due to the need for such differentiation. She postulated that older British Asian men had a more complex repertoire range because of a need to maintain strong transnational ties to India and also the need to pass as British because of the pervasive hostility toward migrant families. In the same way, Malay women might have a more differentiated repertoire because of a need to do so. Due to the predominantly patriarchal Malay community, coupled with the socio-economic disadvantages of and relatively poorer access to social resources such as higher education by the ethnic Malay minority (see Mutalib, 2012, chapter 4), Malay women may need to do more to be successful and adapt/conform in order to gain greater social mobility, and therefore show a more nuanced use of linguistic resources, especially prestige forms and standard varieties. Therefore, in addition to the maintenance and use of ethnically-distinct variants for their sociocultural capital, young Malay women also have in their repertoire prestige forms possibly for their symbolic expressions of status or to access social, political or economic power (Queen, 2013; Schilling, 2011). This perspective is aligned with the findings of Cavallaro & Serwe (2010). In a study of the language use patterns of 233 Malay Singaporeans in various domains and towards family, relatives and close Malay friends, they found that their female participants in the 18–24 year old group, which coincides with the age of the caregivers in this study, used more English than their male counterparts. They drew parallels between these young Malay women and women of other societies who used the language variety of prestige in a bid to move up the social ladder, and commented that the higher use of English by the younger Malay women in their study reflected their higher educational and career aspirations. Based on their BLP results, mothers in this study also had a more positive attitude towards the use of English and were more strongly affiliated to an English-speaking culture than most fathers, and so did the two fathers who had used more l-less tokens with their very young children in formal contexts. Interestingly, the father of the next youngest child, who did not produce more l-less tokens in formal contexts, did not identify with the English-speaking culture at all (i.e. a rating of '0'). Finally, the findings can be explained by the observed general differences between maternal and paternal CDS. Studies in paternal infant-directed speech have found that fathers do indeed modify acoustic properties in CDS, but not to the same extent as mothers, and they also accommodate less. The way fathers modify their speech also differs across societies and cultures (Broesch & Bryant, 2018). Moreover, some studies found that fathers play a special role in facilitating language learning by using more complex speech than mothers, and this contributes significantly to the child's later language development (e.g. Pancsofar & Vernon-Feagans, 2006). These suggest that both mothers and fathers play a role in the language development of their children, but in different ways. In addition, age-correlated effects in CDS could also be different for mothers and fathers. Warren-Leubecker & Bohannon (1984) studied the intonational patterns in CDS between mothers and fathers in their dyadic interactions with their 2-year-old children or 5-year-old children. They found that mothers raised their pitch equally for both ages of child listeners but used a greater pitch range when speaking with the younger children. In contrast, fathers increased their pitch and ranges even more than mothers when addressing younger children, but did not differentiate between 5-year-old and adult listeners. Thus, the older children in this study could also be a contributing factor to why there was no variation in paternal CDS for most fathers.

Some age effects were observed in the fathers; as mentioned, in formal contexts, fathers of younger children used more l-less tokens. However, due to a lack of a balanced sample, these effects should be interpreted with caution. Other social factors like gender of the children and social class of the families did not significantly modulate the darkness of the laterals in CDS in this study. Previous studies have shown that more standard forms were used with girls, but the same effect was not found. Again, one reason could be the unbalanced sample, given that there were only three girls. If there were indeed gender effects, however, we should expect to see little variation in mothers' use of /l/ with the seven boys, but this was not the case. Foulkes et al. (2005) and Foulkes & Docherty (2006) explained that the variation in CDS was a result of mothers tailoring their speech in line with the emerging gender of their children and community norms. No gender differentiation in the use of clear-l by Malay Singaporeans was reported in Sim (2015, 2019), and perhaps this could also explain the lack of variation in CDS according to the gender of child in this study. A study with a cross-sectional design that includes more children could be conducted in the future to examine these effects further. That the use of a clearer coda /l/ by these participants was not differentiated by social class is also expected, given that ethnically distinct features can be used by any member of the community. Social class, however, can be associated with predictors of ethnic accentedness, such as social networks and language background, but participants in this study did not differ much in these aspects.

The variation in CDS that has been described reveals the complexity of phonological acquisition in the bilingual children of these caregivers, and this also applies to heritage speakers or speakers of contact languages. Not only is there a mixed representation of two or even three allophones of /l/ in their English input, which may appear to the child as probabilistic, but clearer coda /l/ is also shared with their other language, Malay. Further, this variation is only present in maternal CDS, but not paternal CDS. The frequency of clearer coda /l/ in the ambient language environment is therefore considerably higher than that of the darker or l-less variant. In this case, we might expect them to show a preference to the most frequently encountered variant, as also observed in the studies previously described (e.g. Khattab, 2002; Kirkham, 2017). Preliminary analysis of the children's production in casual interactions indeed revealed that they used relatively clearer /l/ in all syllable positions, regardless of which parent the children were speaking to. Two questions remain to be explored. The first is with regard to the acquisition of darker /l/ and its stylistic constraints of use. As previously discussed, not only do monolingual children acquire sociolinguistic variation at an early age (Nardy et al., 2013), but bilinguals may also use different variants for various purposes (e.g. Khattab, 2002; Sharma, 2011). However, the linguistic and social salience of a feature can affect when it is acquired (Foulkes & Hay, 2015). In the Singapore context, the prominence of dark-l may only increase as the children are exposed to other situations where dark-l is used, such as in mass media or in schools, and during which will they have greater access to and a better understanding of its indexical associations. The second question is whether Malay adults and children phonetically distinguish between the clearer variant of coda /l/ in their Malay and English. A few studies have consistently shown cross-linguistic influence between the lateral systems of both languages, showing evidence of similar categories merging, or darker laterals being clearer than those of their monolingual counterparts (Barlow et al., 2013; Khattab, 2011; Simonet, 2010a). The case is slightly different here, because clear-l is found in both lateral systems instead of one, and bilinguals may show 'deflecting effects' (Kehoe, 2015), in order to maximise the contrast between the two language systems.

This study set out to better understand whether, how and why Singaporean English-Malay bilingual caregivers vary their use of syllable-final /l/ in the child-directed speech towards their preschoolers. Consistent with previous studies on bilectal monolinguals and ethnolect speakers that involved socially-conditioned segmental modifications, this study has shown how mothers but less so fathers varied their production of /l/ in their CDS according to the communicative intent and their potential socio-indexical associations, and also explored how CDS patterns may be shaped by cultural norms and expectations. More importantly, it illustrates the linguistic and sociolinguistic complexity in language acquisition by children in similar multilingual and multicultural contexts, and stresses that external factors play an integral role in the acquisition process. Given that the input they receive is highly varied but not necessarily probabilistic, an area in language acquisition that is worth further exploration is thus how these children negotiate such complexity in their input, and the effects it has on their language development.

CHAPTER 6

Bilingual acquisition of /l/ by English-Malay bilingual children

Original abstract: The present study examined the English and Malay laterals of fourteen simultaneous bilingual preschoolers in Singapore who were exposed to several allophones of /l/ in their input. Specifically, their caregivers used predominantly clear-l in English and Malay, but their English coda laterals can also be l-less (vocalised/deleted) and in formal contexts, velarised. The children may also be confronted with the variety of the Chinese ethnic majority, whose coda laterals are typically l-less. The findings revealed that children who received a largely homogenous input model from caregivers and peers developed a merged lateral system that favoured clear-l, suggesting regularisation. Contrastingly, those who were additionally exposed to the l-less model through having close Chinese peers exhibited more l-lessness in their English coda laterals, thereby showing greater contrast in their two languages. The findings illustrate how input properties, learning mechanisms and social factors are all operative in phonological acquisition in a plural society.

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INTRODUCTION

The phonetic and phonological development of child bilinguals has been shown to be mediated by both linguistic and social/language-external factors. It is well established that bilingual children may differ from their monolingual counterparts in specific speech properties that suggest cross-linguistic interactions (e.g. Hambly et al., 2013; Keffala et al., 2018; Kehoe & Havy, 2018). These interactions may manifest as an acceleration or delay in the acquisition of certain speech properties relative to monolinguals. They may also involve the transfer of features from one language to another, or the merging or deflecting of some properties of their two language systems that reduces or enhances contrast between them (Kehoe, 2015; Paradis & Genesee, 1996). Linguistic factors alone, however, cannot fully explain variable outcomes in bilinguals. Early bilinguals in the same community who are exposed to the same languages, for example, may exhibit different language outcomes in terms of rate of acquisition and production accuracy based on which language they use or hear more (e.g. En et al., 2014; Wrembel et al., 2019). Such social or language-external factors play a greater role in predicting the language outcomes for bilinguals in certain contexts. In particular, there is a growing body of work that foregrounds the role of the input in early phonological acquisition. Many of these studies examined specific phonetic aspects of the input models and found associations between individual variation in child production and phonetic details in the input the child receives. Such input may be from caregivers who are non-native speakers or late learners (e.g. Fish et al., 2017; Mayr & Siddika, 2018; Stoehr et al., 2019), or from speakers of dialects that arose from long-term language contact (Mayr et al., 2017; Sim & Post, 2021a). In many pluralistic communities in which inter- and intra-speaker variation is the norm, children are faced with alternative variants of a phoneme not only in the child-directed speech (CDS) of their caregivers, but also in other competing input models of other significant adults and peers in their ethnic group and the broader community (Mayr & Montanari, 2015; Sharma, 2011; Sharma & Sankaran, 2011; Sim, 2021c).

This present study investigates the acquisition of English and Malay laterals by English-Malay simultaneous bilingual preschoolers in Singapore who were exposed to several allophones of /l/ in the input. As will be described in greater detail below, in their caregivers' English CDS alone, three realisations of coda /l/, namely l-less (vocalised or deleted), clear-l and dark-l were found, and additionally their distributions were linguistically and socially conditioned (Sim, 2021c). At the same time, these children were exposed to Malay laterals, which are clear in all syllable positions. The input model they receive at home can further be in contrast with the variety spoken by the Chinese ethnic majority, whose English coda laterals tend to be l-less, if not velarised (i.e. dark-l). The examination of the distribution of the variants and the phonetic implementation of the laterals of these children ascertains whether and how the exposure to several allophones, one of which phonetically similar between the two languages, could affect bilingual phonological acquisition and their attainment of the adult target, and what social factors could result in individual variation.

6.1.1. The Malay ethnic community in Singapore and variants of /l/

The Malays, while being the indigenous people, constitute an ethnic minority in Singapore, and account for about 15% of the citizen population, compared to 75.9% who are ethnically Chinese, and 7.5% who are Indians. Almost all Malays in Singapore are Muslims, and they share customs, traditions and values that are shaped by their Islamic faith. The Malay language, being their common ethnic mother tongue, is also strongly associated with their cultural and religious identity in Singapore (Kassim, 2008). The members of the ethnic community have strong, dense ties and share a sense of ethnic group-belonging, despite being increasingly English dominant as a result of the significant language shifts towards English brought about the bilingual policy since the 1960s (Mathews & Selvarajan, 2020).

While the Malays also speak Singaporean English (SgE) and share innovative phonological features that are pan-Singaporean, some features remain distinctive of particular ethnic groups because of phonetic convergences between English and their ethnic mother tongue, which have further undergone inter-generational transmission (e.g. Sim, 2019; Starr & Balasubramaniam, 2019). Despite being widely accepted, such local forms can be in variation with alternative forms that are associated with more established standard varieties of English (e.g. Standard Southern British English, General American English), which are enregistered as prescriptively correct and standard through wide-ranging state-motivated meta-discursive/pragmatic practices, such as classroom instruction, the media and government campaigns. Present-day Singaporeans, many of whom are L1 speakers of English compared to those of previous generations, therefore have an especially rich English repertoire that can be used creatively based on the socio-indexical meanings of the variants and their communicative needs (Leimgruber, 2013; Sim, 2021b).

The laterals of SgE, which are the feature of interest in this study, are examples of such variable forms. Cross-linguistically, alveolar laterals differ with regard to their degree of velarisation and/or pharyngealisation, with some languages having a darker (more velarised or pharyngealised) variant than others (Recasens, 2012), which is articulatorily characterised by a greater degree of tongue predorsum lowering and of postdorsum retraction towards the uvular area or upper pharyngeal wall. In addition, some varieties of languages exhibit a clearer or darker variant in all syllable positions, while in others the two variants are syllabically conditioned (Carter & Local, 2007; Kirkham et al., 2020). The vocalisation of postvocalic /l/, a process by which the tongue tip contact with the alveolar ridge is lost and is replaced by either a (labial-)velar approximant or a back vowel or semivowel, is also common in some languages and dialects (E. R. Thomas, 2007; Turton, 2017). This has been described to be the norm of Singaporeans, especially the Chinese (Deterding, 2007b; K. K. Tan, 2005; L.-H. Wee, 2008). Further, coda laterals may also be deleted or assimilated to the nucleus after back vowels (e.g. *ball* [bɔː]) or after a schwa (e.g. *little* [lɪtə]; syllabic [l] does not typically occur in SgE). These two realisations are typically regarded as instances of l-vocalisation (L.-H. Wee, 2008), and are here treated as one phonological phenomenon, l-lessness (Sim, 2021c; E. R. Thomas, 2007). English-Malay bilinguals in Singapore were found to have a rather unique English lateral system that can be regarded as a hybrid between the dominant l-less variety and the lateral system of Malay. Sim (2019) found that the English coda laterals of his Malay participants were less likely to be l-less, but their retained /l/ may be clear in all syllable positions like Malay laterals, especially for those who belonged to more Malay-dominant families and social circles and identified with a Malay-speaking culture. This was considering that they were at least early sequential bilinguals of both languages, if not simultaneous, and therefore could have acquired the phonetic trait from the input. The coda laterals of English-dominant Malays, contrastingly, were significantly darker if not l-less, but they may switch to clear-l and assume a more ethnically distinctive repertoire when speaking to their Malay-dominant peers (Sim, 2021b).

Sim (2021c) further found that Malay caregivers may vary in their use of English coda /l/ in their CDS towards preschoolers. In casual CDS, their English laterals were clear in all positions, if not l-less. In formal contexts, however, mothers used a darker coda /l/ and/or exhibited more l-lessness. The use of wide-ranging variants in CDS was argued to help the children construct a full sociolinguistic repertoire (Foulkes et al., 2005), based on the socio-indexical meanings of these variants and community norms: clearer /l/ was used even in CDS as it indexes group membership, while darker /l/ was used in teaching and learning for its semiotic connections to formality, higher social class, and educational attainment (e.g. Sim, 2021b). A question that this paper seeks to explore is therefore how, in their acquisition of the lateral systems of the two languages, these Malay preschoolers negotiate the mixed phonetic representations of /l/ that is present not only in the input of their caregivers, but also in the speech of other significant adults and peers in the wider community.

6.1.2. Acquisition of /l/

6.1.2.1 Normative studies

Normative studies on lateral production by monolingual children speaking American, British and Australian English have shown that onset laterals are acquired early (indicated by >75% accuracy), usually by 3;0-3;5 (Dodd et al., 2003; Lin & Demuth, 2015; Smit et al., 1990). Postvocalic or coda laterals that are velarised are acquired later, in part because their production is articulatorily complex since they require the coordination of both anterior and posterior constrictions. Lin & Demuth (2015), who examined the production of Australian English-speaking children aged between 3;0 and 7;11, found that only 5% of the coda laterals produced by children in the 3;0 group were perceptually target-like, and even for the oldest group, only 52% of the coda laterals were perceptually accurate, highlighting the difficulties for young children to consistently achieve adult-like anterior-posterior constrictions. These children relied on labial articulations like lip rounding or protrusion instead to achieve acoustic/auditory similarity to adults' speech. In contrast with English, there is no known allophonic variation in Malay /l/, which is clear in all positions (Clynes & Deterding, 2011; Yunus Maris, 1980). The distribution of Malay /l/ is similar to English /l/: it occurs word-initially (e.g. *lima* 'five'), word-finally (e.g. *muncul* 'appear'), syllable-finally (usually forming a consonant cluster across morpheme boundaries before suffixes; e.g. *meninggalkan* 'to leave behind'), and intervocalically (e.g. *tilam* 'mattress'). Phoon et al. (2014) examined the consonant acquisition by Malay-dominant Malay preschoolers between 4 to 6 years old living in Penang, Malaysia and found that by 4;0-4;5, children were showing customary production of onset and coda /l/ (occurs when 50% of the children in an age group produced the segment correctly at least twice in two consecutive age groups), but coda /l/ was only mastered at the age of 5;06-5;11 (occurs when 90% of the children in an age group produced it correctly at least twice in two consecutive age groups).

6.1.2.2 Acquisition of laterals by early child bilinguals

A few studies have revealed that although child bilinguals do not perform identically to their monolingual counterparts, they show distinct production patterns for their two languages if they have different /l/ distributions. Barlow et al. (2013), for example, examined the acquisition of /l/ by early Spanish-English bilinguals with a mean age of 4;7 in the Southern California and Baja California area. Spanish /l/ is clearer than English /l/, regardless of syllable position. They found that the bilinguals' prevocalic English /l/ was as clear as monolingual Spanish /l/. Their English postvocalic /l/ was darker than their English prevocalic /l/, and comparable to the postvocalic /l/ of English monolinguals, exhibiting phonological knowledge of the allophonic velarisation rule of the variety of English spoken. Barlow and colleagues interpreted the findings to be evidence of a merged phonetic category for prevocalic /l/ but not postvocalic /l/. That there was allophonic velarisation in English but not in Spanish was also taken as evidence of separate lateral systems. Kirkham & McCarthy (2021) also reported similar findings. In their study of the acquisition of allophonic contrast and phonetic details of laterals by second-generation Sylheti-English bilingual children in London, UK with a mean age of 6;7, they found that despite the transfer of hyper-clear laterals from Sylheti to English, the children produced positional contrast in their English laterals, albeit to a smaller degree than English monolingual children.

Phonological acquisition in contexts that involve competing variants between CDS and local norms is more complex. Specific speech features of children raised by foreign-born parents or in an ethnic minority setting can diverge from CDS norms of their primary caregiver to approximate mainstream norms or those of their peers (e.g. Mayr & Siddika, 2018; Sharma & Sankaran, 2011). Khattab (2002), for example, examined the acquisition of /l/ in three English-Arabic bilingual heritage speakers born and raised in Yorkshire by Lebanese parents who had lived in Yorkshire for over ten years. The children in her study were 5, 7 and 10 years old. In the Yorkshire dialect, /l/ is reportedly dark in all positions, which contrasts with the clear /l/ of Arabic. The Lebanese parents in the study had used clear-l syllable-finally in their English speech to different extents. Their bilingual children, however, produced mainly dark-l or vocalised-l, similar to their English monolingual peers. Interestingly, when the children code-switched to English during the recording sessions in which Arabic was to be used, the /l/ in the code-switched words was clear in all positions, revealing effects of being in different language modes. This suggests that while they had acquired the mainstream norms, the children remained sensitive to the distinctive features in CDS and could have acquired them as part of their linguistic repertoire to be used in certain contexts. Indeed, speakers in pluralistic communities, such as British Asians, may variably use phonetic features associated with their heritage language in their English speech for social-indexical functions, once they recognise the sociolinguistic value of these variants (Kirkham, 2017; Sharma, 2011; Sharma & Sankaran, 2011).

6.1.3. Current study

This study is concerned with how bilingual preschoolers, who are faced with a mixed representation of three allophones of /l/ in the English and Malay input of their caregivers and potentially a different lateral system from Chinese peers and adults, acquire the lateral systems of their two languages. Based on the findings from the studies above, the study seeks to answer these research questions:

(1) Do the children show the development of distinct lateral systems for English and Malay?

It is predicted that children in this study will show evidence of two lateral systems (Barlow et al., 2013; Khattab, 2002; Kirkham & McCarthy, 2021). Whereas previous studies involve language varieties that differ based on the presence/absence of the allophonic velarisation rule, SgE differs from Malay in that the coda laterals of SgE are described to be typically l-less. L-lessness is therefore expected to occur in the English but not the Malay production of these Malay children. Additionally, l-lessness will not be entirely random, but follows the same linguistic and lexical constraints as in adult production (e.g. Smith et al., 2007). Children may also distinguish English laterals from Malay by producing darker English coda /l/; however, see (2).

(2) Do the children's retained English laterals follow the allophonic velarisation rule? If not, are they phonetically distinct from Malay laterals?

The studies above show that children as young as 3;0 begin to produce darker coda laterals if the language model presents an allophonic velarisation rule, but separate phonetic categories may not form if the laterals are phonetically similar or equivalent (Barlow et al., 2013; Kirkham & McCarthy, 2021). Studies have also shown that children after the age of three begin to show adult-like stylistic variation of use of alternative forms (e.g. Smith et al., 2007). Other than being l-less, the children's English laterals in this study may potentially show allophonic velarisation as the children could have, seeing that the elicitation tasks are a form of a test of their language abilities, adopted the form that their mothers used in contexts of teaching and learning (i.e. darker coda /l/). Alternatively, they may show preference for clear-l, which occurs much more frequently, being phonetically similar across both languages. If this is the case, a question is then whether the children show deflecting patterns to maximise contrast between the two lateral systems (Kehoe, 2015).

(3) What social or language-external factors modulate production patterns?

Language-external factors such as language dominance (e.g. En et al., 2014; Sim, 2019; Simonet, 2010) and peer group (e.g. Khattab, 2002; Kirkham, 2017; Mayr & Montanari, 2015) have been shown to predict variation. While this study is primarily interested in overall group behaviours, social factors including percentage use of Malay, socioeconomic status, preschool type, and peer group type were considered in the analyses, to uncover and control for potential variation.

METHODOLOGY

6.2.1. Participants

The data used in this study belonged to a larger corpus that comprises recordings from 60 Singaporean families. 14 Malay children who were firstborns (to control for influence of older siblings) and had completed the English picture-naming task described below were selected for this study. The details of the 14 families are shown in Table 6.1; recordings of nine of the 14 families were used/analysed in Sim (2021c).

Table 6.1. Description of the participants including the age and gender of child, percent use of Singapore English (SgE) and Malay (Mly), preschool type, peer group type, socioeconomic status (SES), and the Bilingual Language Profile (BLP) score of the caregivers.

Family ID	Age	Gender	% SgE use	% Mly use	Preschool	Peer group	SES	BLP score	
								Mother	Father
Mi9	3;1	F	43	48	Malay	Malay	18	-28.79	-143.03
M9	3;1	F	74	23	Mix	Mix	20	34.33	57.40
M10	3;2	M	90	9	Mix	Mix	17	127.77	36.42
Mi23	3;6	F	78	22	Malay	Malay	22	48.22	15.16
Mi1	3;8	M	56	43	Malay	Malay	23	11.35	-65.20
Mi2	4;5	F	62	35	Malay	Malay	25	34.61	35.24
M7	4;6	M	87	12	Malay	Malay	21	68.57	46.32
M8	4;10	M	86	8	Mix	Mix	19	72.20	75.47
Mi21	4;10	F	62	37	Malay	Mix	16	-1.36	21.34
M17	4;11	M	86	11	Malay	Malay	21	60.76	61.03
M6	5;1	M	61	39	Malay	Mix	23	-8.35	-32.24
M15	5;2	M	71	25	Mix	Malay	22	47.04	-34.05
M18	5;7	M	77	23	Mix	Mix	24	56.22	37.15
M11	5;8	M	83	6	Mix	Mix	25	87.27	147.66

Note: Age is in years;months. Gender: F(emale), M(ale).

The children (5 females, 9 males) in this study were aged between 3;1 and 5;9 (*Mdn* = 4;8). They were all typically developing simultaneous bilinguals, having been exposed to both languages by the age of three (Genesee & Nicoladis, 2007). Their language experience was ascertained through a child language experience survey developed for the corpus (see Sim & Post (2021a) for a more detailed description of the tool). The language use of the child was calculated from an accumulated measurement of the language variety and estimated amount and proportion of time for which the language variety was used with the significant people in his/her immediate ecosystem, as well as their language use in self-interaction and exposure to media. The Malay children in this study were primarily exposed to Singaporean English and Malay (>89% of total language use). While some participants would be classified as English monolinguals for having used Malay less than 10-20% of the time (Kehoe & Havy, 2019; Lauro et al., 2020), Malay was used exclusively with some significant adults by these children, for example in their interactions with their grandparents. This study therefore considers all as functional bilinguals, with some being more English-dominant than others. Questions about three of the child's closest and most influential friends were also asked; the closest friends of some children were all ethnically Malay, while others had a mix of Malay and Chinese friends. Finally, the exposure to teachers and children of other ethnicities in their preschool was considered; children either attended Malay-dominant/only preschools, or not (i.e. mix). It is worth noting that variation in the language experience of children is characteristic of language acquisition in pluralistic communities, and instead of testing a homogeneous sample, we seek commonalities as well as individual variation by considering various social factors in our statistical models.

The Malay caregivers in this study were between 29 and 37 years old (*Mdn* = 33). They were all simultaneous or early sequential bilinguals, except for the father of M11, who started learning Malay in primary school at around seven years old, but still sounded perceivably Malay due to peer influence. The language dominance of the adults was measured using the Bilingual Language Profile (BLP; Birdsong et al., 2012), a self-reported measure of their language history, proficiency, use and attitudes. The dominance scores were automatically tabulated, and possible scores ranged from -218 (Malay-dominant) to +218 (English-dominant). The mean BLP score for mothers was 43.56 (*SD* = 41.22, *Mdn* = 47.63, range = -28.79–127.77) and 18.48 for fathers (*SD* = 69.85, *Mdn* = 35.83, range = -143.03–147.66). The socioeconomic status (SES) of the families was also measured using the Family Affluence Scale (Currie et al., 2008). The FAS assesses SES by aggregating information on material affluence based on the material condition of the household. This study also included education level and profession of the parents as part of the measure. These items in the survey generated a composite score, with the highest possible SES score being 35; the average SES score of the participants was 21.14 (*SD* = 2.81; range = 16-27).

6.2.2. Materials and procedure

The data came from a larger corpus that also elicited other speech features, and therefore the stimuli were not balanced in terms of their vowel context and number by syllable position. The lists of target words are presented in Table 6.2.

Table 6.2. English and Malay target words, excluding words from adult spontaneous speech (†only in child data; *only in adult data).

Position	Target word		
	English	**Malay**	(Transcription and gloss)
Onset	Cleaner†	Ahli bomba†	/ahli/ 'fireman'
	Ladybird(bug)†	L̲alu*	/lalu/ 'hence'
	Lemon†	Lebih*	/ləbih/ 'more'
	Lina†	Limau†	/limau/ 'lemon'
	Lion†		
Ambisyllabic	Ambulance†	Bola†	/bola/ 'ball'
	Balloon†	Bulan†	/bulan/ 'moon'
	Binoculars†	Gula-gula	/gula/ 'candy'
	Broccoli†	Lal̲u*	/lalu/ 'hence'
	Caterpillar†	Melukis†	/məlukis/ 'to draw'
	Gorilla†	Membeli†	/məmbəli/ 'to buy'
	Helicopter†	Memeluk*	/məməluk/ 'to hug'
	Jelly†	Mengalah*	/məŋalah/ 'to give in'
	Police†	Pengelap†	/pəŋəlap/ 'mop'
	Television†	Pula*	/pula/ *intensifier*
	Umbrella†	Selesai*	/sələsai/ 'to end'
	Watermelon†	Ular†	/ular/ 'snake'
Coda	Ball	Almari†	/almari/ 'cupboard'
	Bowl	Bakul	/bakul/ 'basket'
	Children	Baldi	/baldi/ 'pail'
	Cold	Bantal	/bantal/ 'pillow'
	Crocodile	Gatal	/gatal/ 'itchy'
	Elbow	Kecil	/kətʃil/ 'small'
	Fingernail	Mahal	/mahal/ 'expensive'
	Holding†	Menanggalkan*	/mənaŋgalkan/ 'to remove'
	Milk	Menjual†	/məndʒual/ 'sell'
	Pineapple†	Panggil	/paŋgil/ 'to call'
	Pool	Salji	/saldʒi/ 'snow'
	Selfie		
	Snail		
	Vegetables†		
	Wolf		

Child data were elicited through a picture naming task and additionally for children aged 3;8 and above, an information gap activity. Both activities were carried out by one of the caregivers, typically the mother, and facilitated by the first author. The activities were conducted in English first, followed by some interaction in Malay, before moving on to the Malay stimuli. In the picture naming task, target words were elicited twice using picture cards that were presented in a random order, although occasionally a greater or lower number of repetitions were obtained. Some Malay words were unfamiliar to the English-dominant children, and in such cases, they imitated their caregiver's production. This is unlikely to have influenced their production; in all these cases, the children were already reliably producing Malay laterals in other known words, and further there were many instances in which the /l/ variants in the adult production and imitated response were different. Many of the same words in the picture naming task were elicited again in the information gap activity, during which the child had to help their mother match puzzle pieces by giving structured clues based on what they saw on picture cards (e.g. 'Lina is passing a ball'). Malay tokens were not elicited from the child of family Mi23. There were a total of 966 English and 505 Malay child tokens.

The English laterals of the caregivers were described in detail by Sim (2021c). In the present study, their Malay laterals were empirically analysed with their English laterals, for a more complete description of caregiver norms. The English data set of the caregivers comprised the same target words presented in the child picture naming task, each elicited twice in a carrier phrase ('I say _ again'), presented in a list. Naturalistic data from unstructured play and casual interactions reported in Sim (2021c) were also reanalysed to include the data from the five caregivers who were not in the previous study. Their Malay data set comprised the same Malay target words in the child picture naming task, also elicited through carrier phrase in a list (*Dia kata _ tiga kali* 'I say _ three times'.). The data set also included Malay words from the reading of the Malay translation of the 'North Wind and the Sun' (Clynes & Deterding, 2011). The Malay laterals of the caregivers of the two children excluded from the study were also analysed, given that little is known about their Malay lateral system. It is worth noting that when reading a Malay text most caregivers preferred the standard pronunciation (*sebutan baku*) over a common/colloquial one (*sebutan biasa*); these styles differ mainly in the selectional differences in some of the vowels. One of the major differences is that the letter <a> at the end of words (e.g. *gula* 'sugar') is typically pronounced /a/ in standard but /ə/ colloquially. /u/ and /i/ for <u> and <i> in final closed syllables respectively (e.g. *bakul* 'basket', *panggil* 'to call') are standard, while /o/ and /e/ are informal. These differences in the vowel contexts were accounted for in the statistical models (see below). There were a total of 767 English and 871 Malay caregiver tokens.

The recording took place in a quiet room with minimal reverberation and noise in the respective homes of the participants. In recording sessions that involved both caregiver and child, they each had pinned on their collar an omni-directional lapel microphone, which was connected to a NAGRA ARES-MII recorder recording at a sampling rate of 44.1 kHz at 16 bit. Adult controlled speech (i.e. words in carrier phrase and read passage) was recorded by the first author using a Zoom H5 recorder, also at a sampling rate of 44.1 kHz at 16 bit.

6.2.3. Auditory and acoustic analysis

Tokens were hand-segmented and analysed aurally and acoustically based on visual inspection of the waveform and wide-band spectrogram on Praat (v. 6.1.4; Boersma & Weenink, 2019). Each token was first labelled according to whether they were retained (i.e. clearer or darker /l/) or l-less (i.e. vocalised or deleted /l/). Tokens that could not be reliably measured due to reasons such as noise or creak were marked as 'unclear'. The difficulty in acoustically distinguishing dark-l and vocalised-l is well established, and consequently many have relied mainly on auditory cues, which have been found to be fairly reliable (Hall-Lew & Fix, 2012). A phonetician who was not involved in this study was trained in the coding and asked to analyse the coda laterals of 180 randomly selected tokens (about 10% of the child and adult tokens respectively) and rate whether they were retained (clear/dark) or l-less (vocalised/deleted). 88% of the tokens were in agreement; Cohen's κ analysis revealed a substantial agreement between the ratings, $\kappa = 0.76$ (95% CI, 0.66 to 0.85), $p < 0.001$.

Retained laterals were further analysed. They were hand-segmented for their onsets and offsets, defined as the first and last pitch period where there is a change in F2 intensity compared to the neighbouring vowel, and this is usually accompanied by a change in the amplitude of the waveform (Amengual, 2018; Kirkham, 2017). F1 and F2 were then extracted manually from the temporal midpoint of the laterals. An example is shown in Figure 6.1. Formant tracks were calculated with the built-in Burg algorithm in Praat. The effective window length was set at 25 ms, and the maximum number of formants was kept at five (1.0 mm dot size), and the formant ceiling was adjusted according to speaker to rectify tracking errors. The raw values in Hertz were converted to Bark, a psychoacoustic scale, to reflect darkness of /l/ as a perceptual phenomenon. Following previous studies, the difference between F2 and F1 was used as a measure of lateral darkness (e.g. Amengual, 2018; Kirkham & McCarthy, 2021; Sim, 2021c); clearer /l/ has higher F2–F1 values.

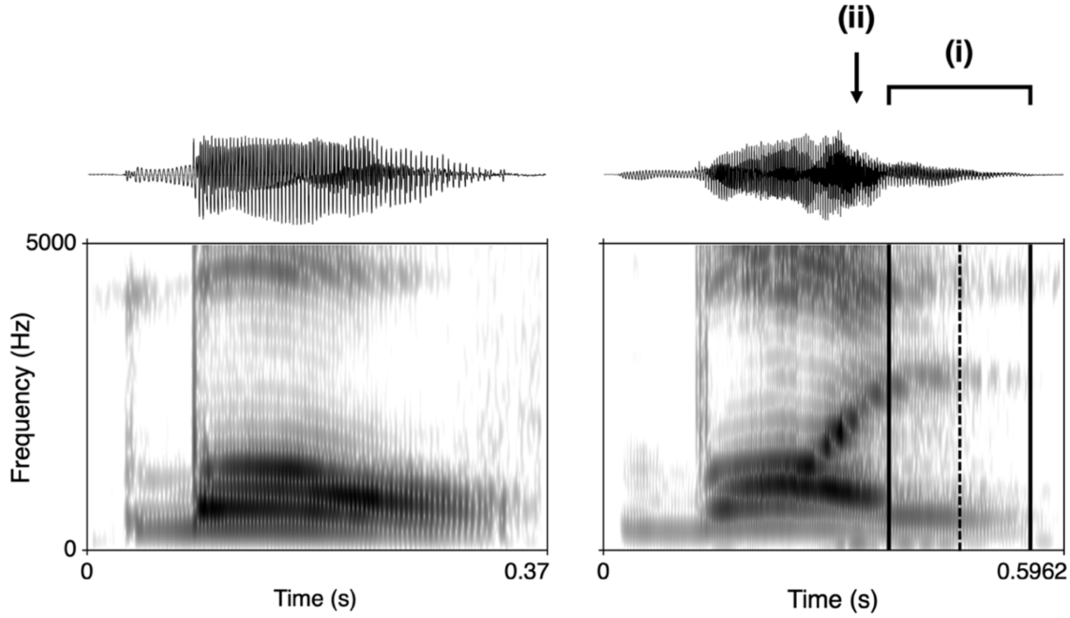

Figure 6.1 Representative waveforms and spectrograms of coda lateral in *ball* (left: vocalised; right: retained). (i) lateral duration, (ii) 30 ms mark into offset of vowel, dotted line: lateral temporal midpoint.

Several linguistic factors were considered to account for potential inter-speaker variation that may exist despite the controlled stimuli. The duration of the lateral defined by the landmarks was recorded to account for phonetic effects of duration, which has been found to positively correlate with darkness of /l/ (Sproat & Fujimura, 1993; Yuan & Liberman, 2009). Vowel context is also known to influence l-darkening. Specifically, laterals have been found to be clearer with fronter vowels (Morris, 2017; Sim, 2021c; van Hofwegen, 2010). Following these studies, inter-speaker variation in the vowel realisation was accounted for by the F2 of the point 30 ms into the offset or onset of the neighbouring vowel; 30 ms was an arbitrary value that allowed for some transition into the vowel. For intervocalic /l/, the F2 of the following vowel was used, based on the assumptions of onset maximisation. Within-subject z-score standardization was then performed on the vowel F2 values to normalise between-speaker differences. Finally, in the elicitation tasks, some repetitions were done in quick succession, whereas in others a short pause (defined as silence longer than 300 ms, or breathing) was inserted between repetitions of a target word. There were also some slight variations in the production of target words (e.g. *vegetable* instead of *vegetables*). The adjacent consonant type or phonetic environment, as specified in the regression models later, was thus also recorded, to account for the effects of phonetic contexts that may affect l-darkening or likelihood of l-vocalisation (Davidson, 2012; Morris, 2017; Scobbie & Wrench, 2003; Sim, 2021c). There is no inherent lexical stress in Malay (Clynes & Deterding, 2011), and stress in SgE is difficult to determine (Deterding, 2007b). Given that the stimuli in this study were controlled and that lexical stress was not a predictor of l-darkening nor likelihood of l-lessness in Sim (2021c), lexical stress was not included as a linguistic factor in this study. Outliers in all raw measurements were detected using the interquartile range method and corrected if they were due to mismeasurement.

6.2.4. Statistical analyses

Mixed-effects regression analyses were conducted using the R software (R Core Team, 2020), the 'lme4' package (Bates et al., 2015), and the 'lmerTest' package (Kuznetsova et al., 2017). In all models, the random effect structure included random intercepts for subject and word and, for variables of interest, by-subject and by-word slopes, as justified by the data. Interaction terms were further investigated using the 'emmeans' package (Lenth, 2018). To evaluate the contribution of each predictor for all models, and to arrive at a more restricted model, pairwise model comparisons between a full model that included all the explanatory variables and a more restricted model that excluded the predictor under consideration were performed using likelihood ratio tests. All continuous predictors were z-standardised. Categorical predictors were treatment coded.

Results

6.3.1. Distribution of realisations of coda /l/

6.3.1.1 *Caregiver norms*

The distributions of the realisations of English and Malay coda laterals in the controlled speech of each caregiver are presented in Figure 6.2. It was mentioned previously that SgE permits l-lessness in its coda laterals but not Malay, and a visual inspection of the figure shows that this is the case. Despite some inter-speaker variation, it can be observed that caregivers overall vocalised/deleted their English coda laterals more frequently than Malay laterals. Interestingly, the Malay laterals of M7F and M6M were mostly l-less. This could have been a result of very careful reading rather than due to cross-linguistic transfer from English, especially since M6M was a Malay language teacher.

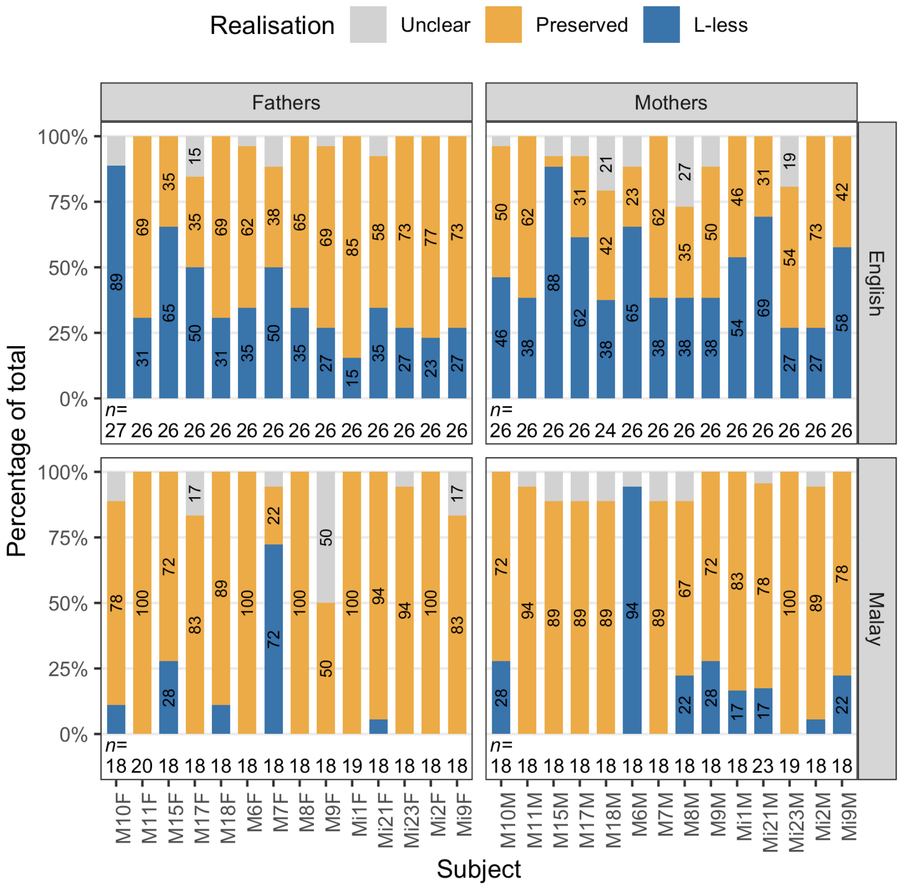

Figure 6.2 Proportions of realisations of coda /l/ by caregivers as a function of language (top-bottom) and role (left-right). Percentages in the main plot are rounded to the nearest percent and only percentages above 15% are shown. Sample sizes (*n*) refer to the total number of coda /l/ tokens in the respective language for each caregiver.

A mixed-effects logistic regression model was fit to the adult laterals to confirm the effect of language on the binary outcome of l-lessness (0 = l-less, 1 = retained), while controlling for effects of phonetic environment (preconsonantal/prevocalic). Role (father/mother) was also added as a predictor. All two-way interactions between these three variables were tested. The random effect structure included random intercepts for subject and word. The details of the best-fitting model are shown in Table 6.3. Only language and phonetic environment were significant predictors; prevocalic laterals were more likely to be retained, and English laterals were more likely to be l-less.

Table 6.3. Regression coefficients of a best-fitting mixed-effects logistic regression model fit to the adult coda laterals.

Fixed effects	***B***	***SE***	**Odds Ratio**	**95% CI**	***p***
(Intercept)	2.82	0.67	16.78	[4.56 – 61.83]	**< 0.001**
Language [English]	-3.50	0.84	0.03	[0.01 – 0.15]	**< 0.001**
Phon. Env. [Prevocalic]	1.60	0.62	4.94	[1.47 – 16.67]	**0.01**

Note: Observations = 1165. Marginal R^2 = 0.20, Conditional R^2 = 0.70. Reference level of language is Malay, phonetic environment is preconsonantal.

6.3.1.2 Children's laterals

The children's onset (n = 177) and ambisyllabic laterals (n = 521) were accurately and consistently produced, at 90.4% (n = 160) and 97.1% (n = 506) of all analysable tokens respectively, with the bulk of inaccurate production (n = 32) a result of speech errors/slips. The remainder of this section focuses on their coda laterals. The distributions of the realisations of English and Malay coda /l/ for each Malay child are presented in Figure 6.3, ordered by increasing age. It can be observed that overall, more English coda laterals were l-less compared to Malay laterals, but there is some inter-child variation. Their Malay coda laterals, contrastingly, were mostly retained, except for the younger children. It is likely that the coda laterals of the younger children, Mi9, M9, M10 and Mi23, were still developing, as they were only customarily producing these laterals. Interestingly, a few of their coda laterals were vocalised with a high front vocoid (e.g. *mahal* [mahai], *ball* [bɔi]), similar to how /j/ is used in place of onset laterals, likely as a strategy to achieve acoustic/auditory similarity to clear-l. In some cases, because they have yet to attained the adult-like distribution of their use, they exhibited inconsistency or doubt in the choice of variant when for some of the words (e.g. the consecutive repetitions of the word *ball* by M9: [bɔw], [bɔ], [bɔl]).

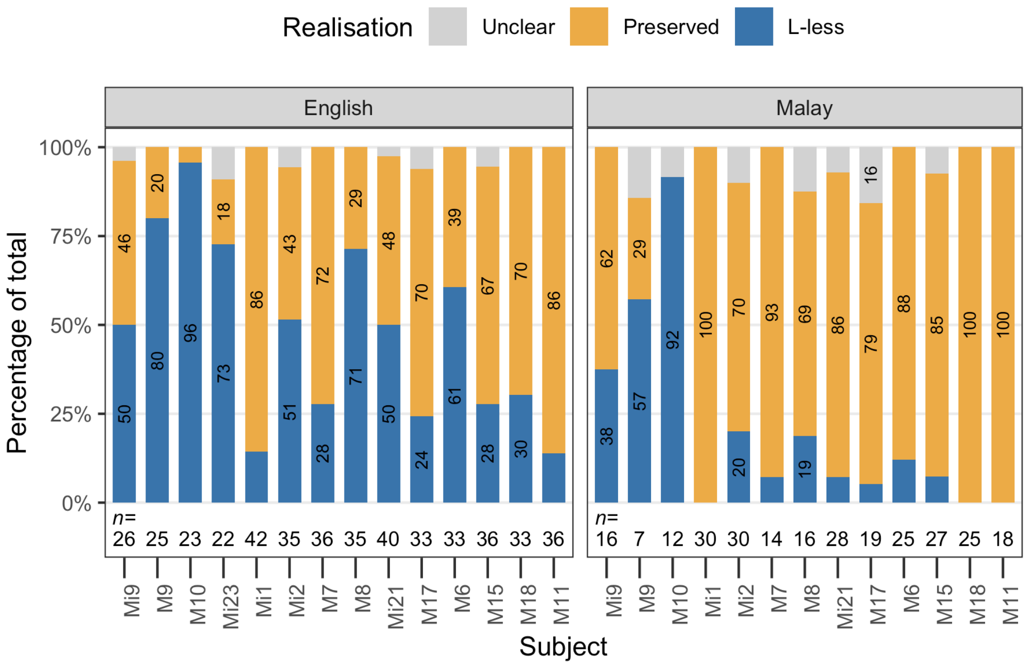

Figure 6.3 Proportions of realisations of coda /l/ by children by language, ordered by increasing age. Note that Malay tokens were not elicited from Mi23. Percentages in the main plot are rounded to the nearest percent and only percentages above 15% are shown. Sample sizes (*n*) refer to the total number of coda /l/ tokens in the respective language for each child.

The coda laterals were further examined to find out whether the laterals of some lexical items were more likely to be l-less. The proportions of l-less child tokens for each English and Malay target words (and their variations in parentheses) are shown in Figure 6.4, in order of increasing rate of l-lessness. The production patterns of mothers and fathers are also presented. Some English lexical items show very high rates of l-lessness by both caregivers and children; for example, /l/ in *wolf* and *milk* was almost always l-less. It also can be observed that, except for *crocodile*, children closely matched the caregivers in terms of the likelihood of l-lessness for each lexical item. The trend may at first glance appear to be largely a result of phonetic environment, as many target words with laterals in the absolute word-final position were less likely to be l-less. However, recall that many child target words were repeated in quick succession during the elicitation tasks, while some were done with pauses in between repetitions; such differences in phonetic contexts are not reflected in the figure.

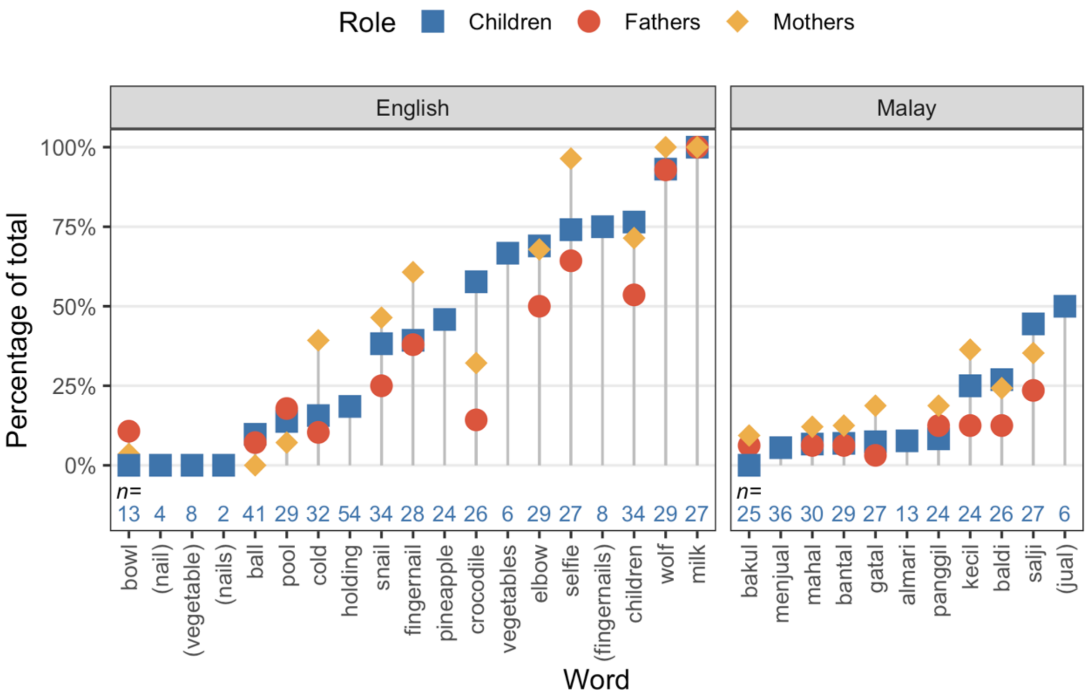

Figure 6.4 Proportions of l-less child and adult tokens by language and lexical item, ordered by increasing rate of l-lessness by children. The sample sizes (*n*) refer to the total number of child tokens for each word. Words in parentheses are variations of target words: fingernail–(fingernail)/(nail)/(nails); vegetables–(vegetable); menjual–(jual).

Mixed-effects generalised regression analysis was run to model the binary outcome of l-lessness (0 = l-less, 1 = retained) on the child coda laterals. The data of the youngest children Mi9, M9, M10 and Mi23 were excluded from this analysis as their variable production is likely due to developmental factors. The random effects structure was kept maximal for subject and word. The linguistic factors in the saturated model included language (Malay/English) and phonetic environment (preconsonantal/prepausal). The external predictors included percentage use of Malay, age, SES, BLP scores of caregivers, preschool type (Malay/mix) and peer group type (Malay/mix). In order to ascertain whether the between-child variation in l-lessness could potentially be attributed to individual variation between caregivers, their caregivers' mean likelihood of l-lessness was also considered in the model. All adult coda laterals, i.e., including those from spontaneous English CDS, were included in the calculations, for a better representation of the input model. Instead of a global average, the mean likelihood of l-lessness of each caregiver specific to language (English/Malay) and phonetic environment (preconsonantal/prepausal) was calculated, generating four averages per caregiver. Each individual child token was then compared with the respective specific mean of their mother and of their father. All two-way interactions between language and other predictors were tested. The results of the reduced model are shown in Table 6.4. As expected, prepausal laterals were significantly more likely to be retained than preconsonantal laterals. There was a significant interaction between language and peer group type. Post-hoc analysis revealed that while English laterals were more likely to be l-less than Malay laterals for all children, the difference was only significant for children who had mix peer group type (B = 4.83, z = 3.61, p < 0.001). Regression analysis performed on child tokens that were not imitated (n = 509) yielded the same significant predictor and contrasts.

Table 6.4. Regression coefficients of a reduced mixed-effects logistic regression model fit to the child coda laterals.

Fixed effects	***B***	***SE***	**Odds Ratio**	**95% CI**	***p***
(Intercept)	3.02	1.14	20.43	[2.17 – 192.27]	**0.01**
Language [English]	-1.84	1.21	0.16	[0.01 – 1.69]	**0.13**
Phon. Env. [Prepausal]	1.88	0.60	6.57	[2.05 – 21.11]	**0.002**
Peer type [Mix]	1.07	1.35	2.91	[0.21 – 40.77]	0.43
Language × Peer type	-2.30	0.80	0.10	[0.02 – 0.48]	**0.004**

Note: Observations = 572. Marginal R^2 = 0.23, Conditional R^2 = 0.82. Reference level of language is Malay, phonetic environment is preconsonantal, peer (group) type is Malay.

To summarise the findings on the distribution of realisations of coda laterals, both the adult and child models revealed that prepausal laterals were more likely to be retained. After controlling for the effect of phonetic environment, adult English coda laterals were found to be significantly more likely to be l-less than Malay laterals. The same difference was also observed in the child model, but only significantly so for children with mixed peer group type.

6.3.2. Darkness of laterals and positional contrast

6.3.2.1 Caregiver norms

Laterals from the caregivers' casual English CDS reported in Sim (2021c), in which parents were found to use predominantly clear-l in all syllable positions, were compared with their Malay laterals. The mean F2–F1 values (Bark) of the laterals by role, language and syllable position are shown in Table 6.5. The laterals are also compared by their F2–F1 values (Bark) in Figure 6.5. By visual inspection, mothers' laterals were overall clearer than those of fathers. Malay laterals also appear to be overall clearer than English laterals regardless of role, and this could be due to the Malay laterals having been elicited in more careful speech. The lack of clear differences between positions in each language could also suggest that the differences in darkness may be due to phonetic factors rather than different articulatory targets (i.e. a velarised allophone). This is considering that the mean F2–F1 (Bark) of the darker coda /l/ in the formal English CDS of mothers in Sim (2021c) was 5.78 (*SD* = 1.93).

Table 6.5. Mean F2–F1 (Bark) values of adult laterals grouped by role, language, and syllable position. Values are mean, standard deviation in parentheses, and sample size.

Role	Language	Position		
		Onset	Ambisyllabic	Coda
Fathers	English (informal)	7.11 (1.19), 122	–	6.89 (1.07), 119
	Malay	8.02 (0.65), 41	7.81 (0.78), 159	7.87 (0.94), 239
Mothers	English (informal)	7.48 (1.11), 194	–	7.64 (1.36), 113
	Malay	8.77 (1.01), 39	9.10 (0.76), 141	8.46 (1.01), 165

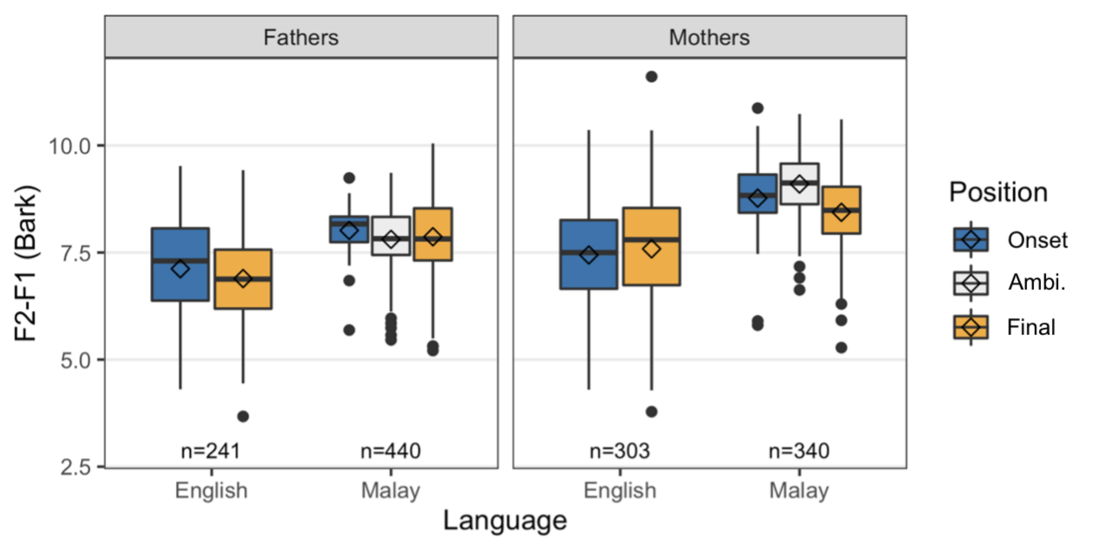

Figure 6.5 F2–F1 values (Bark) of English and Malay laterals of caregivers across different syllable positions grouped by role. Diamonds indicate mean values.

Mixed-effects linear regression with F2–F1 (Bark) as response was run to assess the effects of language, position, and role on l-darkening. English and Malay laterals were analysed separately, because of the differences in the laterals by word position, and because they are not directly comparable due to the differences in the method of elicitation (spontaneous versus controlled speech). The random effects structure for both models included random intercepts for subject and word and by-subject slope for position. In the English-only model, linguistic predictors included position (onset/coda), neighbouring segment type (coronal/glide/glottal/labial/velar), vowel context, and lateral duration. Role (father/mother), BLP and SES were added as language-external factors. A two-way interaction between role and position was added. The same predictors were included in the Malay-only model, except for neighbouring segment type because a disproportionately large number of laterals preceded coronals due to the carrier phrase. The results of the reduced models are shown in Table 6.6.

In the reduced English-only model, only vowel context and neighbouring segment type significantly improved model fit; laterals next to fronter vowels were clearer, and those neighbouring labials and velars were significantly darker than prepausal laterals. Darkness did not differ by role nor by position.

In the Malay-only model, the same effect of vowel context was found. The interaction between role and position was also significant. Plots of marginal effects and pairwise comparisons (with Tukey adjustments) revealed that ambisyllabic laterals were significantly clearer than onset laterals for both fathers (B = 0.64, t = 4.54, p = 0.001) and mothers (B = 1.15, t = 7.86, p < 0.001), and mothers' ambisyllabic laterals were clearer than those of fathers (B = 0.90, t = 6.12, p < 0.001).

Table 6.6. Regression coefficients of reduced mixed-effects linear regression models fit to adult laterals.

Language (*n*)	Fixed effects	Level	*β*	*SE*	*t*	*p*
English	(Intercept)		0.17	0.16	40.18	**< 0.001**
(544)	Role	Mothers	0.19	0.14	1.42	0.16
	Position	Coda	-0.11	0.15	-0.74	0.46
	Vowel context		0.39	0.05	7.97	**< 0.001**
	Nbr. seg. type	Coronal	-0.19	0.11	-1.77	0.08
		Glide	0.19	0.21	0.90	0.37
		Glottal	-0.28	0.27	-1.02	0.31
		Labial	-0.53	0.14	-3.91	**< 0.001**
		Velar	-0.71	0.20	-3.52	**< 0.001**
Malay	(Intercept)		-0.75	0.31	24.19	**< 0.001**
(780)	Role	Mothers	0.40	0.20	1.98	**0.048**
	Position	Ambisyllabic	0.64	0.14	4.58	**< 0.001**
		Coda	0.48	0.40	1.21	0.23
	Vowel context		0.40	0.05	7.55	**< 0.001**
	Role × Position	Mothers, Ambi.	0.50	0.16	3.10	**0.002**
		Mothers, Coda	-0.26	0.22	-1.15	0.25

Note: English-only model: marginal R^2 = 0.21, conditional R^2 = 0.58; Malay-only model: marginal R^2 = 0.28, conditional R^2 = 0.72. Reference level of language is Malay, role is fathers, position is onset, neighbouring segment type (nbr. seg.) is pause.

6.3.2.2 *Children's laterals*

The retained laterals of all 14 Malay children were analysed. The onset and coda /l/ of 41 tokens preceded or followed a vowel very closely, with a silence/pause shorter than 300 ms between segments (e.g. *a /l/ion*; *menjua/l/ ayam*); these were analysed as ambisyllabic laterals. The mean F2–F1 values (Bark) of the laterals by language and word position are shown in Table 6.7. Figure 6.6 compares the English and Malay laterals by their F2–F1 values (Bark). By visual inspection, their laterals across word position and language are very similar in darkness, which suggest an absence of positional contrasts. The considerably clearer Malay onset /l/ is likely due to effects of vowel context since the onset laterals in both target words (*ahli* and *limau*) preceded a high front vowel.

Table 6.7. Mean F2–F1 (Bark) values of child laterals grouped by language and syllable position.

Language	Position		
	Onset *M* (*SD*), *n*	**Ambisyllabic *M* (*SD*), *n***	**Coda *M* (*SD*), *n***
English	9.95 (0.94), 118	9.52 (1.23), 274	9.41 (0.94), 224
Malay	10.53 (0.59), 14	9.60 (1.06), 193	9.33 (1.13), 198

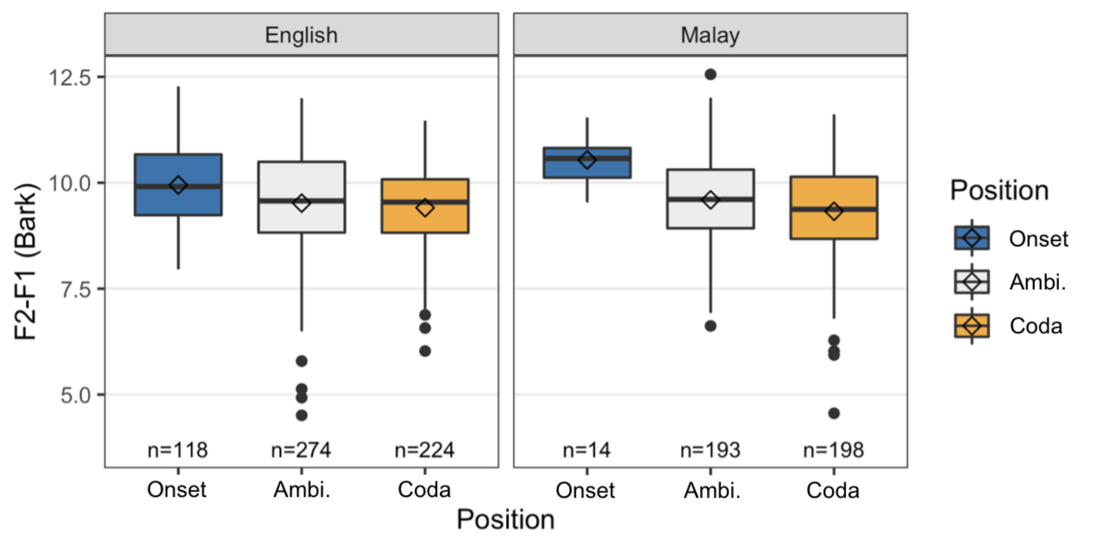

Figure 6.6 F2–F1 values (Bark) of English and Malay laterals of children across different syllable positions grouped by language. Diamonds indicate mean values.

Mixed-effects linear regression analysis with F2–F1 (Bark) values as response was conducted on the child laterals. The random effects structure included intercepts for subject and word and by-subject slopes for language and position. Linguistic predictors included language (Malay/English), position (onset/ambisyllabic/coda), vowel context and lateral duration. Social factors included percentage use of Malay, age, gender, SES, BLP scores of their caregivers, preschool type (Malay/mix) and peer group type (Malay/mix). Contributions of two- and three-way interactions between language, position and the social factors to model fit were also tested, to uncover potential variation. The addition of neighbouring segment type as a predictor resulted in unresolvable convergence issues, again due to the unbalanced distribution. Following Barlow et al. (2013), onset and ambisyllabic laterals were merged (prevocalic) to be compared with coda laterals (postvocalic), and they were analysed in a separate model (Model 2) with the same predictors as Model 1, but with the addition of neighbouring segment type. The results of the two reduced models are shown in Table 6.8. In both models, only linguistic factors significantly predicted l-darkening: longer laterals and those next to fronter vowels were clearer, and laterals neighbouring labials were darker than prepausal ones. The two-way interaction between language and position was not a significant predictor in both models. Post-hoc comparisons by language and position also did not reveal significant differences. These suggest that the child laterals did not differ in their darkness between and within their two languages.

Table 6.8. Regression coefficients of reduced mixed-effects linear regression models fit to child laterals.

Model	Fixed effects	Level	*β*	*SE*	*t*	*p*
Model 1	(Intercept)		0.03	0.19	45.07	**< 0.001**
	Language	English	0.04	0.13	0.33	0.74
	Position	Ambisyllabic	-0.16	0.14	-1.08	0.28
		Coda	-0.16	0.21	-0.76	0.45
	Duration		0.12	0.03	4.40	**< 0.001**
	Vowel context		0.40	0.04	8.96	**< 0.001**
Model 2	(Intercept)		-0.01	0.23	37.71	**< 0.001**
	Language	English	0.07	0.13	0.53	0.60
	Position	Postvocalic	-0.00	0.20	-0.02	0.98
	Duration		0.09	0.03	3.19	**0.001**
	Vowel context		0.40	0.04	8.98	**< 0.001**
	Nbr. seg. type	Coronal	-0.13	0.11	-1.20	0.23
		Glottal	0.44	0.42	1.04	0.30
		Labial	-0.65	0.13	-4.87	**< 0.001**
		Velar	-0.17	0.22	-0.80	0.42
		Vowel	-0.13	0.14	-0.96	0.34

Note: Observations = 1021. Reference level of language is Malay, position is onset (or prevocalic), neighbouring segment (nbr. seg.) type is pause. Model 1: Marginal R^2 = 0.17, Conditional R^2 = 0.55. Model 2: Marginal R^2 = 0.18, Conditional R^2 = 0.56.

In summary, for caregivers, the analyses on the darkness of the laterals revealed that, after controlling for linguistic factors that modulate l-darkening, neither their English laterals nor their Malay laterals showed positional contrasts, although the Malay ambisyllabic laterals were found to be clearer than Malay onset laterals. Similarly, for the children, their English and Malay laterals in all syllable positions were not significantly different in their darkness.

Discussion

This present study set out to better understand early bilingual phonological acquisition in a multilingual and multidialectal context in which intra- and inter-speaker variation is the norm. Specifically, it investigated the lateral production of English-Malay simultaneous bilingual preschoolers in Singapore who were exposed to a mixed phonetic representation of /l/ in their input.

To remind the reader, it was reported in Sim (2021c) that in casual English child-directed speech (CDS) towards preschoolers, the laterals of Singaporean Malay caregivers, if not l-less, were clear in all syllable positions. Mothers, however, were found to use a darker coda /l/ and/or exhibited more l-lessness when teaching and reading in English. Little is hitherto known about the laterals in the Malay CDS of these Malay caregivers, but Malay laterals are not expected to be l-less, and should be phonetically clear in all word positions. These were confirmed in this study; after controlling for effects of phonetic environment, their English coda laterals were indeed found to be significantly more likely to be l-less than their Malay laterals. The analyses of the darkness of the laterals also confirmed that neither the speakers' English laterals (from informal CDS) nor their Malay laterals showed positional contrasts. Ambisyllabic Malay laterals, however, were found to be clearer than onset Malay laterals, but this could be due the imbalance of vowel contexts in the stimuli rather than a systematic property of the Malay language. This input model that Malay children are exposed to at home can further be in contrast with the variety spoken by the Chinese ethnic majority, who typically vocalise/delete their English coda laterals, if not velarise them.

The analyses of the children's laterals revealed that, like their caregivers, their English coda laterals were overall more likely to be l-less than Malay laterals, but this varied between speakers based on their peer group type. If not l-less, their laterals were generally clear, and phonetically similar within and between their two languages. The children's overall production therefore approximated caregiver norms closely, as summarised in Table 6.9. We discuss the findings in detail by revisiting the research questions that this study sought to answer.

Table 6.9. A comparison between Malay caregiver norms and child production patterns.

Language	Realisations of coda laterals		Darkness and positional contrast	
	Caregivers	**Children**	**Caregivers**	**Children**
English	Retained and l-less	Mixed. - Children with at least one Chinese close friend = Retained and l-less - Children whose three closest friends were Malay = Retained	Clear. No positional contrasts. *(but in formal CDS, mothers used darker coda /l/)	Clear. No positional contrasts.
Malay	Retained	Retained	Clear. No positional contrasts.	Clear. No positional contrasts.

Note: * Stylistic variation observed in Sim (2021c).

Do the children show the development of distinct lateral systems for English and Malay?

As observed in the caregivers' production, SgE permits l-lessness in its coda laterals, whereas Malay laterals are more resistant to l-lessness. We therefore regard the presence of l-lessness in English but not in the Malay lateral production of the children as evidence of two distinct lateral systems. The findings revealed that overall, English coda laterals of the Malay children were more likely to be l-less than their Malay coda laterals, reflecting caregiver norms. However, a significant difference in the likelihood of l-lessness between their two languages was only observed in Malay children who had at least one ethnically Chinese friend out of their three closest friends. Specifically, these children showed a greater contrast between their languages by vocalising/deleting their English coda laterals more often than they did for their Malay laterals, after effects of phonetic environment were controlled. Contrastingly, children whose three closest friends were all Malays retained their English coda laterals almost as frequently as their Malay laterals. In addition, as described below, they did not show differentiation in the darkness of laterals within and between their two languages. For these children, the phonological and phonetic similarity in the laterals of their two languages may suggest a merged lateral system.

Additionally, we expected l-lessness in the Malay children's English lateral production to follow the same linguistic and lexical constraints as their caregivers. We found this to be the case, such that child production patterns in general closely matched those of the caregivers. Malay caregivers were more likely to vocalise/delete preconsonantal English coda laterals, and so did the Malay children in this study, regardless of their peer group type. Further, there were some lexical items that were (near) categorically l-less in adult norms, such as *milk* and *wolf*, and their surface forms were learnt veridically. The influence of caregiver input on production is further exemplified by the differences in the production patterns between Malay and Chinese Singaporeans. It was previously mentioned that Chinese Singaporeans typically vocalise even prepausal or prevocalic absolute word-final /l/. An analysis performed on the same child tokens of three Chinese children aged 4;7, 5;8 and 6;1 who were highly English dominant (Mandarin use below 15%) revealed that their coda laterals were almost categorically l-less, about 86-100% of the time, despite being raised by English-dominant caregivers.

Do children's retained English laterals follow the allophonic velarisation rule? If not, are they phonetically distinct from Malay laterals?

Sim (2021c) reported that when teaching and reading to their children, mothers were found to use a much darker coda /l/, thereby presenting to the child the allophonic velarisation rule. A question therefore was whether children's English coda laterals in this study might potentially show allophonic velarisation as the children could have, seeing that the elicitation tasks were a form of a test of their language abilities, adopted the form that their mothers used in contexts of teaching and learning. Alternatively, they may show preference for clear-l, which occurs much more frequently in both languages, and if so, a question is whether they would show deflecting patterns (Kehoe, 2015) to maximise the contrast between their two lateral systems.

The findings revealed that, when not l-less, the children's retained laterals were generally clear, comparable to the very clear /l/s produced by English-Sylheti bilingual children in Kirkham & McCarthy (2021). The laterals, however, did not differ significantly in their darkness within and between their two languages, which suggests that they have similar articulatory strategies for all laterals. Several reasons could have contributed to the absence of allophonic velarisation. A simple explanation could be that children had acquired the darker allophone but did not treat the elicitation tasks to be a context in which dark-l should be used. An impressionistic analysis of their spontaneous data, however, revealed that the children rarely produced the darker variant, if they did at all, even during contexts of teaching and learning. One explanation could be developmental, in particular the difficulty for young children to achieve an anterior-posterior lingual articulation. Lin & Demuth (2015) found that their Australian English-speaking children only produced coda dark-l accurately about 10% of the time at age four, and even by five years only around 40% of their coda laterals were adult-like. This, however, fails to explain why even the older children in this study did not show allophonic velarisation. A more likely account could be that the children had not recognised dark-l as an allophone nor had gained awareness of its socio-indexical meanings, and its late acquisition could be attributed to its relatively lower rate of occurrence and its lack of phonetic salience. Compared to children in other studies whose dominant input model is the one with allophonic velarisation (Barlow et al., 2013; Khattab, 2002; Kirkham & McCarthy, 2021), dark-l in the CDS of these Malay caregivers is limited to contexts of teaching and learning, and to maternal CDS. Moreover, vocalised-l is used in CDS in all contexts, which could have made dark-l less perceptually salient for a separate phonetic category to be formed. In addition, the analysis did not reveal any significant language-external modulator of darkness that suggests deflecting patterns. In other words, those who did not show contrast in the laterals through l-lessness also did not vary in the darkness of their laterals.

What social factors modulate production patterns?

Two main language-external factors that were previously found to predict individual variation were explored in this study, and only effects of peer group type were attested, as described above. One might have expected that the most English-dominant Malay children, who used Malay less than 15% of the time, to behave differently from their more Malay-dominant peers, for example by being more l-less in their Malay laterals, but this was not the case. This is unlikely due to their imitating the caregiver's Malay lateral production during the elicitation tasks, since these tokens constituted only 18% of all the Malay coda laterals produced by them (n = 67). Their ability to produce clear Malay laterals consistently and accurately despite not being highly fluent in Malay is likely facilitated by the similarly clear English coda laterals that they have already acquired.

6.4.1. General discussion

Taken together, the findings provide insights into how properties of the input, general learning mechanisms and social factors are all operative in determining the outcomes of bilingual phonological acquisition in a plural society.

In some bilingual contexts like this one, caregiver input, specifically its phonetic and phonological properties, plays a significant role in shaping language outcomes. It is evident that the clear English coda laterals produced by the Malay children were primarily learned from their English input, and less likely to be a phonetic property transferred from Malay, since the children in this study were balanced if not highly English-dominant simultaneous bilinguals. The findings therefore exemplify how ethnolinguistic features that arose from language contact are transmitted from one generation to another. This supports findings of other studies that also found a strong input-production correspondence between specific phonetic/phonological property in the speech of caregivers and in their children's production (e.g. Mayr & Montanari, 2015; Stoehr et al., 2019). Sim & Post (2021a), for instance, found that Singaporean Chinese mothers who released coda oral stops to a lesser degree also had children who tended to not release their stops, and the same was true for mothers who released their stops to a higher degree, showing that children are sensitive to subphonemic properties of the input. Any investigation into variation in bilingual language outcomes in multi(dia)lectal contexts should therefore also consider the production patterns of the caregivers.

Malay children who had been exposed to a largely homogenous input model from caregivers and peers did not significantly differentiate their two languages, both in terms of rate of l-lessness and darkness of the laterals, and instead showed an overarching preference for clear-l in all positions and in both languages. This suggests that these children could have regularised their input. Several studies on linguistic regularisation have shown that, when encountered with variation in their input that is probabilistic, children impose consistency by choosing a more regular form than one that is less frequent (e.g. Hudson Kam & Newport, 2005, 2009; Singleton & Newport, 2004). While l-lessness in the speech of the caregivers is not entirely in free variation since it is more likely to occur in preconsonantal contexts, it is not highly predictable to the children either. There is considerable inter-speaker variation in whether some lexical items are categorically l-less (e.g. *selfie* and *children*). In contexts of teaching and learning, mothers may also vocalise/delete English coda laterals more frequently (Sim, 2021c). Furthermore, l-lessness is less likely to occur in paternal CDS. That these children could have reduced variability by opting for the most frequent and acoustically salient variant is consistent with previous studies on probabilistic input that show that such inconsistencies are not learnt veridically by younger children (Austin et al., 2021; Hudson Kam & Newport, 2005, 2009; Singleton & Newport, 2004).

By contrast, Malay children who have been exposed to a different lateral model through their close ethnically Chinese peers were more likely to vocalise/delete their English coda laterals, thereby exhibiting greater contrasts between the two languages, and approximating caregiver norms more closely. This finding supports studies that also attested similar peer group effects on child production (Khattab, 2002; Kirkham, 2017; Mayr & Montanari, 2015). Instead of a divergence from caregiver norms, however, the predominantly l-less model of their Chinese peers could have facilitated the children's attainment of the adult target, by presenting linguistic input that is more consistently l-less. Indeed, social circles were proposed by Sim (2019) to be a potential contributor to why Malay-dominant adults had a distinctively-Malay SgE accent whereas their English-dominant counterparts were perceived by listeners to be ethnically Chinese. Future work can be done to explore and confirm such effects by including a more robust way to operationalise peer group type and social network.

Conclusion

This study set out to better understand early bilingual phonological acquisition in a context in which inter- and intra-speaker variation is the norm, by examining the bilingual acquisition of laterals by English-Malay bilingual preschoolers in Singapore who were exposed to several allophones of /l/ in their input. The results revealed that while all the children have acquired the ethnically distinctive properties of their caregiver input by using coda clear-l in both English and Malay, there is variation in their language outcomes modulated by general learning mechanisms and their peer group. Importantly, the complex nature of phonological acquisition as described demonstrates how a context-dependent approach that considers both linguistic and language-external factors can be useful in explaining bilingual production, as it recognises meaningful variation at the outset, thereby more accurately depicting the outcomes of bilingual acquisition.

CHAPTER 7

General Discussion and Conclusion

Revisiting the Research Questions

This thesis sought to better understand early bilingual phonological acquisition in a setting in which input can be especially varied and variable. Four experiments explored the variation in the CDS of Singaporean caregivers and its possible connections with or effects on the outcomes of phonological acquisition in their preschool children. This concluding chapter first reiterates and synthesises the principal findings by revisiting the three main research questions posed in the introductory chapter, and at the same time key implications that can be drawn are highlighted. The chapter concludes with a discussion on theoretical implications of the thesis for the field of child language acquisition, by describing how usage-based approaches, specifically the exemplar model, appear to be particularly useful in accounting for the variable outcomes observed in the thesis and in bilingual acquisition more generally.

> **RQ1:** *What inter- and intra-speaker variation is there in the English child-directed speech of Singaporean caregivers?*

Two segmental variables of SgE were examined. The first was word-final singleton oral stops /p, t, k, b, d, g/, which in SgE tend to be unreleased (or inaudibly released) or replaced by a glottal stop (Bao, 2003, p. 29; Gut, 2005). Bao (ibid.) further noted that this feature is pervasive and widely attested in all social strata. As mentioned in the Introduction (§1.2.3), the accents of Singaporeans are not homogenous, and indeed **Experiment 1** (Chpt. 3) revealed inter-adult variation in the spontaneous casual CDS of Chinese mothers: some mothers tended to not release their coda stops even in prevocalic and prepausal contexts, and to a degree that reflects local norms, whereas another group of mothers matched the rate of coda stop release of American and British adults reported in previous studies (e.g. Fabricius, 2002; Song et al., 2012). The observed inter-adult variation was unlikely to be due to differences in the modifications made to their CDS, but rather due to individual differences in the phonetic realisations of coda stops in their unselfconscious speech. The inter-adult differences, however, could not be explained by the social factors examined—a point that will be returned to below.

The second phonological feature examined was coda /l/, which is known to vary according to ethnicity: the English coda /l/ of Chinese Singaporeans is usually l-less (vocalised or deleted), if not velarised (Deterding, 2007b, pp. 26–27; K. K. Tan, 2005; L.-H. Wee, 2008). Sim (2015, 2019) found that Malay Singaporeans, by contrast, were more likely to retain their English coda laterals, but the laterals produced by Malay-dominant Malays tended to be phonetically clear in all word positions. **Experiment 3** (Chpt. 5) revealed inter-adult differences in the /l/ variants used between the CDS of Malay mothers and fathers, as well as intra-adult variation mostly within maternal CDS. In their informal English CDS, both mothers and fathers were found to use a relatively clearer /l/ in all syllable positions. Contrastingly, in formal contexts that involved teaching and learning, mothers used darker coda /l/ and/or exhibited more instances of l-lessness. Fathers, however, generally did not exhibit more l-lessness, nor did they show differentiation in the darkness of their laterals; in other words, Malay fathers mainly used clearer /l/ in all syllable positions and in all situational contexts in their CDS. The segmental modifications in maternal CDS were explained to be influenced by the different indexical values of the variants, which were thoroughly explored in **Experiment 2** (Chpt. 4). Despite it being stigmatised especially by out-group members, clear-l was used in informal CDS because it indexed ethnic group membership. By contrast, dark-l, the variant associated with exonormative standards, was unanimously accorded social prestige by hearers regardless of their ethnicity, age, gender and cultural affiliation, and evoked semiotic connections to education, status and formality; expectedly, it was the variant of choice by mothers in contexts of teaching and learning. Differences between maternal and paternal CDS patterns were attributed to gender roles and cultural expectations of mothers' dominant role in child-rearing. They were also explained to be a result of and enabled by Malay women's potentially more complex repertoire range: in addition to the maintenance and use of ethnically-distinct variants for their sociocultural capital, young Malay women also have in their repertoire prestige forms possibly for their symbolic expressions of status or to access social, political or economic power.

Key implication 1: ***Inter-speaker variation can be difficult to predict or model.*** An accent of an individual is a product of cognitive, linguistic, social-political and cultural processes. Consequently, it is not always possible to trace the aetiology of the use of certain differential features in the unselfconscious speech of an individual, and therefore inter-adult variation, whether in ADS or CDS, can be difficult to predict or model.

One reason why language outcomes of Singaporeans and individuals in similar contexts can be difficult to predict is that they can be simultaneously modulated by effects of long-term language contact and bilingualism. The nonrelease of English coda stops examined in **Experiment 1** is an example. It was explained earlier that the variable feature of coda stop nonrelease in modern-day SgE could be attributed to substrate influence of the categorically unreleased coda stops of Bazaar Malay (and Malay, its lexifier) and Hokkien (Bao, 1998), which were the intra- and inter-ethnic *lingua francas* before being displaced by English in the 1970s. Contact-induced features such as this one can be transmitted vertically from caregiver to child, and therefore some proficient and highly English-dominant children in **Experiment 1**, who did not speak (Bazaar) Malay nor Hokkien, nevertheless exhibited the use of this feature because of the properties of their input. However, this differential feature could also arise from bilingual effects for some groups of Singaporeans, which can be difficult to disentangle from effects of long-term language contact (cf. Mayr et al., 2017). For example, Malay is still used by Malay Singaporeans and therefore the potential transfer of Malay coda stops [p˺, t˺, k˺] into English could contribute to or confound any variation in the release of English coda stops in English-Malay bilinguals. The same can be said for many in the Chinese community, including the caregivers in **Experiment 1**, who still speak or have been/are exposed to the use of Chinese languages that allow unreleased coda [p˺, t˺, k˺] such as Hokkien, Teochew, and Cantonese (Singh & Seet, 2019), which are language spoken as an L1 or a heritage language by many older Singaporeans[10].

The variable outcomes of bilingual acquisition are additionally moderated by unique lived experiences that have a bearing on linguistic development, behaviours and choices. The linguistic resources that individuals come to eventually possess may vary according to their peers, speech communities and communities of practices (Mayr et al.,

[10] Like many others in my generation, I acquired L1 Hokkien as a heritage language from my maternal grandparents with whom I spent a significant portion of my childhood, L1 Mandarin from my parents, and overheard L1 Hokkien and L1 Teochew from my parents' interactions with other adults. I acquired English as an early sequential learner at around three to four years of age in kindergarten, likely from L2 speakers of English.

2017; Mayr & Montanari, 2015; Meyerhoff & Strycharz, 2013; Morgan, 2013; Unsworth, 2016), ethnic affiliation and cultural orientations (Kirkham, 2017; Sharma, 2011), language learning in the classroom (McCarthy et al., 2014; Rattanasone & Demuth, 2014), and socio-cultural norms and practices (Foulkes et al., 2005; Queen, 2013; Smith et al., 2007; Stanford, 2008; Suratman, 2011), amongst many other factors. Indeed, one explanation for the inter-adult variation observed in **Experiment 1** concerns their jobs, which as a factor had more explanatory power than known/well-investigated variables such as language dominance, education, SES and proficiency: five of six mothers who released their coda stops more frequently were also senior managers in jobs that required frequent interactions with clients. The communicative demands of their jobs could have made them more aware of their speech features, and might have also led to their adoption of phonetic features associated with exonormative standards to index social meanings that are crucial for their roles. In the case of coda stop release, the higher rates of release of coda stops, especially /t/, have been shown, for example, to index learnedness, articulateness, and a pedantic stance, amongst many others interrelated social meanings (Eckert, 2008b, pp. 467–470; Leimgruber, 2013, p. 66). The differences between maternal and paternal CDS patterns in **Experiment 3** also revealed how cultural norms and socio-cultural circumstances can differentially shape linguistic behaviours in CDS, supporting other studies that have shown cultural differences in parenting practices (e.g. Broesch & Bryant, 2018; Shneidman & Goldin-Meadow, 2012; Stanford, 2008; Weber et al., 2017).

> **RQ2:** *What are the effects of variation in child-directed speech on the phonological development of their preschool children?*

Key implication 2: ***Children acquire the differential speech properties in the input.*** Clear correspondences between specific properties of caregiver input and their children's production patterns were observed for the two phonological features in question. These conclusions were drawn after linguistic factors and potential confounders (see §1.3) were accounted for insofar as possible to isolate the effects of input quality. The findings of this thesis thereby contribute to the small but emerging body of work that directly examines input effects on phonological development (e.g. Cristià, 2011; Kerswill & Williams, 2000; Mayr & Montanari, 2015; Smith et al., 2007; Stoehr et al., 2019).

Experiment 1 revealed that the inter-adult variation in the release of coda stops was reflected in their children's production: mothers who released coda stops to a lesser degree also had children who tended to not release their stops, and the same was true for mothers who released their stops to a higher degree. The findings could not be explained by cross-linguistic TRANSFER effects because Mandarin lacks oral coda stops, nor could it be interpreted as a DELAY, as age was not a significant predictor, and all child participants had acquired the coda stops (released or otherwise) but differed only in their phonetic implementation. Further, language dominance (all were highly English dominant), SES and vocabulary sizes of the children did not significantly predict the observed variation. The findings suggest that children are sensitive to subphonemic details in the input, and acoustic realisations that are irrelevant to category membership are not ignored in the acquisition process.

The input effects of variation in /l/ in the CDS of Malay caregivers were examined in **Experiment 4** (Chpt. 6). Similarly, input-production associations were attested: not only did all Malay preschoolers in the study acquire the ethnically distinctive use of coda clear-l in English from their caregivers, but clear-l was also the predominant variant used for all laterals that were retained, regardless of language and word position. That the differential use of coda clear-l in English by the Malay children could be due to cross-linguistic TRANSFER of clear Malay laterals cannot fully explain the observations. One reason for this is because the children in the study were balanced if not highly English-dominant simultaneous bilinguals, and even those who used Malay less than 10% of the time also exhibited the predominant use of coda clear-l in English. Such input effects on language outcomes are further exemplified by the production patterns of their Chinese peers: the coda laterals of three age-matched and highly English-dominant Chinese children (Mandarin use below 15%) raised by caregivers who were highly dominant and proficient in English were found to be categorically l-less, reflecting the typically l-less English lateral system of adult Chinese Singaporeans as mentioned above. The findings thus also illustrate the inter-generational transmission of ethnic-specific features from caregivers to their children.

Key implication 3: *Variation and/or inconsistencies in the input can affect the acquisition of allophony.* Another type of input effect also observed in **Experiment 4** involves the development of allophonic contrasts within the English lateral system of the Malay children. It was mentioned in the Introduction (§1.3.2.1) that inconsistencies and variability in the phonetic input can delay phonemic category formation and/or stabilisation. In this thesis, variation in the input was shown to have an effect on the acquisition of the allophones of /l/ that are found in adult production. It was revealed in both **Experiments 3 and 4** that although l-lessness and the darker /l/ allophone were present in the input of Malay caregivers, they occurred much more variably, inconsistently, and much less frequently relative to coda clear-l. Clear-l was not only the predominant variant used in the English of the caregivers, but also the only variant of /l/ used in their Malay. Preschoolers who were primarily exposed to this input model did not show any allophonic contrast within their English lateral system, nor did they differentiate the laterals phonetically between their two languages; these children showed an overarching preference for clear-l in all word positions and in both languages. The children were argued to have regularised their input (Hudson Kam & Newport, 2005, 2009; Singleton & Newport, 2004), by choosing the most frequent and acoustically salient variant, i.e., clear-l, and ignoring variable l-lessness or allophonic velarisation.

RQ3: *How different is the nature of phonological acquisition in multi(dia)lectal and multicultural contexts from that in less diverse settings?*

Key implication 4: ***Input variability in multidialectal and multicultural contexts can be more complex.*** It is apparent that variation in input quality can be present in any language acquisition context as has been discussed at length in the Introduction (§1.3.2), but the findings of the studies herein illustrate how variation in the input in a long-term language contact situation that is further characterised by societal or widespread multilingualism and multiculturalism can be in many ways more complex.

As children age and begin to participate more in extra-familial contexts, they can be increasingly exposed to and cognisant of accents or accent features that qualitatively differ from the input received at home (§1.3.2.2). This is especially the case with children in multi-dialectal and/or culturally pluralistic societies and communities, who are faced with alternative forms of a phoneme not only in the CDS of their primary caregivers, but also in other competing input models of peers and significant adults within their ethnic group and in the wider community. In the investigations herein, not only were Malay preschoolers shown to be exposed to different variants of coda /l/ that were linguistically and socially conditioned in the CDS of their caregivers (**Experiment 3**), but this input model also contrasted with the predominantly l-less model of their peers or significant adults who were ethnically Chinese (**Experiment 4**). Children in Singapore are also introduced to standard accent features of local or other more established varieties of English through media consumption. Some are further exposed to exogenous features through their live-in helpers who originated mainly from Indonesia and the Philippines as indicated in the Child Language Experience survey responses, and these adults may speak their varieties of Malay and English[11].

In acquiring language, children need to learn not only the linguistic information of their language(s), but also the social-indexical meaning that is intertwined with linguistic meaning (Foulkes & Hay, 2015, pp. 292–293). Children in pluralistic contexts receive input that can be imbued with exceptionally rich social and cultural significance, in addition to being linguistically complex. Owing to long-term language contact and intergenerational transmission, the local /l/ variants (i.e. clear-l and vocalised-l) were revealed in **Experiment 2** to have become associated with specific ethnic groups and ethnic-specific social types. Along with dark-l, these three variants were shown to have in the course of time accrued very diverse social-indexical meanings that are connected within an intricate network of interrelated indices by the socio-cultural and political factors that have created/shaped them. Besides the variable linguistic input these children are faced with, therefore, a further challenge is that they need to negotiate the highly complex social world, in order to interpret and use language appropriately and creatively, according to the norms of their speech communities and the social significance of the variants/varieties.

Key implication 5: ***Multiple moderators of language outcomes.*** One principal finding of **Experiment 4** is that input properties, general learning mechanisms and social factors can simultaneously moderate the outcomes of bilingual phonological acquisition, often in unpredictable ways. As mentioned above, all Malay preschoolers in the experiment were

[11] The three-year-old child of family C15, for example, was reported by their parents to speak in a slight but perceivable Filipino English accent when interacting with her Filipino domestic helper.

shown to have acquired the ethnically distinctive properties of their caregiver by using coda clear-l in English for most if not all their retained laterals. However, not all children had differentiated their two languages by being more l-less in English like their caregivers did, and the inter-child differences were not predicted by language dominance as measured by the amount of use of Malay, as one might have expected. Instead, the inter-child variation observed was predicted by their peer group type: those who were primarily exposed to a predominantly clear-l input model from caregivers and Malay close friends exhibited a merged lateral system (i.e. one system for both languages) that favoured clear-l, suggesting regularisation. By contrast, Malay children who had been exposed to a different lateral model through having close ethnically Chinese peer(s) were more likely to vocalise/delete their English coda laterals, thereby exhibiting greater contrasts between the two languages, and approximating caregiver norms more closely. Interestingly, instead of a divergence from caregiver norms, which is the typical outcome of peer effects (e.g. Kerswill & Williams, 2000; Khattab, 2011; Mayr et al., 2017), the predominantly l-less model of their Chinese peers could have facilitated the children's attainment of the adult target by presenting linguistic input that is more consistently l-less.

Key implication 6: ***Multiculturalism as a moderator.*** One source of variance in language development can be the larger social context (e.g. Foulkes & Hay, 2015, pp. 300–301; Hoff, 2020, p. 84; this thesis, §1.3.2.2), and for societies like Singapore, multiculturalism can be in itself a societal force that can potentially moderate language outcomes.

In pluralistic societies that are organised around the languages and culture of the dominant groups that have historically constituted them, there may be social pressure for minorities to assimilate or integrate and thereby undergo acculturation to some extent. It is not uncommon for the speech of local born, later-generation speakers of migrant families or ethnic minorities to diverge from the accented input of their caregivers and approximate the accents of their monolingual peers or the dominant accent in the host or majority language (e.g. Khattab, 2002, 2011; Mayr & Siddika, 2018; McCarthy et al., 2013, 2014), although some who maintain ethnic social networks and/or an ethnic cultural orientation have been found to preserve and employ ethnic or heritage language features strategically for their social functions (e.g. Clothier, 2019; Kirkham, 2017; Sharma, 2011; Sharma & Sankaran, 2011; Stuart-Smith et al., 2011).

What sets these culturally pluralistic societies apart from multicultural ones is that in the former, ethnic differences are recognised and accepted but minority groups coexist alongside a dominant culture, whereas the multiculturalism model accentuates ethnic differences, is characterised by widespread appreciation and valuing of diversity, and involves political ideologies of separatism and non-assimilation as well as policies and practices to support and accommodate these differences (Mack, 1994, p. 63; Ward et al., 2020, p. 3). While one of the primary goals of state-institutionalised multiracialism in Singapore is to promote racial parity and harmony, it is inherently divisive in that it does not only preserve intangible inter-ethnic boundaries, but it encourages and accentuates them, such that ethnic identities are deeply entrenched (Mathew, 2018; this thesis, §1.2.1). The different ethnic groups are however still encouraged to interact and participate in society fully. Multiculturalism in Singapore is an 'everyday' living phenomenon (Wise & Velayutham, 2009), and from a young age, children are taught to embrace and respect if not tolerate the ethnic differences through, among many other means, the annual Racial Harmony Day in schools, during which inclusivity is inculcated by amplifying cultural differences using the 3F's: Food, Fashion and Festival (Ismail, 2014, p. 227). It is therefore more likely for individuals in multicultural societies to be a part of ethnic social networks and to be bicultural (i.e. being ethnic and mainstream) in their orientations.

In the carving out of these intangible ethnic boundaries, language plays a crucial role. As Meyerhoff & Strycharz (2013) put it, '[l]anguage is understood as but one vehicle by which speakers construct, maintain, or contest the boundaries of social categories and their membership in or exclusion from those categories' (p. 428). Bucholtz (1995) further asserted that the strong ideological association between language and ethnicity is 'so potent that the use of linguistic practices associated with a given ethnic group may be sufficient for an individual to pass as a group member' (p.355). It is argued here that ethnic differentiation brought about by multiculturalism prevents or slows the dissolution of ethnic-specific markers because of the important social functions they play in indexing ethnic identities and ethnic cultural orientations. This could explain the maintenance and continued use of ethnically distinctive features by English-speaking Singaporeans (however, see Kalaivanan et al., 2020), especially by those who are more closely affiliated to their ethnic communities, such as the Malay-dominant Malays in Sim (2015, 2019) and the Malay caregivers in the investigations herein (see **Experiment 3**, §5.4). The social significance of ethnolinguistic repertoires in these settings is also illustrated by how the distinctly Malay-influenced English style is used by ethnically Malay speakers who typically employ a more mainstream repertoire, such as those who are more English dominant, when interacting with their Malay peers who exhibit the use of these features more frequently in their unselfconscious speech, as briefly described in **Experiment 2** (§4.3.3). Finally, the strong sense of ethnic identity in the caregivers of the Malay preschoolers in **Experiment 4**, as well as the normative multiculturalism evident in the children's social world, may also offer some explanation as to why Malay children who had close Chinese friends or attended mixed-race preschools were observed to have also retained the use of clear-l in their English speech, unlike the children raised in Yorkshire by Lebanese parents in Khattab (2002, 2011), who produced dark-l and vocalised-l like their English monolingual peers.

TOWARDS A MODEL OF BILINGUAL PHONOLOGICAL ACQUISITION

One of the goals of research on child bilingual phonology is to construct a developmental theory or model that can satisfactorily explain if not predict the variable outcomes of language contact in early bilingual acquisition (Hambly et al., 2013; Kehoe, 2015; Kehoe & Havy, 2019; Lleó, 2016; Lleó & Cortés, 2013). As mentioned in the Introduction (§1.3.1), much of the research towards this end has taken on a psycholinguistic perspective (Lleó, 2016, §2) by focusing on internal or linguistic factors. In her critical review of the literature that has followed this line of inquiry, Kehoe (2015) stressed that the '[d]eveloping articulatory and lexical abilities are important components of phonological acquisition which need to be controlled since they may lead to considerable individual differences amongst children. Interestingly, they are factors that are rarely controlled [...], with some rare exceptions.' (p.158). Various other non-linguistic factors have also been recommended by Hambly et al. (2013). In their systematic review of 66 empirical studies of speech production by English-speaking bilingual children, Hambly and colleagues concluded that '[d]eveloping models of cross-linguistic bilingual speech acquisition that take into account age of acquisition, length and type of L2 exposure, language proficiency, the development and capacity of perceptual and cognitive systems, individual variation alongside other phonological areas, such as rhythm and intonation is an enormous challenge but will assist practitioners as they assess the speech of bilingual children.' (p.13).

This thesis contributes to this goal by focusing on variable input properties as an external factor. As the findings of this thesis have demonstrated, variation is inherent in the input (e.g. Cristià, 2011; Foulkes & Docherty, 2006; Mayr & Montanari, 2015; Mayr & Siddika, 2018; Smith et al., 2007, 2013; Stoehr et al., 2019; Fish et al., 2017), and is intrinsic to the acquisition process; it is reflected in the differences in children's production and also in their ability to use stylistic variation at a young age (Foulkes & Hay, 2015; Nardy et al., 2013; Smith et al., 2007). That the focus of this thesis is on individual variation rather than on the 'ideal speaker-hearer' that is dominant in structuralist-generative linguistics brings about different problems that should be addressed in the theoretical model. For one, the focus on speaker-specific variation that is shaped by and evolves with individual language experiences is more compatible with functionalist, emergentist, constructivist, usage-based theories than with nativist, generativist, Universal Grammar (UG) approaches. This is not to say that phonological variation cannot be or has not been accounted for in generativist approaches; in fact, variation is increasingly acknowledged in and accommodated by generative phonological frameworks and models (see Coetzee & Kawahara, 2013; Coetzee & Pater, 2011). The differences that are relevant to the present discussion are in their foci: the central theoretical concern of generativist approaches is in language universals and therefore language acquisition is often minimised to rules and constraints. By contrast, usage-based approaches, as explained below, are 'maximalist' in nature as linguistic knowledge is assumed to be derived 'bottom-up' through experiences and usage events. Therefore, unlike purely abstractionist models, models in this approach do not require additional assumptions to cater for individual variation that arises from language-external factors that moderate such experiences. They can also easily account for the intertwining of social and indexical information with phonological information (Foulkes & Docherty, 2006, p. 426; Docherty & Foulkes, 2014, pp. 42–43), which has been shown to modulate production and perception in this thesis.

Usage-based theories of language representation and acquisition emerged from various strands of research in functional and cognitive linguistics and psycholinguistics (Bybee, 2001; Bybee & Beckner, 2009, 2015; Goldberg, 2006; Tomasello, 2003). These accounts see language use as central; one's knowledge of a language, regardless of its level of abstraction, emerges not through language-specific instincts but it is grounded in concrete usage events and generalisations made over usage events (Ibbotson, 2013). As Bybee (2006) explains, '[w]hile all linguists are likely to agree that grammar is the cognitive organization of language, a usage-based theorist would make the more specific proposal that grammar is the cognitive organization of one's experience with language…certain facets of linguistic experience, such as the frequency of use of particular instances of constructions, have an impact on representation' (p.711). Ambridge & Lieven (2011, p. 2) highlighted that innate abilities to learn language are not abandoned in this theoretical stance. Rather, constructivists reject the notion that children are born with an innate and universal set of distinctive features, i.e, an innate knowledge of grammar such as rules and constraints that form the basis of generative, UG approaches.

A usage-based theoretical framework that has been used to model input variability and the acquisition of sociolinguistic knowledge in early phonological acquisition is the EXEMPLAR MODEL of phonological representation as laid out by Foulkes and Docherty (e.g. Docherty & Foulkes, 2014; Foulkes, 2010; Foulkes & Docherty, 2006), which builds on and contributes to the work of many others in this area (K. Johnson, 2007; Pierrehumbert, 2001, 2003, 2006). It is worth noting that there is no one 'exemplar theory' (see the review by Johnson, 2007, pp. 27–28). Kaplan (2017, §Introduction) explained that while the family of related approaches is diverse, they share these basic assumptions:

1. Linguistic knowledge does not consist of abstract generalizations but rather of a large number of specific remembered linguistic experiences ("exemplars"). A linguistic unit, such as a word, consists of a cloud of exemplars.
2. These exemplars do not consist (only) of discrete abstract units, but of rich phonetic detail, and of information about the extra-linguistic context in which they were experienced.
3. Exemplars may consist of more than just morphemes (the traditional unit of lexical storage); whole words and even whole phrases or utterances may be stored.
4. Generalizations about words and other units arise from the central tendencies of the clouds of exemplars associated with them.

It is also worth pointing out that although the key assumption of exemplar-based models is that phonetically rich information and speaker/situation specific contextual details are not abstracted away during the comprehension process, it does not mean that phonological representation in exemplar theory does not involve abstraction. The form of abstract units, however, is yet to be formalised in many variants of the exemplar model (Docherty & Foulkes, 2014, p. 43; Foulkes & Hay, 2015, p. 307). The exemplar model is also not incompatible with conventional abstract categories such as phonemes and syllables; many researchers have proposed 'hybrid' models that incorporate exemplar-based representations that are phonetically rich with conventional abstractionist phonological categories, to address the explanatory shortcomings of either models (see Pierrehumbert, 2016; Docherty & Foulkes, 2014, p. 46; Ernestus, 2014, pp. 37–38). The focus of the discussion here, however, is on the multi-faceted, phonetically detailed information stored in mental representations that characterises exemplar approaches. The next section describes Foulkes and Docherty's application of the exemplar model to sociolinguistic phenomena and how it can be applied to explain the findings in this thesis.

7.1.1. The Exemplar Model

7.1.1.1 An exemplar-based representation of variants of coda /l/ in SgE

Docherty and Foulkes (2014, pp. 43–45) described in detail how sociophonetic variability can be represented within an exemplar model based on the four assumptions specified above. Their description is here contextualised using the representation of the variants of English coda /l/ in SgE and their ethnic associations in a representative individual. This is illustrated in Figure 7.1, using the word *ball* as an example. In this model, words[12] are not stored in the individual's memory[13] solely as an abstract, invariant minimal string (e.g.

[12] In their model, Docherty and Foulkes have taken words to be the unit of representation, following others such as Johnson (2007), who argued that words form the fundamental building blocks in the conscious experience of language. One reason that Johnson gave was that people notice and talk about words and not sub-word regularities when commenting about language. In other models (e.g. Pierrehumbert, 2001), the unit of representation may be speech sounds.

[13] As Johnson (2007, pp. 31–32) explains it, there are two types of memories: declarative memory is made up of one's knowledge of expressible facts (e.g. gained from reading books), while recognition memory is implicit and comprises knowledge acquired through direct experience of an event or object. The latter has been proposed to be the language-user's knowledge that underlies linguistic performance.

/bɔl/), but consists of exemplars of the word which the individual has heard and uttered, as shown in **(a)** of Figure 7.1. In other words, variability is not discarded, but contributes towards a word's rich distribution or 'cloud' of multi-sensory episodic memories that are phonetically and socially detailed. In **(b)**, through statistical patterning, knowledge of phonetic (and allophonic) variation emerges from the clustering of phonetically similar variants, which in this example are the three common variants of coda /l/ in SgE, namely clear [l], dark [ɫ], and vocalised [w] (or [u] or deleted). Sub-clusters can also emerge through the same process as a result of other structured aspects of the received exemplars, such as social or contextual information; in **(c)**, clusters are formed based on exemplars spoken by ethnically Malay/Indian and Chinese Singaporeans. A coincidence of realisational variability and social tagging results in a statistical association (i.e. contiguity) being made between particular variants and particular social meanings; in **(d)**, associations are formed whereby some Malay/Indian Singaporeans are perceived by the individual to produce clear [l] more frequently than the other variants, whereas Chinese Singaporeans typically vocalise their coda laterals, if they are not velarised.

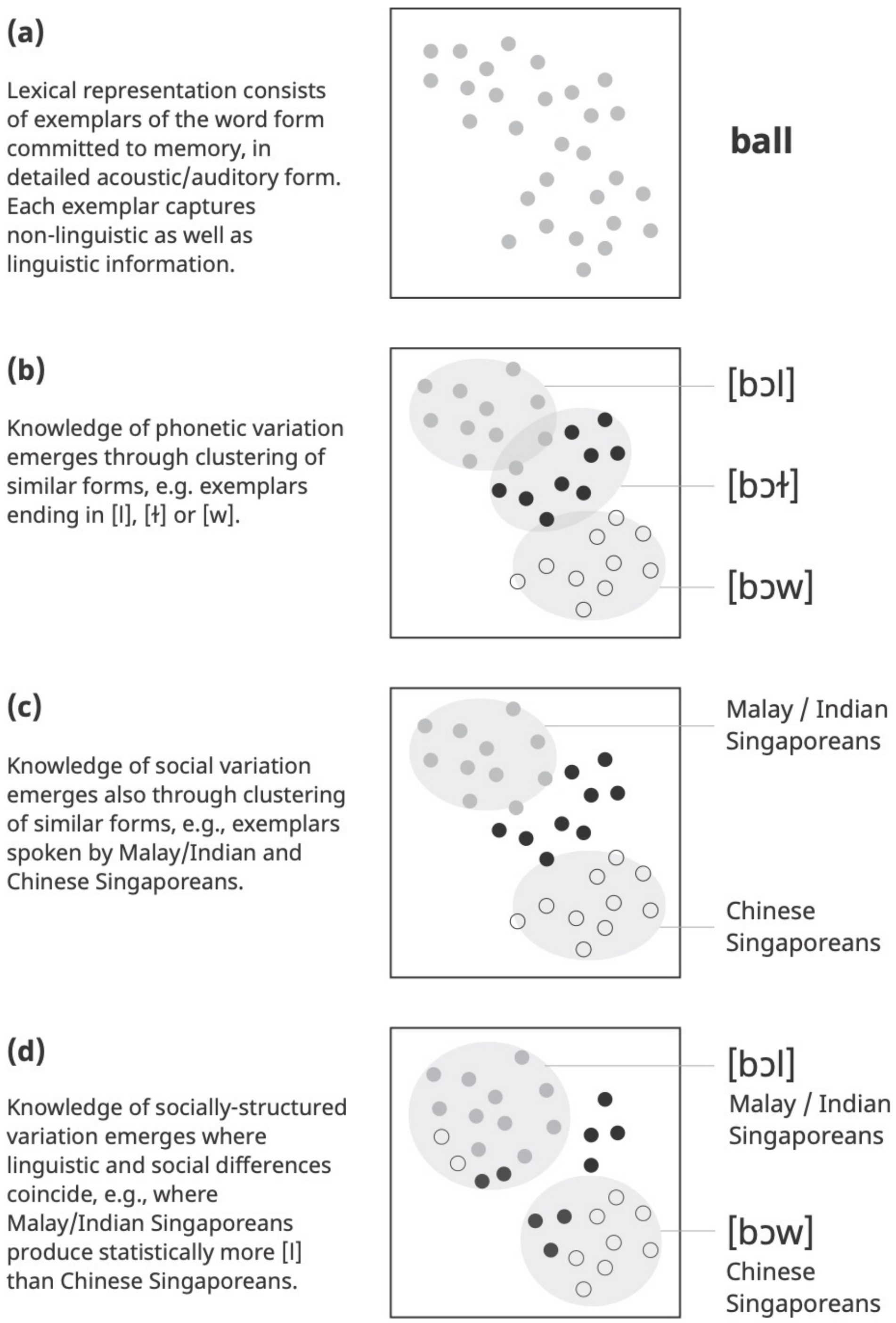

Figure 7.1 Sociophonetic variability within an exemplar model, adapted from Docherty & Foulkes (2014, p. 44).

A key feature of the exemplar model is that since distributional patterns emerge from the exemplars, associations can be updated as a result of on-going experience with language use, that is, new associations may be formed, and existing associations may be mutated or even dissolved over time, to reflect changes in an individual's ambient language input.

Exemplar theory integrates indexicality within perception, learning and production. In perception, an incoming stimulus is matched with the best-matching stored distribution, a process which Johnson (2007, pp. 34–35) refers to as 'similarity matching', thereby activating and reinforcing the exemplar category. Much less has been said regarding how exemplar representations relate to speech production. One mechanism that could be involved in the activation of exemplar representations in production is a 'bias' on the sampling of the exemplar space, whereby the context of an interaction is matched with a contextually relevant subpart of the exemplar space to generate a sociophonetically appropriate target from a phonetic space (Foulkes & Docherty, 2006, p. 430).

7.1.1.2 Bilingual representation

The current descriptions of exemplar-based models are based largely on monolingual representations (of English primarily), but their assumptions can be extended to model bilingual representation. Phonological learning and representations of the other L1 or a sequential L2 could conceivably emerge through the same processes, i.e., the clustering of similar exemplars of a word form, within a shared exemplar space. Docherty & Foulkes (2014, p. 51) pointed out that the signal-dependent information (the information present within the speech signal) 'not only shapes the nature of exemplar representation but is itself also shaped by the listener's existing knowledge of phonological patterning'. The implication for a bilingual representation, then, is that interaction effects can be expected in perception, learning, and production, because exemplars from the two languages are interconnected in one mental representation. Amengual (2012), for example, tested the VOT production of Spanish-English bilinguals with a hypothesis that cognate status (i.e. lexical items with considerable phonological, semantic, and orthographic overlap) was expected to produce longer VOTs in the production of Spanish words with English cognates, but shorter, more Spanish-like VOTs for non-cognates. His hypothesis was confirmed by the results. He explained that bilinguals may associate two phonologically-similar word representations (cognates) in the same or overlapping exemplar 'cloud'. In their VOT production, the bilinguals in his study could have activated a phonetic target from an exemplar space which included exemplars of both English and Spanish VOTs for the cognate lexical items. That cross-linguistic exemplars could be interconnected is also consistent with transfer effects or merging patterns that have been observed in bilingual production (e.g. Barlow et al., 2013; Kirkham & McCarthy, 2021).

Further, as Pierrehumbert (2001) pointed out, 'frequency is built in to the very mechanism by which memories of categories are stored and new examples are classified' (p. 144), and therefore the exemplar model can be useful in accounting for or to test predictors of bilingual outcomes that are directly or indirectly influenced by frequency effects, such as age of L2 acquisition, language dominance, quantity of input, and proficiency (e.g. vocabulary size), to name a few. More robust representations arising from more numerous exemplars (from being more dominant in or being exposed to one language earlier, for instance) will dominate the production statistics, and will require more experience in the other language to form new/more distinct categories or effect a shift in production patterns.

7.1.2. Applying the exemplar model to the findings of this thesis

7.1.2.1 Explaining variable outcomes in children

It is easy to see the appeal of the exemplar model in accounting for the effects of variable input in early language acquisition. As pointed out by Docherty & Foulkes (2014), the exemplar model does not treat variation as a problem, but rather as 'an inherent property of the speech signal and of the architecture which is deployed in interpreting the many types of information contained within the signal' (p. 46). Because the exemplar-based model posits that phonological knowledge is gradually built from language experience, it readily accommodates input effects. In **Experiment 1**, it was revealed that ethnically Chinese preschoolers released their coda oral stops as frequently as their mothers did. Similarly, in **Experiment 4**, Malay preschoolers who were primarily exposed to coda clear-l in both their English and Malay input had also developed a merged lateral system that favoured coda clear-l. It is worth noting the release of coda oral stop and the use of clear-l were not categorical; Chinese mothers who released their coda stops frequently also produced unreleased stops, and Malay caregivers who produced mostly clear-l also vocalised their coda laterals to some extent. It is the relative frequency of these exemplars that gave rise to a skew in their distributions within the exemplar space. Pierrehumbert (2001) proposed that in both perception and production, representations that are more frequent (represented by more exemplars) and recent are more likely to be activated. Infrequent categories that are represented by less numerous exemplars, by contrast, may result in more variable or less stable representations and production (Bosch & Ramon-Casas, 2011; Levy & Hanulíková, 2019), as is the case of the children in **Experiment 4** who did not exhibit dark-l or l-lessness like their caregivers did because of their infrequent exposure to these forms.

That mental representation is influenced by the frequency of forms in the input is aligned with the proposition that some of the Malay children in **Experiment 4** could have regularised their caregivers' inconsistent use of vocalised-l and dark-l because these forms were presented less frequently and systematically. This may also extend to the children in **Experiment 1**, who generally produced one dominant form of coda stops (unreleased or released), after linguistic factors are considered. Regularisation as a process fits well with exemplar theory as both assume that domain-general learning mechanisms and cognitive abilities underpin language acquisition (Austin et al., 2021, pp. 23-24). In particular, studies on regularisation behaviour have asked whether memory involved in storing linguistic input plays a role in regularisation. Newport (1990), for example, hypothesised that learners with limited memory capacity may regularise inconsistent input because of the difficulty they face in storing and retrieving forms that are used less frequently or inconsistently. This is supported by some evidence that showed that as the complexity of variation in a language increases, even adults begin to regularise in a way similar to young children (Hudson Kam & Chang, 2009; Hudson Kam & Newport, 2009).

A related question that cannot be fully answered in this thesis is why the correspondence between caregiver input and child production attested in **Experiment 1** was not observed in **Experiment 4**, as not all Malay children had vocalised their English coda laterals as frequently as their caregivers did, and that the only input effect that was observed across all Malay children was in their use of English clear-l. One reason as explained above is that because the variation in coda /l/ involves multiple inconsistent forms and is more complex, the Malay children could have regularised more. Another related reason lies in the level of phonetic variation. Whereas **Experiment 1** focused on variation at the subphonemic level (the presence or absence of an audible release), **Experiment 4** involved allophones that require different articulatory targets, and therefore the children could require more evidence in the input for the allophones and contrasts to be acquired, which seems to be the case for those children with close Chinese peers as discussed below. Another reason could be due to the differences in the methodology. Whereas **Experiment 1** compared between the coda stop production of caregiver and child in the same speech style (spontaneous speech), **Experiment 4** compared the children's controlled production in picture card naming with the norms taken from the spontaneous CDS of their caregivers in **Experiment 3**. Further analysis could be conducted to ascertain whether Malay children would exhibit more variability in their use of /l/ in spontaneous speech.

Malay children who had close Chinese peers in **Experiment 4** were significantly more likely to vocalise or delete their coda laterals in English than they did in Malay, thereby approximating Malay adult norms. It was proposed that the categorically l-less model of their Chinese peers could have facilitated their attainment of the adult target, by presenting linguistic input that was more consistently l-less. While it is likely that the mental category for l-lessness in these Malay children was represented by more exemplars than the same category in the other group of Malay children, one question that arises is why this had caused a significant shift in their production patterns, especially since it was not the case that these children had ceased to be exposed to the influence of their caregivers and Malay peers, and therefore should still have maintained a much stronger exemplar representation for clear-l based on overall frequency. A possible explanation could be found in a similar shift in production patterns that has been observed in children who are introduced to a new peer group at the onset of schooling or at the point of relocation (e.g. Kerswill & Williams, 2000; Mayr & Montanari, 2015). Docherty & Foulkes (2014, p. 52) explained that the information present within the speech signal could be skewed or moderated by an individual's pre-existing social constructs and not necessarily reflect the raw statistical properties of the input. Foulkes (2010, pp. 28–29; also see Pierrehumbert, 2006) added that language experience can also be mediated by factors such as attention and saliency. He explained that although exemplars derived from caregiver input carry most weight initially, the social importance of exemplars derived from peer interaction may become more influential in the child's language development, despite them being presented in smaller quantity. In the case of the Malay preschoolers, there is also an increased saliency brought about by their increasing awareness of racial or ethnic differences (Quintana, 1998), and these include their accent features. How these 'signal-independent' factors moderate the intake of phonetic input and shape representations in the exemplar store remain as questions to be explored in exemplar theory (Foulkes & Hay, 2015, p. 307).

7.1.2.2 Explaining variation in perception and production of adults

Since the exemplar model focuses on the development of phonological knowledge from individual experiences with language use, Docherty & Foulkes (2014, p. 48) pointed out that even within the same speech community individuals will differ in their exposure to patterns of phonetic variation, and therefore it cannot be assumed that speakers of the same language or variety are operating on the basis of identical phonological knowledge. The observed inter-adult variation in the perception of listeners in the matched-guise task (**Experiment 2**) and in the production of Malay caregivers (**Experiment 3**) supports this point, and again can be adequately accounted for by the model.

Perception studies have indeed shown that, because individuals experience the sociolinguistic world differently, form-meaning connections between phonological knowledge and indexical information are not created and reinforced in the same way for all, even if they belong to the same community (e.g. Agha, 2003; Campbell-Kibler, 2008; Johnstone & Kiesling, 2008). Similarly, in **Experiment 2**, it was revealed that although the three variants of /l/ in SgE were imbued with exceptionally rich social and cultural significance, listeners had different and sometimes conflicting evaluations, which were explained to be shaped by their experiences with the complex sociolinguistic reality or a lack thereof. This interpretation, and more generally the past findings on individual variation in the evaluation of phonetic features, are highly congruent with the propositions of usage-based models. In particular, not only did the open-ended responses in **Experiment 2** exemplify the intertwinement of linguistic and socio-indexical information, but they also revealed that the subjective interpretations of the variants were based on listeners' past episodic memories with the variants: for those who had infrequent experiences with variants other than the ones used by themselves, the guises activated exemplars of very specific people or social types (e.g. "Reminds me of my Chinese colleague"; "*nasi briyani* auntie"). By contrast, those who were exposed to considerably more exemplars of the variants by the different sub-group of users and in wide-ranging contexts would have formed a greater number of and more complex links with real-world referents, and therefore could draw broader generalisations across these exemplars (e.g. "Malay-dominant Malays"; "I think it is typical of Chinese people"). There are yet some others who had severely limited exposure, and for these listeners, the closest matching exemplars could be related to some phonetic attributes of the laterals; the guises of clear-l, for instance, could have activated exemplars of retroflex consonants used by Indian Singaporeans that were more familiar to these listeners (e.g. "The way Indian…speaks has a certain twang and slang to it."). Above such individuality, however, some experiences are more communal and regimented by widely-circulating metapragmatic practices, and therefore towards these speech forms listeners may share a common interpretation—the unanimously positive evaluations of dark-l by listeners in **Experiment 2** is one such example.

In **Experiment 3**, two main reasons were proposed to explain why Malay mothers but not fathers used darker coda /l/ and/or vocalised-l in their CDS in literary contexts: (1) Malay women's potentially more complex repertoire range, and (2) gender roles and cultural expectations of mothers' dominant role in child-rearing. The observed variability in speech performance can again be explained by the exemplar-based approach. Despite the Malay caregivers having been exposed to largely the same input by being members of the same ethnic community and having been through the same education system, the differences in their repertoires could have been a result of their differential attention towards English speech forms that index social prestige. It was previously mentioned that sensitivity to the statistical properties of the signal-dependent information (that is, the information present within the speech signal) can be moderated by signal-independent information (Docherty & Foulkes, 2014, pp. 51–52). Foulkes & Docherty (2006, p. 431), for example, explained that the emerging awareness of gender roles may lead boys to pay greater attention to input sourced from other male speakers, even if the male tokens are overall less frequent than female tokens. In the same way, Malay women's yearning for greater social mobility and higher educational/career aspirations (Cavallaro & Serwe, 2010; Mutalib, 2012), in addition to their more positive attitude towards the use of English and their stronger affiliation to the English-speaking culture than fathers, could have led them to be more attuned to features of social prestige in their English input than men, thereby developing denser exemplar representations and establishing stronger socio-indexical patterning between the prestige forms and their semiotic connections to education, status and formality in their mental categories. Their greater access to these forms (by means of activation), coupled with the social pressures that Malay women have as the role model and teacher of language at home, could have created a far greater 'bias' on the sampling of the exemplar space for Malay mothers than fathers to use a variant that they thought was most sociophonetically appropriate in literary contexts, i.e., dark-l.

Limitations, Future Work, and Final Remarks

In addition to the experiment-specific limitations raised in the preceding chapters, there are some that pertain to the scope of this thesis, and these are highlighted below to inform future research.

Due to constraints of thesis length and time, only two of the many phonological features that were included in the speech corpus (Chpt. 2) have been extensively investigated/examined in the main analyses. The investigations herein have also dealt with segmental features, as with the bulk of past studies on input variability (see §1.3), and therefore a priority is to examine input effects on prosodic development. A preliminary, small-scale study that examined the phonetic variation in pitch scaling between Chinese and Malay children in the present corpus revealed similar input effects to those described above. Sim & Post (2021b), using the data from the information gap activity in the corpus, tested the effects of EMT and language dominance on pitch scaling in the English of three English-dominant English-Chinese bilinguals (average English use: 85%), three English-dominant English-Malay bilinguals (average English use: 82%), and three English-Malay bilinguals who were more Malay-dominant than (average Malay use: 38%). The production patterns of their mothers were also analysed. Initial findings suggest that the children's production patterns were influenced more by quality of input (i.e. EMT, patterns in maternal input) than by language dominance (i.e. input quantity). The lack of differences between the two groups of Malay children show that cross-linguistic interactions and quantity of input cannot fully explain variable outcomes in bilinguals, and that input quality plays a crucial role, supporting the key findings of **Experiments 1** and **4**.

Another potential area for future research is whether and how variation in CDS is moderated by the sociolinguistic salience of the phonological features, especially since the features in the speech corpus, and in fact all the innovative features of SgE more generally, are likely to differ in their salience. Sociolinguistic salience has been defined as the 'property of a spoken form which causes listeners to respond to the form in such a way as to indicate that it encodes information about the (presumed) social characteristics and/or geographical origins of the speaker' (Llamas et al., 2016, p. 2). Because of their strong links with social identities as described in **Experiment 2**, variants of /l/ in SgE can be argued to be relatively more salient to Singaporeans than other innovations of SgE such as the vowel inventory, which has been shown to be largely similar across ethnic groups (Deterding, 2007a). This begs many questions: for example, it was mentioned above that, according to the exemplar model, the information present within the speech signal could be moderated by factors such as attention and saliency. It is unclear whether adults are also sensitive to alternative forms of phonological features that less or non-salient to members of the speech community (or 'indicators' in Labov's [1991] taxonomy). One example is the tense–lax vowel distinctions that are present in other established standard varieties of English but are typically diminished or absent in SgE across speakers. This raises another question, and that is whether features that are less salient are treated differently in CDS; for example, less salient phonological features may be expected to be more invariable between and within ADS and CDS (e.g. Smith et al., 2013).

Another factor that merits further scrutiny are the effects of SES, education and language dominance. The caregivers in the speech corpus analysed here were educated (96 out of 109 [88%] had at least a Bachelor's degree), from mid to higher socio-economic status (SES), and who were English dominant, fairly proficient in English, and/or who used English with their children more often than their ethnic mother tongues (EMT). Although this bias did not pose a problem to the studies herein because these were confounders that had to be controlled to isolate input effects, as a consequence much less is known about the input variability and input effects that may exist in the under-represented population. In particular, previous studies on SES (which typically comprises education level) have shown that SES has an indirect impact on the input children receive especially in other language domains such as vocabulary and grammar: high-SES children generally receiving more input and higher-quality (e.g. more word tokens and word types; greater syntactic diversity; more complex sentences) than lower-SES children (Hoff, 2006; Schwab & Lew-Williams, 2016). Whether, how and why SES and language dominance of caregivers moderate input quality and the rate and outcomes of early phonological acquisition could be an avenue to be explored.

Finally, the focus of the thesis has been on the impact of (sociolinguistic) variation in caregiver input on early phonological acquisition and not on the acquisition of sociolinguistic variation in children, and therefore the natural continuation of the work in this thesis is to answer some key issues that remain to be addressed in the latter line of inquiry (Chevrot & Foulkes, 2013, pp. 252–253). These include, for instance, the appearance of adult-like sociolinguistic patterns during development (e.g. at what age will Malay children acquire the use dark-l, and when will stylistic patterns of use of variants of /l/ emerge? How and when do knowledge of the complex socio-indexical meanings associated with the various variants of /l/ as observed in **Experiment 2** emerge?), the motor of acquisition (e.g. is acquisition guided by the awareness of social issues such as norms or identity, or is it based on the statistical learning of implicit patterns encountered in the environment?), and the relationship between peers, teachers and the acquisition of sociolinguistic variation.

Investigations into early language acquisition in linguistically, culturally, and ethnically diverse settings like this one offer an important perspective on language acquisition and development, by bringing to the fore the sociological-cognitive issues and concerns that underpin the role of language as a social and cultural tool. Especially in such contexts, it appears insufficient to describe phonological acquisition merely in terms of the learning of discrete, invariant phonological categories or phonemic contrasts of their varieties of languages, or in terms of the extent to which a developing child conforms to normative expectations; due attention has to be paid to the individualities in their phonological knowledge and (socio)linguistic repertoire that arise from the exposure to highly variable input and also from the negotiation of their personal, complex social world that is constantly evolving. This thesis has only scratched the surface of this enterprise by revealing some of the complexity in the linguistic and social information that is present in the input of caregivers and others in such heterogeneous communities, and its direct effects on the production on the preschoolers; there is certainly much left to be explored.

Description of adult and child participants by family

ID	Age			Gender of child	BLP score			Age of acquisition (years)						SES	Child language use (%)		Vocabulary score		
								M		F		C							
	M	F	C (Mths)		M	F	Diff.	Eng.	EMT	Eng.	EMT	Eng.	EMT		Eng.	EMT	Eng.	EMT	Total
C1	33	34	38	F	108.706	108.068	0.638	0	0	0	0	0	1;0	26	81	11	872	470	1342
C15	31	29	28	F	107.344	140.76	33.416	0	4	0	0	1;0	2;0	20	89	4	645	11	656
C16	35	39	73	M	93.808	132.494	38.686	0	2	0	5	1;0	4;0	22	84	14	1152	104	1256
C17	38	40	53	M	3.456	101.982	98.526	3	0	0	0	0	0	21	79	8	860	108	968
C18	38	41	32	F	129.682	123.324	6.358	0	5	0	0	0	0	25	96	3	843	180	1023
C20	31	41	56	M	91.088	109.978	18.89	0	4	0	0	0	1;6	28	83	6	1136	697	1833
C24	31	30	34	F	57.218	47.138	10.08	2	0	0	0	0	0	19	79	20	885	158	1043
C28	31	31	33	F	102.53	84.734	17.796	0	7	0	0	0	2;0	21	88	10	689	61	750
C3	38	37	36	F	-58.664	-61.846	3.182	5	0	4	0	1;6	0	23	11	82	216	434	650
C30	33	34	48	F	68.746	66.206	2.54	0	0	0	0	0	0	22	71	28	1226	681	1907
C31	28	33	36	F	20.888	31.608	10.72	0	0	5	0	2;0	0	19	74	25	932	395	1327
C35	34	37	47	M	150.838	79.098	71.74	0	5	4	0	1;0	2;0	23	89	10	966	51	1017
C38	33	34	31	F	144.934	107.978	36.956	0	3	0	2	0	0;6	25	87	9	590	36	626
C39	30	37	45	F	107.434	3.726	103.708	0	0	7	4	0	0	24	85	8	811	272	1083
C43	28	38	50	M	-2.45	-39.772	37.322	4	0	5	0	0	0	19	40	51	1158	1222	2380
C44	30	32	27	F	56.49	85.188	28.698	4	7	0	0	0	0	20	74	4	1150	316	1466
C46	36	36	37	F	129.136	104.254	24.882	0	3	0	0	0	2;8	21	85	7	854	16	870
C47	37	37	47	M	106.256	151.562	45.306	0	0	0	0	0	1;0	31	92	4	1098	239	1337
C5	33	33	45	F	31.338	83.916	52.578	0	0	0	0	0	0	23	78	18	734	453	1187
C50	31	33	32	M	75.286	44.594	30.692	0	4	3	0	2;0	1;0	16	72	25	327	177	504
C51	33	37	33	M	49.13	57.302	8.172	4	0	5	0	0	0	18	69	25	535	252	787
C52	38	44	42	M	20.888	3.088	17.8	7	0	7	0	3;0	2;0	23	38	55	764	700	1464
C54O	35	37	67	F	75.924	166.184	90.26	4	0	0	0	1;6	2;6	27	92	4	1117	0	1117

C54Y	35	37	33	M	75.924	166.184	90.26	4	0	0	0	1;6	2;6	27	91	4	636	0	636
C55	41	44	32	M	65.204	10.356	54.848	0	0	5	4	0	0	23	76	14	954	422	1376
C56	36	36	71	M	64.662	36.506	28.156	6	0	0	0	0	1;0	23	85	13	829	72	901
C58	32	34	32	M	86.55	79.016	7.534	0	4	0	–	0	0	25	93	2	869	155	1024
C60	34	37	31	F	65.39	84.186	18.796	0	0	0	0	1;3	1;8	26	79	18	497	130	627
C61	37	39	31	M	87.638	42.14	45.498	0	2	0	0	0	1;6	21	87	5	785	20	805
C65	37	43	29	M	50.314	80.734	30.42	0	2	6	4	0	0	23	75	19	727	276	1003
C69	30	32	25	M	7.088	28.608	21.52	4	0	6	5	0	0	22	15	75	227	334	561
C7	33	39	49	F	19.894	79.012	59.118	5	0	0	0	0	0	23	26	67	804	559	1363
C71	37	39	27	F	9.086	-1.632	10.718	2	0	4	2	0	0	23	84	12	533	2	535
C74	37	39	54	F	114.426	63.94	50.486	0	0	0	0	0	0	26	91	8	946	545	1491
C75	32	34	50	M	72.654	38.688	33.966	0	3	0	5	0	1;0	20	44	53	954	828	1782
C9	33	31	39	M	82.28	102.348	20.068	0	6	0	0	0	0	21	84	14	1027	153	1180
M10	29	32	38	M	127.774	36.422	91.352	0	0	0	0	0	0	17	90	9	1219	255	1474
M11	36	36	68	M	87.274	147.66	60.386	0	4	5	7	0	0	25	83	6	1170	238	1408
M15	33	31	62	M	47.044	-34.05	81.094	0	0	5	0	0	0	22	71	25	798	471	1269
M16	31	33	76	M	49.134	18.258	30.876	0	0	4	0	0	0	16	70	28	1191	1198	2389
M17	35	36	59	M	60.762	61.032	0.27	0	0	0	0	0	2;0	21	86	11	1021	237	1258
M18	33	35	67	M	56.218	37.15	19.068	0	0	5	0	0	0	24	77	23	1225	991	2216
M2	32	34	52	M	45.228	10.356	34.872	0	0	0	0	3;0	0	20	85	13	638	69	707
M21	35	37	72	F	-30.778	-17.706	13.072	5	0	5	0	2;0	1;0	24	47	51	1189	1210	2399
M6	31	37	61	M	-8.348	-32.236	23.888	7	3	5	4	2;0	1;6	23	61	39	1122	967	2089
M7	30	32	54	M	68.57	46.324	22.246	0	0	0	0	0	0	21	87	12	1133	229	1362
M8	32	31	58	M	72.202	75.47	3.268	2	0	0	5	0	1;0	19	86	8	1224	163	1387
M9	31	32	37	F	34.332	57.396	23.064	0	0	5	0	0	0	20	74	23	605	163	768
Mi1	31	33	44	M	11.354	-65.2	76.554	0	0	5	0	0	0	23	56	43	1202	1024	2226
Mi16	30	29	26	F	55.764	46.682	9.082	0	0	3	2	0	0	18	47	48	451	277	728
Mi19	30	32	39	F	24.16	5.72	18.44	4	0	6	0	0	0	22	68	27	651	13	664
Mi2	34	35	52	F	34.608	35.24	0.632	5	0	6	0	0	0	25	62	35	1127	854	1981

Mi21	32	34	58	F	-1.362	21.342	22.704	3	0	0	0	0	0	16	62	37	1121	887	2008
Mi23	32	34	42	F	48.224	15.164	33.06	0	0	0	0	0	3;0	22	78	22	656	48	704
Mi9	30	34	36	F	-28.79	-143.026	114.236	5	0	5	0	0	0	18	43	48	347	166	513
T3	31	29	27	M	75.2	55.22	19.98	5	0	5	4	0	0	19	89	5	756	-	-

Note: ID that begins with C = ethnically Chinese family (except for father of family C58, who is ethnically Indian), M/Mi = Malay, T = Indian.
M = Mother, **F** = Father, **C** = Child, **BLP** = Bilingual Language Profile, **Eng.** = English, **EMT** = Ethnic Mother Tongue, **SES** = Socioeconomic status

Consent

This survey was created with support from the Center for Open Educational Resources and Language Learning at the University of Texas at Austin to better understand the profiles of bilingual speakers in diverse settings with diverse backgrounds.

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Introduction

This is a survey on language background and use by Singaporeans. You will be asked to answer a few questions concerning your language history, use, proficiency, and attitudes. The survey consists of 19 questions and will take less than 10 minutes to complete. This is not a test, so there are no right or wrong answers. Please answer every question and give your answers sincerely, as only this will guarantee the success of the investigation.

Confidentiality

The data collected will be identified by the Participant Code assigned to you, password protected and kept in a secure location only accessible by the researcher. Personal data will also be encrypted. The data will be kept strictly confidential; they will not be used or made available for any purposes other than the research project. If needed, only data that will not lead to the identification of any participant will be shared with other researchers, published in scientific journals or presented at conferences, and this will also be done entirely anonymously. There is no foreseeable risk or discomfort resulting from this study. At any point in time, you may withdraw any part of the data from the study, or withdraw from the study altogether, without giving any reason. You may do so by contacting the researcher via email at **[Email redacted]**.

Retention and destruction of data

In line with University policy, data will generally be kept till the completion of the project + 10 years. After this, it will be destroyed.

Clicking NEXT signifies the agreement and consent to the use of your data under the terms described above.

(Note: This is a hardcopy of the survey. ‘Language’ is either ‘Mandarin Chinese’, ‘Malay’ or ‘Tamil’, depending on the ethnic mother tongue spoken by the adult participant.)

II. Language history

In this section, we would like you to answer some factual questions about your language history by placing a check in the appropriate box.

1. At what age did you **start learning** the following languages?

English

☐ Since birth ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 ☐ 17 ☐ 18 ☐ 19 ☐ 20+

Language

☐ Since birth ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 ☐ 17 ☐ 18 ☐ 19 ☐ 20+

2. At what age did you **start to feel comfortable** using the following languages?

English

☐ As early as I can remember ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 ☐ 17 ☐ 18 ☐ 19 ☐ 20+ ☐ not yet

Language

☐ As early as I can remember ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 ☐ 17 ☐ 18 ☐ 19 ☐ 20+ ☐ not yet

3. How many years of **classes (grammar, history, math, etc.)** have you had in the following languages (primary school through university)?

English

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 ☐ 17 ☐ 18 ☐ 19 ☐ 20+

Language

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 ☐ 17 ☐ 18 ☐ 19 ☐ 20+

4. How many years have you spent in a **country/region** where the following languages are spoken?

English

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 ☐ 17 ☐ 18 ☐ 19 ☐ 20+

Language

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 ☐ 17 ☐ 18 ☐ 19 ☐ 20+

5. How many years have you spent in a **family** where the following languages are spoken?

English

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 ☐ 17 ☐ 18 ☐ 19 ☐ 20+

Language

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 ☐ 17 ☐ 18 ☐ 19 ☐ 20+

6. How many years have you spent in a **work environment** where the following languages are spoken?

English

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 ☐ 17 ☐ 18 ☐ 19 ☐ 20+

Language

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 ☐ 17 ☐ 18 ☐ 19 ☐ 20+

III. Language use

In this section, we would like you to answer some questions about your language use by placing a check in the appropriate box. Total use for all languages in a given question should equal 100%.

7. In an average week, what percentage of the time do you use the following languages **with friends**?

	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
English	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Language	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Other languages	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

8. In an average week, what percentage of the time do you use the following languages **with family**?

	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
English	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Language	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Other languages	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

9. In an average week, what percentage of the time do you use the following languages **at school/work**?

	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
English	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Language	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Other languages	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

10. When you talk to yourself, how often do you **talk to yourself** in the following languages?

	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
English	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Language	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Other languages	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

11. When you count, how often do you **count** in the following languages?

	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
English	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Language	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Other languages	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

IV. Language proficiency

In this section, we would like you to rate your language proficiency by giving marks from 0 to 6.

	0=not well at all						*6=very well*
12. a. How well do you speak **English**?	☐0	☐1	☐2	☐3	☐4	☐5	☐6
b. How well do you speak **Language**?	☐0	☐1	☐2	☐3	☐4	☐5	☐6
13. a. How well do you understand **English**?	☐0	☐1	☐2	☐3	☐4	☐5	☐6
b. How well do you understand **Language**?	☐0	☐1	☐2	☐3	☐4	☐5	☐6
14. a. How well do you read **English**?	☐0	☐1	☐2	☐3	☐4	☐5	☐6
b. How well do you read **Language**?	☐0	☐1	☐2	☐3	☐4	☐5	☐6
15. a. How well do you write **English**?	☐0	☐1	☐2	☐3	☐4	☐5	☐6
b. How well do you write **Language**?	☐0	☐1	☐2	☐3	☐4	☐5	☐6

V. Language attitudes

In this section, we would like you to respond to statements about language attitudes by giving marks from 0-6.

	0=disagree						*6=agree*
16. a. I feel like myself when I speak **English**.	☐0	☐1	☐2	☐3	☐4	☐5	☐6
b. I feel like myself when I speak **Language**.	☐0	☐1	☐2	☐3	☐4	☐5	☐6
17. a. I identify with an **English-speaking** culture.	☐0	☐1	☐2	☐3	☐4	☐5	☐6
b. I identify with a **Language -speaking** culture.	☐0	☐1	☐2	☐3	☐4	☐5	☐6
18. a. It is important to me to use (or eventually use) **English** like a native speaker.	☐0	☐1	☐2	☐3	☐4	☐5	☐6
b. It is important to me to use (or eventually use) **Language** like a native speaker.	☐0	☐1	☐2	☐3	☐4	☐5	☐6
19. a. I want others to think I am a native speaker of **English**.	☐0	☐1	☐2	☐3	☐4	☐5	☐6
b. I want others to think I am a native speaker of **Language**.	☐0	☐1	☐2	☐3	☐4	☐5	☐6

Child Language Experience Survey

All information collected will be kept confidential and secure.

Participant no.:
Date:

INSTRUCTIONS AND NOTES:

- Please check the boxes and fill in the blanks as appropriate.
- When asked about **"language"** spoken, please specify the **specific variety** you are referring to. For example: *Sg English/SgE, Sg Hokkien, Sg Mandarin, Sg Malay, M'sia Malay, Brit English, US English, Filipino English.*
- The '**dominant**' language is the one that is usually the one uses most frequently/comfortably, is most proficient in, and identifies with its culture most.
- When asked about "% of time", please give a rough estimate.

0 GENERAL INFORMATION ABOUT THIS CHILD

This child's date of birth: ____

This child's gender: ____

Your relationship to this child:

☐ Mother
☐ Father
☐ Other ____

Does this child have any known developmental disorders or speech / hearing problems?

☐ No
☐ Yes. Please specify: ____

Please list the languages the child knows/speaks and the age they started learning it. On average, how much % of the time does he/she hear this language at home?

Language / variety	Age of acquisition	% of the time (total should add up to 100%)

Do you send this child to a childcare centre / preschool?

☐ No
☐ Yes

If **yes**, date when child commenced childcare / preschool ______

How frequently? ______ times a week, ______ hours per session

What main language(s) / variety(s) do the **three main** caregivers at the centre know/speak? (If you are unsure, you may write their ethnicity). Their **most dominant language should come first.**

Main caregiver 1			
Main caregiver 2			
Main caregiver 3			

What language(s) do the caregivers at the centre speak to this child, and how many % of the time?

Language / variety	% of the time (total should add up to 100%)

Has this child attended any language classes (including lessons in childcare centre/preschool)?

☐ No
☐ Yes

If **yes**,

For which language / variety	For how long has it been (in months)	How frequent are the classes per week (in hours)

---

2 CHILD'S LANGUAGE EXPERIENCE

PARENTS (Note: This section repeats for father)

Mother's Interactions with this child

Generally, what language(s) do you speak to this child and how many % of the time?

Language / variety % of the time (total should add up to 100%)

On average, how many **hours each week** do you spend with this child that will involve interaction and communication?

When speaking to **other adults** (including your spouse and others in this family), **but with this child around**, what language(s) do you use that this child hears, and how many % of the time?

Language / variety % of the time (total should add up to 100%)

On average, how many **hours each week** does this child **hear such indirect speech?**

Generally, what language(s) does this child use to speak to you, and how many % of the time?

Language / variety % of the time (total should add up to 100%)

Mother's specific Interactions with this child

What language(s) do you speak to this child when doing activities that involve **play and routine** (e.g. playtime, bathing time, dressing up, shopping) and how many % of the time?

Language / variety % of the time (total should add up to 100%)

What language(s) does this child use to speak to you when doing activities that involve **play and routine**, and how many % of the time?

Language / variety % of the time (total should add up to 100%)

On average, how many **hours each week** do you spend with this child doing activities that involve **play and routine**?

What language(s) do you speak to this child when doing activities that involve **teaching and discipline** (e.g. reading a book, teaching the child how to count, educating the child), and how many % of the time?

Language / variety % of the time (total should add up to 100%)

What language(s) does this child use to speak to you when doing activities that involve **teaching and discipline**, and how many % of the time?

Language / variety % of the time (total should add up to 100%)

On average, how many **hours each week** do you spend with this child doing activities that involve **teaching and discipline**? [ ]

GRANDPARENTS (Note: This section repeats for all grandparents)

Maternal grandmother's interaction with this child *(if applicable)*

What main language(s) / variety(s) does this grandparent know/speak? Her **most dominant language should come first.**

[ ] [ ] [ ]

How often does this grandparent see this child?

- ☐ Every day
- ☐ At least once a week
- ☐ At least once a month
- ☐ Less than once a month

Generally, what language(s) does this grandparent speak to this child and how many % of the time?

Language / variety	% of the time (total should add up to 100%)

On average, how many **hours each <u>month</u>** does this grandparent spend with this child that will involve interaction and communication? [ ]

When speaking to **other adults** (including your spouse and others in this family), **but with this child around**, what language(s) does this grandparent use that this child hears, and how many % of the time?

Language / variety	% of the time (total should add up to 100%)

On average, how many **hours each <u>month</u>** does this child **hear** such indirect speech? [ ]

Generally, what language(s) does this child use to speak to this grandparent and how many % of the time?

Language / variety % of the time (total should add up to 100%)

OTHER SIGNIFICANT ADULTS
(Note: Mothers can provide details for up to three other significant adults)

Other adults who spend considerable time with the child *(if applicable only, including helpers, family friends and other caregivers, but excluding day-care and preschool).*

What is the relationship of this adult to the child?

Does this adult live with your family?

☐ Yes
☐ No

What main language(s) / variety(s) does he/she know/speak? His/her **most dominant language should come first.**

Generally, what language(s) does he/she speak to this child, and how many % of the time?

Language / variety % of the time (total should add up to 100%)

On average, how many **hours each week** does this adult spend with this child that will involve interaction and communication?

When speaking to **other adults** (including those in this family), **but with this child around**, what language(s) does he/she use that this child hears, and how many % of the time?

Language / variety % of the time (total should add up to 100%)

On average, how many **hours each week** does this child **hear such indirect speech?**

Generally, what language(s) does this child use to speak to this adult, and how many % of the time?

Language / variety % of the time (total should add up to 100%)

SIBLINGS

This child's interaction with his/her sibling(s) *(if applicable)*

What main language(s) / variety(s) does his/her sibling(s) know/speak? Their **most dominant language should come first.**

Sibling 1 (Age (**Y**;**M**):)

Sibling 2 (Age (**Y**;**M**):)

Generally, what language(s) do they speak to this child, and how many % of the time?

Language / variety % of the time (total should add up to 100%)

On average, how many **hours each week** do they spend with this child that will involve interaction and communication?

When speaking to **other adults** (including those in this family), **but with this child around**, what language(s) do they use that this child hears, and how many % of the time?

Language / variety % of the time (total should add up to 100%)

On average, how many **hours each week** does this child **hear such indirect speech?**

Generally, what language(s) does this child use to speak to his/her sibling(s), and how many % of the time?

Language / variety % of the time (total should add up to 100%)

PEERS

This child's interaction with his/her <u>closer</u> friends OR other <u>significant</u> children *(These children are those that spend much time with this child and have considerable influence over this child.)*

What main language(s) do the **three closest friends/children** know/speak? (If you are unsure, you may write their ethnicity). Their **most dominant language should come first.**

Close friend / child 1 (Age (**Y;M**))
Close friend / child 2 (Age (**Y;M**))
Close friend / child 3 (Age (**Y;M**))

Generally, what language(s) do they speak to this child, and how many % of the time?

Language / variety % of the time (total should add up to 100%)

On average, how many **hours each week** do they spend with this child that will involve interaction and communication?

Generally, what language(s) does this child use when interacting with them, and how many % of the time?

Language / variety % of the time (total should add up to 100%)

WITH SELF AND EXPOSURE TO MEDIA

This child's self-interaction

What language(s) does this child use when playing with imaginary friends / toys / role playing / speaking to oneself, and how many % of the time?

Language / variety % of the time (total should add up to 100%)

On average, how many **hours each week** does this child spend interacting with oneself?

Exposure to media

What language(s) is this child exposed to when he/she uses media (e.g. watching the TV, playing games on the mobile phone, watching YouTube videos), and how many % of the time? (Note: American and British English are available as options in the dropdown list)

Language / variety % of the time (total should add up to 100%)

On average, how many **hours each week** does this child use media?

3 CHILD'S LANGUAGE PROFICIENCY

(Fill in the blanks with the language(s) / variety(s) that this child knows)

Speaking

How well does this child speak ☐ relative to other children?

0 (not well at all) **6** (very well)

☐ ☐ ☐ ☐ ☐ ☐

How well does this child speak ☐ relative to other children?

0 (not well at all) **6** (very well)

☐ ☐ ☐ ☐ ☐ ☐

How well does this child speak ☐ relative to other children? (*if a trilingual*)

0 (not well at all) **6** (very well)

☐ ☐ ☐ ☐ ☐ ☐

Understanding

How well does this child understand ☐ relative to other children?

0 (not well at all) **6** (very well)

☐ ☐ ☐ ☐ ☐ ☐

How well does this child understand ☐ relative to other children?

0 (not well at all) **6** (very well)

☐ ☐ ☐ ☐ ☐ ☐

How well does this child understand ☐ relative to other children? *(if a trilingual*)

0 (not well at all) **6** (very well)

☐ ☐ ☐ ☐ ☐ ☐

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4 CHILD'S LANGUAGE ATTITUDES

(Fill in the blanks with the language(s) / variety(s) that this child knows)

Identification with x-speaking culture

How much does this child identify with a ______________ -speaking culture?

0 (not at all) **6** (very much)

☐ ☐ ☐ ☐ ☐ ☐

How much does this child identify with a ______________ -speaking culture?

0 (not at all) **6** (very much)

☐ ☐ ☐ ☐ ☐ ☐

How much does this child identify with a ______________ -speaking culture? (*if a trilingual)*

0 (not at all) **6** (very much)

☐ ☐ ☐ ☐ ☐ ☐

Preferences

In general, how much does this child prefer ______________ ?

0 (not at all) **6** (very much)

☐ ☐ ☐ ☐ ☐ ☐

In general, how much does this child prefer ______________ ?

0 (not at all) **6** (very much)

☐ ☐ ☐ ☐ ☐ ☐

In general, how much does this child prefer ______________ ? *(if a trilingual)*

0 (not at all) **6** (very much)

☐ ☐ ☐ ☐ ☐ ☐

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5 GENERAL INFORMATION ABOUT YOU AND YOUR FAMILY

(Note: This section repeats for father)

Mother's education

What is your highest level of formal education? (or the current level of formal education, if you are a student)

- ☐ Secondary
- ☐ Junior College / Polytechnic / ITE
- ☐ Bachelor's degree
- ☐ Postgraduate (Diploma, having completed a Bachelor's degree)
- ☐ Postgraduate (Masters, PhD)
- ☐ Other ______

Mother's occupation

What is your age? ______

What is your employment status?

- ☐ Self-employed
- ☐ Employee
- ☐ Employer
- ☐ Student
- ☐ Other ______

If **not** a student,

What is your designation/job title? ______

Are you in a managerial/supervisorial role?
- ☐ No
- ☐ Yes

Briefly, what do you do in your job?

______

INFORMATION ABOUT YOUR FAMILY

How many computers (including laptops and tablets, but not including game consoles and smartphones) does this family own?

- ☐ None
- ☐ One
- ☐ Two
- ☐ More than two

Does this family own a car or another motorised vehicle?

- ☐ None
- ☐ One
- ☐ Two or more

How many times did you and your family travel out of Singapore for holiday / vacation (excluding one-day trips to nearby countries) last year?

- ☐ Not at all
- ☐ Once
- ☐ Twice
- ☐ More than twice

What type of home does this child live in?

- ☐ HDB – 2-room flat or similar
- ☐ HDB – 3-room flat
- ☐ HDB – 4-room flat
- ☐ HDB – 5-room flat / maisonette or bigger
- ☐ Private condominium
- ☐ Terrace / semi-detached / bungalow

Do you pay people from outside the family to work at your home on a regular (that is, on a daily or weekly) basis?

- ☐ Yes
- ☐ No

Vocabulary checklist

Instructions for mothers:

- The list contains English and Chinese (or Malay) words.
- **Only mark words that your child can produce** in meaningful contexts, or when shown a picture of the item, without needing to mimic you. **Do not** mark words that your child knows but cannot produce (e.g. your child may know the concept of “stadium”, or have seen one, but may not know the name for it, or may not know what to say to refer to it”. In this case, do not mark the word).
- **Mark the word even if the child uses a different pronunciation** (e.g. if your child produces “raffle” instead of “giraffe” or “sketti” for “spaghetti”, mark these words).
- Please do not test your child to see what words he/she can produce. It will take an excessively long time to complete if you do so.
- If your child can produce only the English word, mark “1” in the blue “English Only" column. If your child can only produce the Chinese word, mark “1” in the yellow “Chinese (or Malay) Only” column. If your child can produce both, mark the green “Both” column.
- To speed up, use the arrow keys to help you navigate through the columns quickly.
- Save the file frequently to prevent loss of information.
- This test should take around 30 mins, but some parents have reported that they have spent longer on it.

Sample items in the English–Chinese vocabulary checklist:

English word	English only	Both	Chinese only	Chinese word
Action Words				
Change				换
Cough				咳嗽
Dress up				穿衣服 / 装扮 / 打扮

Words from the NUS MB-CDI
(English, Chinese, Malay)

A/an, 一个, satu
Above/on top of/over, 上面, atas / di atas / lebih
After, 过后 / 之后, selepas
Air-conditioner, 冷气机, penghawa dingin
Airplane/Aeroplane, 飞机, kapal terbang / kapal terbang
All, 全部 / 所有, semua
Ambulance, 救护车, ambulans
And, 和, dan
Angry, 生气, marah
Animal, 动物, haiwan
Ankle, 脚腕, buku lali / pergelangan kaki
Another, 多一个 / 另一个, lain
Ant, 蚂蚁, semut
Any, 任何, sembarang
Apple, 苹果, epal
Arm, 手臂, lengan
Around (as in around the vicinity), 周围, sekitar
Asleep, 睡着 / 睡觉, tidur
At, 在, pada / di
Aunt/Aunty, 阿姨 / 姑姑 / 舅妈 / 伯母, makcik / aunty
Awake, 睡醒, bangun
Baby, 宝宝/婴孩/婴儿, bayi
Back/behind, 后面, belakang / belakang
Backside, 屁股, bahagian belakang
Backyard, 后院, belakang rumah
Bad, 坏, buruk
Ball, 球, bola
Balloon, 气球, belon
Banana, 香蕉, pisang
Basket, 篮子, bakul
Bat, 球棒, –
Bath / Shower, 洗澡 / 冲凉, mandian / pancuran
Bathtub, 浴缸, tab mandi
Be (e.g. is, are, am, was, were), 是, ialah (e.g. iaitu, adalah, am, adalah, adalah)
Beads, 珠子, manik
Bear, 熊, beruang
Because, 因为, kerana
Bed, 床, katil
Bedroom, 睡房, bilik tidur
Bee, 蜜蜂, lebah
Before, 之前, sebelum
Belly Button, 肚脐/肚脐眼, pusat
Man, 男人, lelaki
Mandarin orange, 橘子, limau mandarin
Meat, 肉, daging
Medicine, 药剂师, ubat
Melon, 瓜, melon
Microwave, 微波炉, microwave
Milk, 牛奶, susu
Mine/my, 自己的 / 我的, saya
Money, 钱, wang
Monkey, 猴子, monyet
Month, 月, bulan
Moon, 月亮, bulan
Mop, 拖把, pengelap
More/much, 多, lebih lagi / banyak
Morning, 早上, pagi
Mother, 妈妈 / 妈咪, ibu
Motorcycle, 摩托车, motosikal
Mouse, 老鼠, tikus
Mouth, 嘴 / 口, mulut
Movie, 电影, filem / wayang
MRT, 地铁, mrt
Muffin, 松饼, muffin
Myself, 我自己, saya senditi
Nail, 钉子, kuku
Nails, 指甲, kuku
Nap, 休息 / 小睡 / 睡觉, tidur sekajap
Napkin, 餐巾, serbet
Naughty, 坏蛋, nakal
Near, 近, berhampiran
Necklace, 项链, kalung
Need/Need to, 需要, perlu
New, 新, baru
Night, 晚上, malam
No, 没有, tidak
No More, 没有了, tiada ladi
Noisy, 吵, bising
None, 没有, tiada
Noodles, 面, mi
Nose, 鼻子, hidung
Not, 不, tidak
Now, 现在, sekarang
Nurse, 护士, jururawat
Old, 老/旧, tua
On top of, 在。。。上, di atas

Belt, 皮带/腰带, tali pinggang
Bench, 长椅, bangku
Beside/next to, 旁边, di sebelah / bersebelahan
Better, 更好, lebih baik
Bib, 围嘴, bib
Bicycle, 脚踏车 / 脚车, basikal
Big, 大, besar
Bird, 鸟, burung
Biscuit/cookie, 饼干, biskut / kuki
Bite, 咬, gigit
Black, 黑色, hitam
Blanket, 被子, selimut
Block (as in wooden blocks), 积木, blok (seperti dalam blok kayu)
Blow, 吹, tiup
Blue, 蓝色, biru
Boat, 船, bot
Book, 书, buku
Bottle, 瓶子, botol
Bowl, 碗, mangkuk
Box, 盒子, kotak
Boy, 男孩, budak lelaki
Bread, 面包, roti
Break, 打破, pecah / patah
Breakfast, 早餐, sarapan
Bring, 带, bawa
Broken, 破了, pecah
Broom, 扫把, penyapu
Brother, 哥哥 / 弟弟, abang / adik
Brown, 棕色, cokelat
Brush, 刷子, berus
Bubbles, 泡泡, buih
Bucket, 桶, baldi
Bug, 虫, serangga
Build, 建, bina
Bump, 碰, langgar
Burger, 汉堡包, burger
Bus, 巴士, bas
But, 可是 / 但是, tetapi
Butter, 牛油, mentega
Butterfly, 蝴蝶, rama-rama
Button, 钮扣 / 扣子, butang
Buy, 买, beli
Bye, 再见, selamat tinggal
Cake, 蛋糕, kek
Call (on phone), 打 (电话), talipon
Camera, 照相机 / 相机, kamera
Open, 打开, buka
Orange, 橙子, oren
Orange (as in colour), 橙色, oren (seperti dalam warna)
Other, 另外 / 其他, lain
Our, 我们的, kami
Out, 外, keluar
Outside, 外面 / 外头, luar
Oven, 烘炉, ketuhar
Overhead Bridge, 天桥, jejantas
Owl, 猫头鹰, burung hantu
Pajamas, 睡衣, baju tidur
Pancake, 薄煎饼, penkek / lempeng
Panda, 熊猫, panda
Pants/trousers, 长裤, seluar / seluar
Paper, 纸, kertas
Park, 公园, taman
Party, 派对, parti
Pavement, 行人道, jalanan
Peanut butter, 花生酱, mentega kacang
Peanuts, 花生, kacang tanah
Peas, 豆子, kacang pis
Pen, 笔, pena
Pencil, 铅笔, pensil
Penguin, 企鹅, penguin
Person, 人, orang
Pet’s name, 宠物的名字, nama haiwan peliharaan
Petrol Station, 油站 / 加油站 / 车油站, stesen minyak
Pick, 选, pilihkan
Picnic, 野餐, berkelah
Picture, 图画, gambar
Pig, 猪, babi
Pillow, 枕头, bantal
Pizza, 比萨, pizza
Plant, 植物, tumbuhan
Play, 玩, bermain
Play, 玩, bermain
Play Dough, 彩色塑泥, permainan dough
Play Pen, 婴儿围栏, playpen
Playful, 好玩, suka bermain/ suka bergurau
Playground, 游乐场, taman permainan
Please, 请, sila / tolong
Police, 警察, polis
Pool, 游泳池, kolam renang
Poor, 穷, miskin

Can, 罐头, boleh
Can/could, 会 / 可以 / 能, boleh
Candy/sweets, 糖果, gula-gula
Car, 车, kereta
Careful, 小心, berhati-hati
Carrots, 红萝卜, lobak merah
Carry, 抱, membawa
Cat, 猫, kucing
Catch, 接/抓, tangkap
Cereal, 麦片, bijirin
Chair, 椅子, kerusi
Chalk, 粉笔, kapur
Chase, 追, kejar
Cheek, 脸蛋, pipi
Cheese, 奶酪 / 芝士, keju
Chicken, 鸡, ayam
Chicken, 鸡, ayam
Child, 孩子 / 小孩, kanak-kanak
Child's own name, 孩子自己的名字, nama anak sendiri
Chin, 下巴, dagu
Chocolate, 巧克力, coklat
Church / Mosque / Temple, 教堂 / 清真寺 / 庙, gereja / masjid / kuil
Circle, 圆形 / 圆圈, bulatan
Clap, 拍 / 拍手, tepuk tangan
Clean, 打扫, bersih
Clean, 打扫, bersih
Climb, 爬, mendaki
Clock, 时钟, jam
Close (e.g. close your eyes, mouth), 关 / 闭（眼，嘴）, tutup
Closet/cupboard/wardrobe, 柜子/衣橱, almari / almari / almari pakaian
Clouds, 云, awan
Clown, 小丑, badut
Coffee, 咖啡, kopi
Coins, 零钱, syiling
Coke, 可乐, kok
Cold, 冷, sejuk
Comb, 梳子, sikat
Computer, 电脑, komputer
Cook, 煮, masak
Corn, 玉米, jagung
Corridor, 走廊, koridor
Country, 国家, negara
Cover, 盖, tutup
Popcorn, 爆米花, popcorn
Porridge, 粥, bubur
Postman, 邮差, posmen
Potato, 马铃薯, kentang
Potato chip, 薯片, kerepek kentang
Potty, 尿盆, tandas
Pour, 倒, tuangkan
Pram, 婴儿车, pram
Present, 礼物, hadiah
Pretend, 假装, berpura-pura
Pretty/beautiful/nice, 漂亮 / 美, cantik / menarik / elok
Pull, 拉, tarik
Pumpkin, 南瓜, labu
Puppy, 小狗, anak anjing
Push, 推, tolak
Put, 放, letak
Puzzle, 拼图, teka-teki
Quiet, 安静, senyap
Rabbit, 兔子, arnab
Radio, 收音机, radio
Rain, 雨, hujan
Rainbow, 彩虹, pelangi
Raisin, 葡萄干, kismis
Read, 读, baca
Rectangle, 矩形, segi empat tepat
Red, 红色, merah
Rice, 饭, nasi
Ride, 骑, tunggan
Rock/Stone, 石头, batu
Rocking Chair, 摇椅, kerusi goyang
Roof, 屋顶, bumbung
Room, 房间, bilik
Rooster, 公鸡, ayam jantan
Rubbish, 垃圾, sampah
Run, 跑, lari
Sad, 伤心, sedih
Salt, 盐, garam
Same, 一样, sama
Sand, 沙, pasir
Sandwich, 三文治, sandwic
Sauce, 酱, sos
Say, 说, berkata
Scared, 害怕, takut
School, 学校, sekolah
Scissors, 剪刀, gunting
See-Saw, 跷跷板, see-saw

Cow, 牛, lembu
Crayon, 蜡笔, krayon
Crib, 婴儿床, katil bayi / buaian
Crocodile, 鳄鱼, buaya
Cry, 哭, nangis
Cup, 杯, cawan
Cut, 剪 / 切 （菜）, potong
Cute, 可爱, comel
Dance, 跳舞, tari
Dark, 黑暗, gelap
Day, 天, hari
Deer, 鹿, rusa
Diaper/nappy, 尿布 / 尿片, lampin / lampin
Did/do/does, 做, lakukan / buat
Dinner, 晚餐, makan malam
Dinosaur, 恐龙, dinosaur
Dirty, 脏 / 肮脏, kotor
Dish/Plate, 盘 / 碟, hidangan / pinggan
Doctor, 医生, doktor
Dog, 狗, anjing
Doll, 娃娃, anak patung
Don't, 别, jangan
Donkey, 驴, keldai
Door, 门, pintu
Down, 下, turun
Dragon, 龙, naga
Draw/Paint, 画画, lukis / cat
Drawer, 抽屉, laci
Dress/skirt, 裙子, pakaian / skirt
Drink, 喝, minum
Drink, 喝, minum
Drive, 开（车）/ 驾车, pandu
Drop, 掉, jatuh
Dry, 弄干 / 晒干, kering
Dry, 弄干 / 晒干, kering
Dryer, 烘干机 / 干衣机, pengering
Duck, 鸭, itik
Dustbin, 垃圾桶, tong sampah
Each/every, 每个, setiap / setiap
Ear, 耳朵, telinga
Eat, 吃, makan
Egg, 鸡蛋, telur
Elephant, 大象, gajah
Empty, 空, kosong
Eye, 眼睛, mata
Face, 脸, muka
Fall, 跌倒, jatuh
See/Watch (something), 看, lihat / tonton (sesuatu)
Shake, 摇, goncang
Share, 分享, kongsi
Sheep, 羊, kambing biri-biri
Shh/shush/hush, 嘘, shh / diam
Shirt, 衬衫, baju
Shoe, 鞋子, kasut
Shopping, 逛街 / 购物, membeli-belah
Shorts, 短裤, seluar pendek
Shoulder, 肩膀, bahu
Show (as in show you something), 给。。。看, menunjuk (seperti dalam menunjuk sesuatu kepada anda)
Shower, 淋浴头, pancuran
Sick, 生病, sakit
Sing, 唱 / 唱歌, nyanyi
Sink, 水槽, sinki
Sister, 姐姐/妹妹, kakak
Sit, 坐, duduk
Sky, 天 / 天空, langit
Sleep, 睡觉, tidur
Sleepy, 想睡, mengantuk
Slide, 滑, gelongsor
Slide, 滑, gelongsor
Slipper, 拖鞋, selipar
Slow, 慢, lembab / lambat
Small, 小, kecil
Smelly, 臭, berbau
Smile, 笑, senyum
Snack, 零食, snek
Snake, 蛇, ular
Sneaker / running shoes / sports shoes, 球鞋 / 运动鞋, kasut / kasut lari / kasut sukan
So, 所以, jadi
So big!, 很大！/ 真大!, besarnya!
Soap, 肥皂, sabun
Sock, 袜子, stokin / sarung kaki
Sofa, 沙发, sofa
Soft, 软, lembut
Some, 些, sesetengah
Soup, 汤, sup
Soya bean milk, 豆奶, susu soya
Spade, 铲子, pudar
Spaghetti, 意大利面, spageti
Spectacles, 眼镜, cermin mata
Spicy, 辣, pedas

Fan, 风扇, kipas
Fast, 快, cepat
Father, 爸爸, bapa
Feed, 喂, suap / beri makan
Feet/Leg, 脚, kaki
Find, 找, cari
Finger, 手指, jari
Finish, 做完 / 完了, selesai
Fire Engine, 救火车 / 消防车, kereta bomba
Fireman, 救火员, ahli bomba
First, 第一, pertama
Fish, 鱼, ikan
Fish, 鱼, ikan
Fishball, 鱼丸, bebola ikan
Fit (as in the shirt fits me), 适合, fit (seperti dalam baju sesuai dengan saya)
Fix, 修, menetapkan
Flag, 旗, bendera
Flower, 花, bunga
Food, 食物, makanan
Fork, 叉, garpu
French fries, 薯条, kentang goreng
Fridge, 冰箱, peti sejuk
Friend, 朋友, kawan / rakan
Frog, 青蛙, katak
Full, 满 / 饱, penuh
Game, 游戏, permainan
Garden, 花园, taman
Gentle, 温和 / 温柔, lembut
Get, 拿, dapatkan
Giraffe, 长颈鹿, jerapah
Girl, 女孩, perempuan
Give, 给/送, memberi
Glass, 玻璃杯, kaca
Glue, 胶水, gam
Go, 去, pergi
Go out, 出去, keluar
Go potty / poo poo, 尿尿 / 小便 / 拉, pergi tandas
Going to, 要, pergi ke
Good, 好 / 乖, baik
Goodnight, 晚安, selamat malam
Goose, 鹅, angsa
Got to/Have to, 必须, mendapat / perlu
Grandfather, 爷爷 / 公公, datuk
Grandmother, 奶奶 / 外婆 / 婆婆, nenek
Grapes, 葡萄, anggur
Grass, 草, rumput
Spill, 流出 / 漏出, tumpah
Splash, 扑通, percikan
Spoilt, 坏了, pecah
Spoon, 汤匙, sudu
Square, 四方形, persegi
Squirrel, 松鼠, tupai
Stairs, 楼梯, tangga
Stand, 站, berdiri
Star, 星星, bintang
Stay, 留, tinggal / duduk
Stick, 棍子, kayu
Stickers, 贴纸, pelekat
Sticky, 黏, melekit
Stomach, 肚子, perut
Stop, 停, hentikan
Store/Shop, 商店 / 店, kedai / kedai
Story, 故事, cerita
Stove, 火炉, dapur
Strawberry, 草莓, strawberi
Street, 街 / 街道, jalan
Stuck, 卡住, tersangkut
Sun, 太阳, matahari
Sunglasses, 太阳眼镜, cermin mata hitam
Sweep, 扫（地）, sapu
Swim, 游泳, berenang
Swimsuit, 游泳衣, baju renang
Swing, 摇动, hayun
Swing, 摇动, hayun
Table, 桌子, meja
Take, 拿, mengambil
Talk, 讲话, cakap
Taste, 尝, rasa
Teacher, 老师, guru
Tear, 撕, koyak
Tear, 撕, koyak
Teddybear, 玩具熊, anak patung beruang
Telephone, 电话, telefon
Television, 电视机, televisyen
Thank you, 谢谢, terima kasih
That, 那个, itu
The, 那个, yang
Their, 他们的 / 她, mereka
Them/they, 他们 / 她们 / 它们, mereka
Theme Park, 主题公园, taman tema
Then, 就 / 那么, kemudian
There, 那边 / 那儿 / 那里, di sana
These, 这些, ini

Green, 绿色 / 青色, hijau
Green beans, 绿豆, kacang hijau
Hair, 头发, rambut
Hammer, 锤子, tukul
Hamster, 仓鼠, hamster
Hand, 手, tangan
Handphone, 手机, telefon bimbit
Happy, 开心 / 高兴, gembira / bahagia
Hard, 硬, keras
Hat, 帽子, topi
Hate, 讨厌, benci
Have (as in I have...), 有, mempunyai (seperti dalam saya mempunyai ...)
He/it/she/her/him, 他 / 它 / 她, dia / ia
Head, 头, kepala
Hear, 听 / 听见, dengar
Heavy, 重, berat
Helicopter, 直升机, helikopter
Hello/hi, 你好, helo / hi
Help (as in to help someone), 帮助 / 帮忙, bantu / tolong (seperti dalam untuk membantu/menolong seseorang)
Hen, 母鸡, ayam
Here, 这边 / 这儿 / 这里, di sini
Hide, 藏 / 躲, sembunyi
Hide and seek, 捉迷藏, –
High, 高, tinggi
High Chair, 高椅, kerusi tinggi
High-five, –, –
His/hers, 他的 / 她的 / 它的, dia
Hit, 打, pukul
Hold (as in to hold on to something), 拿着, pegang (seperti dalam untuk berpegang kepada sesuatu)
Home, 家, rumah
Hope, 希望, berharap
Horse, 马, kuda
Hose, 软管, hos
Hot, 热, panas
House, 房子 / 屋子, rumah
How, 怎么, bagaimana
Hug, 抱 / 拥抱, peluk
Hungry, 饿, lapar
Hurry, 赶紧 / 快点, tergesa-gesa / cepat
Hurt, 伤害, mencederakan
I/me, 我, saya
Ice, 冰, ais
Ice Cream, 冰淇淋 / 雪糕, ais krim
Think, 想, fikirkan
Thirsty, 渴, dahaga
This, 这个, ini
Those, 那些, itu
Throw, 丢 / 扔, membuang
Tickle, 搔, menggeletek
Tiger, 老虎, harimau
Tights/leggings, 紧身库, bingkap
Tired, 累, penat
Tissue, 纸巾, tisu
Tissue, 纸巾, tisu
To, 到, kepada
Toast, 烤面包, roti bakar
Today, 今天, hari ini
Toe, 脚趾, jari kaki
Toilet, 厕所, tandas
Tomorrow, 明天, esok
Tongue, 舌头, lidah
Tonight, 今晚, malam ini
Too, 也, juga
Tooth, 牙齿, gigi
Toothbrush, 牙刷, berus gigi
Touch, 摸/动, sentuh
Towel, 毛巾, tuala
Toy, 玩具, mainan
Traffic Light, 红绿灯 / 交通灯, lampu isyarat
Train/Choo-Choo Train, 火车, kereta api
Tray, 托盘, dulang
Tree, 树, pokok
Triangle, 三角形, segi tiga
Tricycle, 三轮车, roda tiga
Try, 试 / 试试看, cuba
Turkey, 火鸡, ayam belanda
Turn around, 转过来, pusing
Turtle/Tortoise, 乌龟, penyu / kura-kura
Uncle, 叔叔 / 伯伯 / 舅舅 / 姨丈 / 姑丈, bapa saudara
Under, 底下 / 下面, di bawah
Underwear/underpants, 内裤 / 内衣, seluar dalam
Unicorn, 独角兽, unicorn
Up, 上, ke atas
Us/we, 我们, kami / kita
Vacuum, 吸尘机, vakum
Vegetables, 菜, sayur-sayuran
Vitamins, 维他命, zat / vitamin
Void Deck, 组屋楼下, dek kosong

If, 如果 / 要是, jika
Inside/in/into, 里面, dalam / di / ke dalam
IPad, –, ipad
Iron, 熨斗, besi
Jacket/sweater, 外套 / 冷衣, jaket / sweater
Jar, 罐子 / 玻璃罐, balang
Jeans, 牛仔裤, seluar jeans
Jelly, 果冻, agar-agar
Juice, 果汁, jus
Jump, 跳, lumpat
Kettle, 壶, cerek
Keys, 钥匙/锁匙, kunci
Kick, 踢, tendang
Kiss, 亲(一个) / 吻, cium
Kitchen, 厨房, dapur
Kitten, 小猫, anak kucing
Knee, 膝盖, lutut
Knife, 刀, pisau
Knock, 撞 / 敲, mengetuk
Ladder, 梯子, tangga
Lady, 女人, wanita
Lamb, 小羊, kambing
Lamp, 灯, lampu
Last, 持续, terakhir
Later (as in later than usual), 晚一点 / 迟一点, kemudian (seperti dalam lewat daripada biasa)
Leaf, 叶子, daun
Let me, 让我, biar saya
Lick, 舔, jilat
Light, 灯光, cahaya
Like, 喜欢, suka
Lion, 狮子, singa
Lips, 嘴唇, bibir
Listen, 听, mendengar
Little, 小, kecil / sedikit
Living Room, 客厅, ruang tamu
Lollipop, 棒棒糖, lollipop
Long, 长, panjang
Look, 看, melihat
Lorry, 卡车 / 货车 / 羅里, lori
Loud, 大声, kuat / lantang
Love, 爱, sayang
Lunch, 午餐, makan tengah hari
Maid, 女佣 / 公人, pembantu rumah
Make (e.g. make a cake), 做, membuat (e.g. membuat kek)
Wait, 等, tunggu
Wake, 醒, bangun
Walk, 步, jalan
Walker, 助步车, pejalann kaki
Wallet, 钱包, dompet
Want to, 要, ingin
Wash, 洗, basuh
Washing Machine, 洗衣机, mesin basuh
Watch, 手表, jam tangan
Water, 水, air
Water, 水, air
Watering Can, 喷壶, bekas siraman
Week, 星期 / 礼拜, minggu
Wet, 湿, basah
What, 什么, apa
When, 几时 / 什么时候, bila
Where, 哪里, di mana
Which, 哪个, yang mana
White, 白色, putih
Who, 谁, siapa
Why, 为什么, mengapa
Will/would, 肯, akan
Wind, 风, angin
Window, 窗户 / 窗, tingkap
Windy, 多风 / 风大, berangin
Wipe, 擦 / 抹, lap
Wish, 许愿, ingin
With, 跟, dengan
Wolf, 狼, serigala
Work, 做工, kerja
Work, 做工, kerja
Write, 写, tulis
Year, 年, tahun
Yellow, 黄色, kuning
Yes, 是 / 对, ya
Yesterday, 昨天, semalam
Yogurt, 酸奶 / 酸奶酪, yogurt
You, 你, anda
Your, 你的, anda
Yourself, 你自己, diri sendiri
Yucky, 恶心, menjijikkan
Zebra, 斑马, zebra
Zipper, 拉链, zip
Zoo, 动物园, zoo

Words from the Cambridge English A1 Movers
(English, Chinese, Malay)

(Sports) Field, 操场, lapangan sukan
Address, 地址, alamat
Afraid, （害）怕, takut
Age (as in my age is...), 岁 / 年龄, umur (seperti dalam umur saya ialah ...)
All right, 好的 / 行 / 好吧, baiklah
Along (as in along the river), 沿着, sepanjang (as in sepanjang sungai)
Always, 每次 / 总是, sentiasa
App (as in mobile app), 应用程序, app / aplikasi (seperti dalam aplikasi telefon bimbit)
Balcony, 阳台, balkoni
Band, 乐团, band
Basement, 地下室, tingkat bawah tanah
Be called (e.g. my pet is called 'Milo'), 叫, dipanggil (e.g. haiwan peliharaan saya dipanggil 'milo')
Beard, 胡子, janggut
Below, 下面, di bawah
Best, 最好, terbaik
Boring, 无聊, membosankan
Both, 双 / 两个。。。都, kedua-dua
Bottom, 底, bawah
Brave, 勇敢, berani
Brilliant, 灿烂 / 辉煌, cemerlang
Building, 建筑物 / 大厦, bangunan
Bus Interchange/bus station, 巴士转换站, stesen pertukaran bas / stesen bas
Bus stop, 巴士车站, perhentian bas
Busy, 忙, sibuk
Café / coffeeshop, 咖啡店, kafe / keda kopt
Cage, 笼, sangkar
Carefully, 小心地, berhati-hati
Carpark, 停车场, tempat letak kereta
Centre (e.g. shopping centre, art centre), 中心, pusat
Change, 换, tukar
Cinema, 戏院 / 电影院, pawagam / panggung wayang
Circus, 马戏（团）, sarkas
City, 城市, bandar
Clever, 聪明, pandai
Cloud, 云, awan
Cloudy, 多云的, mendung
Comic, 漫画, komik
Lose, 失去, kehilangan
Loudly, 打声地, dengan kuat
Machine, 机器, mesin
Map, 地图, peta
Market, 市场, pasaran
Mean (e.g. what does this mean?), 意思, bermaksud (e.g. apa maknanya?)
Message, 信息, mesej
Milkshake, 奶昔, susu kocak
Mistake, 错误, kesilapan
Model, 模特儿, model
Monday, 星期一, isnin
Most, 最, paling
Mountain, 山, gunung
Moustache, 胡子, misai
Move, 移, bergerak
Movie Star, 电影明星, bintang filem
Must, 必须, mesti /perlu
Near, 近, berhampiran
Neck, 颈项, leher
Need, 需要, perlu
Net, 网, jaring / rangkaian
Never, 决不 / 一定不, tidak pernah
Noise, 响声 / 噪声 / 吵闹声, bunyi bising
Nothing, 没有什么, tiada apa-apa
O'Clock, 点（钟）, –
Often, 经常 / 常常, sering
Only, 只要, sahaja
Opposite, 对面, bertentangan
Pair, 对 / 双, pasangan
Parent, 爸妈 / 父母, ibu bapa
Parrot, 鹦鹉, burung nuri
Pasta, 意大利面, pasta
Pirate, 海盗, lanun
Place, 地方 / 地点, tempat
Plate, 盘子, pinggan
Player, 播放机, pemain
Practice, 训练 / 练习, amalan
Practise, 练习, berlatih
Put on, 穿上, memakai
Quick, 快, pantas
Quickly, 很快地, cepat
Quietly, 悄悄地, secara senyap-senyap

Cough, 咳嗽, batuk
Curly, 卷（曲）/ 鬈鬈, berkerinting
Dangerous, 危险, berbahaya
Daughter, 女儿, anak perempuan
Dentist, 牙医, doktor gigi
Difference, 分别, beza
Different, 不同 / 不一样 / 差别, berbeza
Difficult, 难 / 不容易, susah
Dolphin, 海豚, ikan lumba-lumba
Down, 下, turun
Downstairs, 楼下, di tingkat bawah
Dress up, 穿衣服 / 装扮 / 打扮, berpakaian
Driver, 司机, pemandu
E-Book, 电子书, e-book
Easy, 容易 / 简单, mudah
Elevator/Lift, 电梯, lif
Email, 电子邮件, e-mel
Escalator, （自动）扶梯, eskalator
Everyone, 大家 / 每个人 / 所有的人, setiap orang
Everything, 一切, semua
Exciting, 使人兴奋, mengujakan
Excuse me, 对不起 / 不好意思, maafkan saya
Fair, 公平, adil
Famous, 出名, terkenal
Farm, 农场, ladang
Farmer, 农民, petani
Fat, 肥, lemak
Fine, （精）细, halus
Floor/Storey, 楼, lantai / tingkat
Fly, 苍蝇, terbang
Forest, 森林 / 树林, hutan
Friday, 星期五, jumaat
Frightened, 被吓 / 惊, takut
Funfair, 游乐场, pesta ria
Get changed, 换衣服, tukar baju
Get dressed, 穿衣服, pakai baju
Get Off/Alight, 下车, turun / turun
Get On/Board, 上车, menaiki / menaiki
Get up, 起床 / 起来, bangun
Goal (as in the net to send ball into for various sports）, 球门, matlamat
Granddaughter, 孙女, cucu
Grandson, 孙子, cucu
Ground, 地面 / 地（面）上, tanah
Grow, 长 / 生, membesar / berkembang
Grown-up/adult, 大人, dewasa / dewasa
Have (got) to, 得, perlu
Reservoir, 蓄水池, takungan
River, 河, sungai
Road, 路, jalan raya
Roller Skates, 溜冰鞋, kasut roda
Roller Skating, 溜冰, berkasut roda
Round, 圆, pusingan / bular
Safe, 安全, selamat
Salad, 沙拉, salad
Saturday, 星期六, sabtu
Scarf, 围巾, selendang
Score, 得分, scor
Seat, 座位, tempat duduk
Second, 第二, kedua
Send, 发送, hantar
Shape, 形状, bentuk
Shark, 鲨鱼, jerung
Should/Shall, 应该, sepatutnya / akan
Shout, 喊, jerit
Skip, 蹦（蹦）跳（跳）, melangkau
Slowly, 慢慢地, perlahan-lahan
Snail, 蜗牛, siput
Snow, 雪, salji
Someone, 有人, seseorang
Something, 一件事情 / 某个东西, sesuatu
Sometimes, 有时, kadang-kadang
Son, 儿子, anak lelaki
Station, 站, stesen
Stomachache, 肚子痛, sakit perut
Straight, 直, lurus
Strong, 强 / 有力, kuat
Sunday, 星期日, ahad
Sunny, 晴朗, cerah
Supermarket, 超级市场, pasar raya
Surprised, 惊讶, terkejut
Sweet, 甜, manis
Swimming pool, 游泳池, kolam renang
Tall, 高, tinggi
Tea, 茶, teh
Teach, 教, mengajar
Temperature, 温度, suhu
Terrible, 可怕, dahsyat
Text (as in i'm texting you), 发简讯, teks
Text (as in SMS text, noun), 简讯, teks
Than, 比, daripada
Third, 第三, ketiga
Thursday, 星期四, khamis
Ticket, 票, tiket

Headache, 头痛, sakit kepala
Helmet, 头盔, topi keledar
Holiday, 假日 / 假期, percutian
Homework, 功课, kerja rumah
Hop, 跳, lumpat
Hospital, 医院, hospital / rumah sakit
How much, 多少, berapa banyak
How often, 多常, berapa kerap / berapa banyak kali
Huge, 很大, besar
Hundred, 百, ratus
Idea, 主意, idea
Internet, 网际网络, internet
Invite, 请, menjemput
Island, 岛, pulau
Jungle, (丛)林, hutan
Kangaroo, 袋鼠, kangaroo
Kind (e.g. I like all kinds of...),（种）类, jenis (e.g. saya suka semua jenis ...)
Laptop, 手提电脑, komputer riba
Laugh, 笑, ketawa
Library, 图书馆, perpustakaan
Toothache, 牙痛 / 牙疼, sakit gigi
Toothpaste, 牙膏, ubat gigi
Town, 镇, bandar
Travel, 旅行, perjalanan
Treasure, 宝, harta karun
Trip, 旅行, perjalanan
Tuesday, 星期二, selasa
Unwell/ill, 不舒服 / 病了, kurang sihat / sakit
Upstairs, 楼上, tingkat atas
Video, 录像 / 视频, video
Village, 村, kampung
Waterfall, 瀑布, air terjun
Weak, 弱, lemah
Weather, 天气, cuaca
Website, 网站, laman web
Wednesday, 星期三, rabu
Weekend, 周末, hujung minggu
Whale, 鲸（鱼）, ikan paus
World, 世界, dunia
Worse, 更差, lebih buruk lagi
Worst, 最差, paling buruk / paling teruk
Wrong, 错, salah

Words from the Cambridge English A2 Flyers
(English, Chinese, Malay)

(music) instrument, 乐器, alat (muzik)
A few, 一些, beberapa
A little / bit, 一点, sedikit
Across, 对面, seluruh
Act, 扮, tindak
Actor, 演员, pelakon
Actually, 其实, sebenarnya
Adventure, 冒险, pengembaraan
Afternoon/noon, 下午/中午, tengah hari / tengah hari
Ago,（以）前, lali
Agree, 同意, setuju
Air, 空气, udara
Airport, 飞机场, lapangan terbang
Alone, 孤单 / 单独, bersendirian
Already, 已经, sudah
Also, 也, juga
Amazing, 惊奇 / 惊人, menakjubkan
Anyone, 哪个人 / 任何人, sesiapa
Anything,（无论）什么, apa-apa sahaja
Anywhere, 任何地方, mana-mana
Low, 低, rendah
Lucky, 幸运, bertuah
Magazine (as in book), 杂志, majalah (seperti dalam buku)
Make sure, 确保, pastikan
Manager, 老板 / 经理, pengurus
March, 游行, mac
Married, 已婚 / 嫁人了, berkahwin
Maths, 数学, matematik
May/might, 也许 / 可能, mungkin
Maybe, 也许, mungkin
Meal, 餐, makanan
Meet, 遇见 / 见面, bertemu
Meeting, 会议, mesyuarat
Member, 会员, ahli
Metal, 铁 / 金属, logam
Middle, 中间, tengah / pusat
Midnight, 午夜, tengah malam
Million, 百万, juta
Mind, 精神 / 头脑, minda
Minute, 分钟, minit

Appear, 出现, muncul
April, 四月, april
Arrive, 到, tiba
Art, 艺术品 / 美术, seni
Artist, 艺术家, artis
As, 和。。。一样, seperti
As, 和。。。一样, seperti
Astronaut, 太空人, angkasawan
At the moment, 现在 / 这个时候, pada masa ini
August, 八月, ogos
Backpack, 背包, ransel
Bandage, 绷带, pembalut
Bank, 银行, bank
Beetle, 蛄 / 甲虫, kumbang
Begin, 开始, mula
Believe, 相信, percaya
Bin (as in rubbish bin), 垃圾桶, bekas
Bored, 闷 / 无聊, bosan
Borrow, 借, pinjam
Bracelet, 手镯, gelang
Bridge, 桥, jambatan
Burn, 烧, bakar
Business, 商业, perniagaan
Businessman/businesswoman, 商人, ahli perniagaan
By myself, 我自己, dengan diri sendiri
By yourself, 你自己, oleh anda sendiri
Calendar, 日历, kalendar
Camel, 骆驼, unta
Camp, 营, kem / berkhemah
Card, 卡, kad
Cartoon, 卡通 / 动画片, kartun
Castle, 城堡, istana
Cave, 山洞, gua
Century, 世纪, abad
Channel, 频道 / 电视台, saluran
Chat, 聊 / 谈, berbual
Cheap, 便宜, murah
Chess, 棋, catur
Club, 俱乐部, kelab
Collect, 收集, kumpul
Competition, 比赛, pertandingan
Concert, 演唱会, konsert
Conversation, 讲话 / 谈话, perbualan
Cooker, 锅, periuk
Corner, 角落, sudut
Costume, 服装, pakaian
Missing, 失踪, hilang
Mix, 掺, campuran
Museum, 博物馆, muzium
Nest, 窝, sarang
News, 新闻, berita
Newspaper, 报纸, akhbar
No one (as in no one is here), 没有人, tiada sesiapa (seperti dalam tiada sesiapa yang di sini)
No problem, 没问题, tiada masalah
North, 北, utara
November, 十一月, november
Nowhere (as in nowhere to go), 哪里都不, tiada tempat
Ocean, 海洋, laut
October, 十月, oktober
Octopus, 八爪鱼 / 章鱼, sotong
Of course, 当然, sudah tentu
Office, 办公室, pejabat
Olives, 橄榄, buah zaitun
Once, 一次, sekali
Online, 网上, online
Passenger, 乘客, penumpang
Past, 过去, masa lalu
Path, 小路, jalan / lorong
Pepper, 胡椒, lada
Pharmacist, 药剂师, ahli farmasi
Pharmacy, 药店, farmasi
Photographer, 摄影师, juru gambar
Piece, 片, sekeping
Pilot, 飞机师, juruterbang
Planet, 行星, planet
Plastic, 塑胶, plastik
Platform, 平台, platform / pentas
Pleased, 满意, gembira
Pocket, 口袋, poket
Police station, 警察局, balai polis
Pond, 池塘, kolam
Popular, 流行, popular / disukai ramai
Post (as in post a letter), 寄（信）, hantar surat
Post office, 邮局, pejabat pos
Postcard, 明信片, poskad
Prefer, 比较喜欢, lebih suka
Prepare, 准备, sediakan
Prize, 奖, hadiah
Problem, 问题, masalah
Programme, 节目, program
Project, 专题作业, projek

Creature, 动物 / 生物, makhluk
Crown, 王冠 / 冠冕, mahkota
Cushion, 垫子, kusyen
Cycle, 骑脚踏车, kayuh
Date (as in time), 日期（如时间）, tarikh (sebagai masa dalam)
December, 十二月, disember
Decide, 决定, membuat keputusan
Deep, 深, mendalam
Delicious, 好吃 / 美味, delicious
Desert, 沙漠, padang pasir
Design, 设计, reka
Design, 设计, reka
Designer, 设计师, pereka
Diary, 日记, buku harian
Dictionary, 字典, kamus
Disappear, 消失, hilang
Drum, 鼓, dram / gendang
During, 中 / 在。。。时, semasa
Eagle, 鹰 / 老鹰, helang
Early, 早, awal
Earth, 地球, bumi
East, 东, timur
Elbow, 手肘, siku
Else, 其他, lain
Engine, 发动机 / 引擎, enjin
Engineer, 工程师, jurutera
Enormous, 巨大, besar
Enough, 够, cukup
Enter (a competition), 加入, masuk (pertandingan)
Entrance, 入口, pintu masuk
Envelope, 信封, sampul surat
Environment, 环境, alam sekitar
Ever, 自从 / 从来, pernah
Everywhere, 到处, dimana - mana
Excellent, 优秀, cemerlang
Excited, 兴奋, teruja
Exit, 出口, keluar
Expensive, （昂）贵, mahal
Explain, 解释, menjelaskan
Explore, 探索, meneroka
Extinct, 绝种, pupus
Factory, （公）厂, kilang
Fall over, 摔倒, jatuh
Far, 远, jauh
February, 二月, februari
Pyramid, 金字塔, piramid
Quarter (as in 1/4, 2/4...), 四分之一, suku (seperti dalam 1/4, 2/4 ...)
Queen, 女王, ratu
Quite, 蛮 / 相当, agak
Quiz, （小）测验, kuiz
Race (as in race you to the finish line), 比谁快 / 看谁快, berlumba
Race / racing (as in swimming/running/car race), 赛, perlumbaan / berlumba
Railway, 铁路 / 铁道 / 铁轨, keretapi
Ready, 准备, bersedia
Remember, 记得, ingat
Repair, 修理, pembaikan
Repairman, 修理工, pembaikan
Repeat, 重复, ulangan
Restaurant, 餐厅, restoran
Rich, 丰富, kaya
Ring, 环, cincin
Rocket, 火箭, roket
Save, 救, selamatkan
Science, 科学, sains
Screen, 屏幕, skrin
Search, 找 / 寻找, carian
Secret, 秘密, rahsia
Sell, 卖, jual
September, 九月, september
Several, 一些 / 几个, beberapa
Shampoo, 洗发水, syampu
Shelf, 架, rak
Silver, 银, perak
Since, （自）从, sejak
Singer, 歌手, penyanyi
Skyscrapper, 高楼大厦, pencakar langit
Smell, 臭味 / 气味, bau
Snowball, 雪球, bola salji
Snowman, 雪人, orang salji
Somewhere, 某个地方 / 某处, di suatu tempat
Soon, 不久, tidak lama lagi
Sore, 疼 / 疮, sakit
Sound, 声音, bunyi
South, 南, selatan
Space, 空间, ruang
Spaceship, 飞船, kapal angkasa
Speak, 说话, bercakap
Special, 特别, khas / istimewa
Spend, 花（钱）, belanja

Feel (as in I feel cold/happy), 感觉, rasa
Festival, 节, perayaan / pesta
Fetch, 接, ambil
File (as in a document file), 文件夹, fail (seperti dalam fail dokumen)
Find out, 找出, cari tahu
Fire, 火, api
Fire Fighter, 消防战士, ahli bomba
Fire Station, 消防局, balai bomba
Flag, 旗, bendera
Flour, 面粉, tepung
Fog, 多雾路段, kabus
Foggy, 有雾, berkabus
Follow, 跟, ikut
Forget, 忘记, lupa
Friendly, 友好, mesra
Frightening, 可怕 / 吓人, menakutkan
Front, 前面 / 面前, depan
Fur, 毛皮, bulu
Furry, 毛毛, berbulu
Future, 未来, masa depan
Gate, （铁）门, pintu gerbang
Geography, 地理, geografi
Glove, 手套, sarung tangan
Go away, 走开, pergi
Go out, 出去, keluar
Gold, 金, emas
Golf, 高尔夫球, golf
Group, 组 / 群, kumpulan
Guess, 猜, teka
Gym, 健身房, gim
Half, 半, separuh
Happen, 发生, berlaku
Highway, 高速公路 / 快速公路, lebuh raya
Hill, 山, bukit
History, 历史, sejarah
Hole, 洞, lubang
Honey, 蜜糖, madu
Horrible, 可恶, dahsyat
Hotel, 旅店 / 旅馆, hotel
Hour, 小时, jam
How long, 多久, berapa lama
Husband, 老公 / 丈夫, suami
If you want, 如果你想要, jika anda mahu
Important, 重要, penting
Improve, 进步, memperbaiki
In a minute, （稍）等一下, dalam satu minit
Spot, 点, tompok
Spotted, 斑, bertompok
Stadium, 体育场, stadium
Stage (as in performance stage), 舞台, pentas
Stamp, 邮票, setem
Step (as in act of lifting foot), 步, langkah
Still, 平静, masih
Stone, 石头, batu
Storm, 暴风雨, ribut
Strange, 奇怪, pelik
Stream, （小）河, aliran
Stripe, 条纹, jalur
Striped, 有条纹, berjalur
Student, 学生, pelajar
Study, 学习, belajar
Subject, 科目, subjek
Such, 这样, seperti
Suddenly, 突然, tiba-tiba
Suitcase/luggage, 行李箱, beg pakaian / bagasi
Sure, 当然 / 一定, pasti
Surname, 姓名, nama keluarga
Surprise (as in birthday surprise), 惊喜, kejutan
Swan, 天鹅, angsa
Take (time, as in it takes 10 minutes), 花（时间）, mengambil (masa, seperti dalam ia mengambil masa 10 minit)
Taxi/cab, 德士, teksi
Team, 队, pasukan
Theatre (generic theatre), 戏院, pawagam / panggung wayang
Thousand, 千, ribu
Through, 通过 / 经过 / 穿过, melalui
Tidy, 整齐, kemas
Timetable, 时间表, jadual waktu
Tire, 轮胎, tayar
Together, 一起, bersama-sama
Torchlight, 手电筒, lampu suluh
Tortoise, 乌龟, kura-kura
Tour, 参观 / 旅游, pelancongan
Traffic, 交通, lalu lintas
Tune, 调, lagu
Turn, 转, pusing
Turn off, 关掉, matikan
Turn on, 打开, hidupkan
Twice, 两次, dua kali
Umbrella, 雨伞, payung
Unfriendly, 不友好, tidak mesra

Information, 消息, maklumat
Insect, 昆虫, serangga
Instead, 而, sebaliknya
Interested, 有兴趣, berminat
Interesting, 有趣 / 有意思, menarik
Invent, 发明, mencipta
Invitation, 邀请, jemputan
Jam, 果酱 / （水果）酱, jem
January, 一月, januari
Job, 工作, pekerjaan
Join (as in join a game), 加入, menyertai (seperti dalam menyertai permainan)
Journalist, 记者, wartawan
Journey, 路程 / 行程, perjalanan
July, 七月, julai
June, 六月, jun
Just (as in just got married), 刚刚, hanya
Keep, 保留, simpan
Kind (e.g. he is very kind), 善良 / 友善, berbaik hati (e.g. dia sangat baik hati)
King, 王, raja
Land (as in plots of land), 土地, tanah
Language, 语言, bahasa
Large, 大, besar
Late, 迟到 / 晚了, lewat
Lazy, 懒, malas
Leave, 离开, meninggalkan
Left (direction), 左, kiri (arah)
Let, 让, biarkan
Letter, 信, surat
Lie (as in lie down), 躺, baring (seperti dalam membaring)
Lift (a ride), 搭车, tumpang
Look after, 照顾, menjaga
Look like, 看起来像, nampak seperti
Lovely, 美丽的 / 美好的, indah / cantik
Unhappy, 不快乐, tidak berpuas hati
Uniform, 制服, pakaian seragam
University, 大学, universiti
Unkind, 不良善 / 刻薄, tidak baik
Untidy, 邋, tidak kemas
Until, （一）直到, sehingga
Unusual, 不寻常, luar biasa
Use, 使用, penggunaan
Usually, 平时, biasanya
View, 看 / 观看, pandangan
Violin, 小提琴, biola
Visit, 访问 / 拜访, lawatan
Waiter, 服务员, pelayan
Warm, （温）暖, hangat
Way (as in the way to...), 路, cara (as in cara jalan ke)
West, 西方, barat
Wheel, 轮, roda
While, 而, manakala
Whisper, 讲悄悄话, bisik
Whistle, 吹口哨, bersiul
Wife, 老婆 / 妻子, isteri
Wifi, 无线网, wifi
Wild (as in wild animals), 野生, liar
Win, 赢, menang
Wing, 翅膀, sayap
Winner, 赢家, pemenang
Without, 没有, tanpa
Wonderful, 太好了 / 精彩, indah
Wood, 木, kayu
Wool, 羊毛, bulu
Worried, 担心, bimbang
X-Ray, X-光, x-ray
Yet, 还, namun
You're welcome/no problem/no worries, 不客气 / 不用谢, sama-sama
Zero, 零, sifar

Stimuli

Note: * only for Malay participants; † only for Indian participants; ‡ only for Chinese participants; ^ only for adults.

SINGLE WORD STIMULI

1.1 Word-initial plosives

Vowel	**English**				*** Malay (transcription and gloss)**			
/i/	**pʰ**	pea people peacock	**b**	bee	**p**	pipi /pipi/ 'cheek'	**b**	bibir /bibir/ 'lips'
	tʰ	tea t-shirt tickling	**d**	d	**t**	tiga /tiga/ 'three'	**d**	diri /diri/ 'stand'
	kʰ	keys kitten kicking	**g**	geese	**k**	kitab /kitab/ 'book'	**g**	gigi /gigi/ 'teeth'
/a/	**pʰ**	park	**b**	bark(ing)	**p**	pasir /pasir/ 'sand'	**b**	bapa /bapa/ 'father'
	tʰ	(*pineapple*) tart	**d**	dark	**t**	takut /takut/ 'afraid'	**d**	dagu /dagu/ 'chin'
	kʰ	card	**g**	garden	**k**	kaki /kaki/ 'foot/leg'	**g**	gajah /gadʒah/ 'elephant'
/u/	**pʰ**	(*swimming*) pool	**b**	(*peek-a-*)boo	**p**	putih /putih/ 'white'	**b**	buka /buka/ 'open'
	tʰ	two	**d**	do	**t**	tujuh /tudʒuh/ 'seven'	**d**	duduk /duduk/ 'sit'
	kʰ	cook(ing)	**g**	good	**k**	kuda /kuda/ 'horse'	**g**	gula-gula /gula/ 'candies'

1.2 Syllable-final and intervocalic /l/

Context	English	* Malay		† Tamil	
…V_#	Pool	Gatal	/gatal/ 'itchy'	கப்பல்	/kəppəl/[14] 'ship'
	Snail	Mahal	/mahal/ 'expensive'	கல்	/kəl/ 'stone'
	Ball	Panggil	/paŋgil/ 'to call'	பற்கள்	/pərkəɭ/ 'teeth'
	Turtle	Bantal	/bantal/ 'pillow'	மணல்	/məɳəl/ 'sand'
	Shell	Kecil	/kətʃil/ 'small'	பால்	/pɑːl/ 'milk'
	Bowl	Bakul	/bakul/ 'basket'	நாள்	/nɑːɭ/ 'day'
	Cereal			தாள்	/t̪ɑːɭ/ 'paper'
…V_C…	Wolf	–		–	
	Cold				
	Milk				
…V_.C…	Children	Baldi	/baldi/ 'pail'	–	
	Elbow	Salji	/saldʒi/ 'snow'		
	Selfie				
…V_.V…	Television	–		எலி	/ɛlɪˑ/ 'rat'
	Police			சளி	/səɭɪˑ/ 'mucous'
				வலி	/ʋəlɪˑ/ 'pain'

1.3 Vowels[15]

Monophthongs. Bid, bead, bet, bat, could, cooed, cod, cord, bud, bard, bird
Diphthongs. Bade, bide, bode, bowed, toyed, beard, toured

1.4 Polysyllabic words

Compounds/noun+noun. Strawberry, watermelon, ladybird, fingernail
Non-compounds (with initial stress). Crocodile, broccoli, television[16]
Non-compounds (without initial stress). Cucumber, tomato, binoculars

1.5 * Words with /ɛ/

Bread, umbrella, jelly, strawberry, watermelon, lemon

1.6 ‡ Dental fricatives

Where th-stopping is predicted to occur. Thank you, three, father, mother
Where th-fronting is predicted to occur. Mouth, tooth, teeth, bathing

[14] The IPA transcriptions for the Tamil stimuli were derived from an online transcription tool by Rajan, Vinodh. https://anunaadam.appspot.com/
[15] Taken from Sim (2015).
[16] Thanks to Julia Schwarz for pointing out that although *–vision* in *television* is the only free lexeme in present-day English, *tele–* is derived from Greek, and therefore *television* could have been a compound noun originally. Unlike the other non-compounds in the list, *tele–* is also a productive morpheme in English, forming other words such as *telephone*, *telescope*, etc.

1.7 † Retroflex consonants

	Context	English	Tamil	Transcription and gloss
/r/	Word initial	Red Rain Rock	–	–
	Consonant clusters	Toothbrush Dress Drum Crayons	–	–
	Intervocalic	Carrot Strawberry Orange	கோடாரி எரி பழம் ஏழு நரி கீறு பறி	/koːɖɑːɾɪˑ/ ‘axe’ /ɛɾɪˑ/ ‘burn’ /pəɻəm/ ‘fruit’ /eːɻʉ/ ‘seven’ /nəɾɪˑ/ ‘fox’ /kiːɾʉ/ ‘scratch’ /pəɾɪˑ/ ‘snatch’
/t/	Intervocalic	Party Watermelon	கட்டு மொட்டு தொட்டு	/kəʈʈʉ/ ‘tie (verb)’ /moʈʈʉ/ ‘flower bud’ /t̪oʈʈʉ/ ‘touch’
	After nasals	Auntie Quantity ^ Phantom ^	பந்து அத்தை ஐந்து	/pan̪d̪ʉ/ ‘ball’ /ət̪t̪əj/ ‘aunty’ /əjn̪d̪ʉ/ ‘five’

1.8 † Words with /w, v/

/w/. Wheel, watermelon, towel, flower
/v/. Vase, van, (microwave) oven, television

SENTENCES

2.1 ^ Set 1[17]

Utterance type	Sentences
Simple declarative	I have a bag. We are in the garden early. I will need your umbrella. I mailed my grandmother. They are eligible.
Questions without morphosyntactic markers	That is wrong, you know? He is in Changi? You remember my grandmother? It is your umbrella? They said you are eligible?
Wh-questions	Where are your berries? Why are you going early? When will he call your grandmother? Where is Mongolia? When were you eligible?
Yes-no questions	May I lean on the bag? Are you going home early? Have you called Maria already? Do you remember the melody? Will you be eligible?

[17] Taken from Sim (2015).

Coordinated	Is his name John or Jude? Do you need tea or Milo? Are we in Bali or Java? Are we going Germany or Romania? Are you calling Angelina or Annabella? Do you want rice or noodle?

2.2 ^ Set 2

2.2.1 *English sets*

(Note: †‡ = Indian and Chinese participants only)

Set	Theme	Prompt	Subject	Verb	Direct object
Trial	Shopping	The children are buying something. What are they buying?	Dan	(is) buying	(a) broom
			Ben	(is) buying	(a) hammer
			Lina	(is) buying	(a) radio
			Mary	(is) buying	(a) pizza
1, †‡	Animal	The children are feeding some animals. What are they feeding?	Dan	(is) feeding	(a) bird
			Ben	(is) feeding	(a) dog
			Lina	(is) feeding	(a) duck
			Mary	(is) feeding	(a) zebra
2	Animal	The children are feeding some animals and insect. What are they feeding?	Dan	(is) feeding	(a) lion
			Ben	(is) feeding	(a) gorilla
			Lina	(is) feeding	(a) caterpillar
			Mary	(is) feeding	(a) rabbit
3, †‡	Body part	The children are touching a part of their body. What are they touching?	Dan	(is) touching	(his) leg
			Ben	(is) touching	(his) eye
			Lina	(is) touching	(her) nose
			Mary	(is) touching	(her) ear
4	Food	The children are eating something. What are they eating?	Dan	(is) eating	bread
			Ben	(is) eating	(an) orange
			Lina	(is) eating	(a) strawberry
			Mary	(is) eating	(a) hamburger
5	Food	The children are cutting something. What are they cutting?	Dan	(is) cutting	jelly
			Ben	(is) cutting	(a) banana
			Lina	(is) cutting	(a) watermelon
			Mary	(is) cutting	(a) lemon
6	Activity	The children are holding something. What are they holding?	Dan	(is) holding	broccoli
			Ben	(is) holding	(a) vacuum cleaner
			Lina	(is) holding	(a) camera
			Mary	(is) holding	(a) money
7	Activity	The children are passing something. What are they passing?	Dan	(is) passing	(some) crayons
			Ben	(is) passing	(a) balloon
			Lina	(is) passing	(a) ball
			Mary	(is) passing	(a) bowl
8, †‡	Activity	The children are cleaning something.	Dan	(is) cleaning	(a) table
			Ben	(is) cleaning	(a) television

		What are they cleaning?	Lina	(is) cleaning	binoculars
			Mary	(is) cleaning	(a) motorcycle
9	Hobby	The children are drawing something. What are they drawing?	Dan	(is) drawing	(a) fingernail
			Ben	(is) drawing	(a) ladybird
			Lina	(is) drawing	(a) helicopter
			Mary	(is) drawing	(an) ambulance
10	Hobby	The children are painting something. What are they painting?	Dan	(is) painting	vegetables
			Ben	(is) painting	(a) rhinoceros
			Lina	(is) painting	(a) harmonica
			Mary	(is) painting	(an) umbrella

2.2.2 *Malay sets*

(Note: For Malay participants only)

Set	Theme	Prompt	Subject	Verb	Direct object
1	Hobby	Kanak-kanak melukis sesuatu. Apakah yang kanak-kanak melukis? 'Children paint something. What do children paint?'	Dan	(me)lukis /məlukis/ 'paint'	harimau /harimau/ 'tiger'
			Ben	(me)lukis	bulan /bulan/ 'moon'
			Lina	(me)lukis	ahli bomba /ahli bomba/ 'fireman'
			Mary	(me)lukis	awan /awan/ 'cloud'
2	Activity	Kanak-kanak membawa sesuatu. Apakah yang kanak-kanak membawa? 'Children carry something. What do children carry?'	Dan	(mem)bawa /məmbawa/ 'carry'	wang /waŋ/ 'money'
			Ben	(mem)bawa	ular /ular/ 'snake'
			Lina	(mem)bawa	bola /bola/ 'ball'
			Mary	(mem)bawa	bendara /bəndɛra/ 'flag'
3	Shopping	Kanak-kanak membeli sesuatu. Apakah yang kanak-kanak membeli? 'Children buy something. What do children buy?'	Dan	(mem)beli /məmbəli/ 'buy'	gula-gula /gula/ 'candies'
			Ben	(mem)beli	limau /limau/ 'citrus fruit'
			Lina	(mem)beli	mi /mi/ 'noodles'
			Mary	(mem)beli	gam /gam/ 'glue'
4	Shopping	Kanak-kanak menjual sesuatu. Apakah yang kanak-kanak menjual? 'Children sell something. What do children sell?	Dan	(men)jual /məndʒual/ 'sell'	ayam /ajam/ 'chicken'
			Ben	(men)jual	rumah /rumah/ 'house'
			Lina	(men)jual	almari /almari/ 'cupboard'
			Mary	(men)jual	pengelap /pəŋəlap/ 'mop'

3.1 North Wind and the Sun

3.1.1 English version

This is a story. The North Wind and the Sun were disputing which was the stronger when a traveller came along wrapped in a warm cloak. They agreed that the one who first succeeded in making the traveller take his cloak off should be considered stronger than the other. Then the North Wind blew as hard as he could, but the more he blew, the more closely did the traveller fold his cloak around him; and at last the North Wind gave up the attempt. Then the Sun shone out warmly and immediately the traveller took off his cloak. And so the North wind was obliged to confess that the Sun was the stronger of the two. The end.

3.1.2 Malay version[18]

Begini ceritanya. Ketika Angin Utara dan Matahari sedang bertengkar mengenai siapa yang lebih kuat, datang seorang pengembara yang memakai jubah. Keduanya bersetuju bahawa siapa yang berjaya menyebabkan pengembara tersebut menanggalkan jubahnya akan dianggap lebih kuat. Lalu Angin Utara pun meniup sekuatnya, namun semakin kuat angin bertiup semakin rapat pula pengembara tersebut memeluk jubahnya sehingga akhirnya Angin Utara pun mengalah. Kemudian Matahari memancarkan sinarnya dan dengan segera pengembara tersebut menanggalkan jubahnya. Akhirnya Angin Utara terpaksa mengaku bahawa Matahari lebih kuat daripadanya. Selesai ceritanya. Terima kasih.

3.2 Wolf Passage[19]

This is the story. There was once a poor shepherd boy who used to watch his flocks in the fields next to a dark forest near the foot of a mountain. One hot afternoon, he thought up a good plan to get some company for himself and also have a little fun. Raising his fist in the air, he ran down to the village shouting 'Wolf, Wolf.' As soon as they heard him, the villagers all rushed from their homes, full of concern for his safety, and two of his cousins even stayed with him for a short while. This gave the boy so much pleasure that a few days later he tried exactly the same trick, and once more he was successful. However, not long after, a wolf that had just escaped from the zoo was looking for a change from its usual diet of chicken and duck. So, overcoming its fear of being shot,

[18] Taken from Clynes & Deterding (2011).

[19] Taken from Deterding (2006).

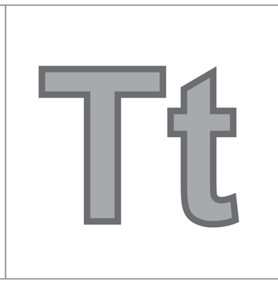
it actually did come out from the forest and began to threaten the sheep. Racing down to the village, the boy of course cried out even louder than before. Unfortunately, as all the villagers were convinced that he was trying to fool them a third time, they told him, 'Go away and don't bother us.' And so the wolf had a feast. The end.

IMAGES USED IN PICTURE CARDS FOR THE PICTURE-NAMING TASK

1.1 For all participants

Pea
Image: brgfx / Freepik.com

Bee
Image: Freepik.com

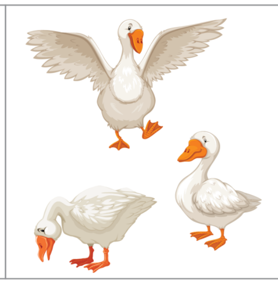


T

Tea
Image: brgfx / Freepik.com

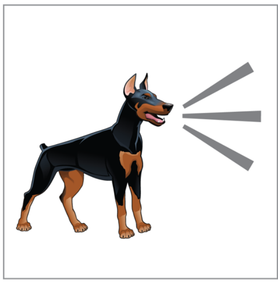
D

Key
Image: Freepik.com



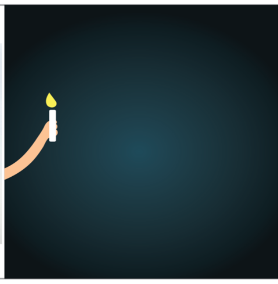
Geese
Image: brgfx / Freepik.com

Park
Image: brgfx / Freepik.com



Bark(ing)
Image: ddraw / Freepik.com

(Pineapple) Tart
Image: owaief89 / flickr.com

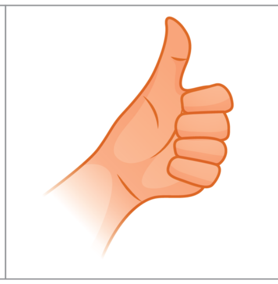


Dark
Image: Freepik.com

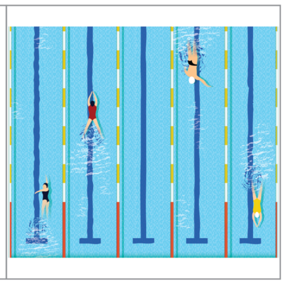
Card
Image: Freepik.com

Garden
Image: Freepik.com

Cook(ing)
Image: macrovector / Freepik.com



Good
Image: Freepik.com

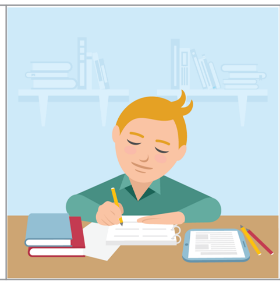


(Swimming) Pool
Image: macrovector / Freepik.com

(Peek-a-)boo

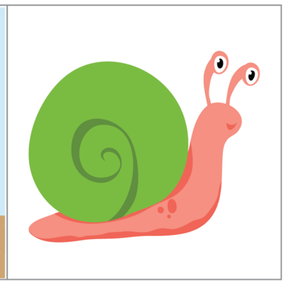
Two

Image: Freepik.com



Do(ing homework)

Image: brgfx / Freepik.com



Snail

Image: terdpongvector / Freepik.com

Wolf

Image: Irene Deev

Ball

Image: terdpongvector / flickr.com

Cold

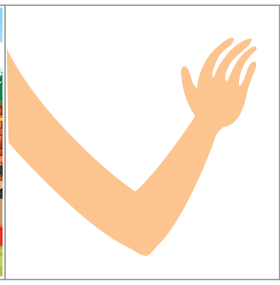
Image: Freepik.com

Milk

Image: starline / Freepik.com

Children

Image: brgfx / Freepik.com



Elbow

Image: Freepik.com

Selfie

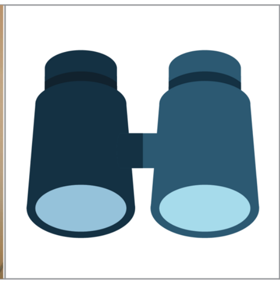
Image: pikisuperstar / Freepik.com

Television

Image: makyzz / Freepik.com

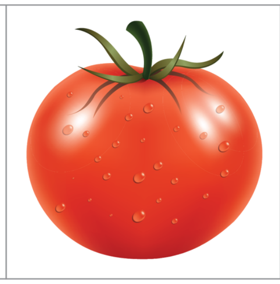
Police

Image: Weave



Binoculars

Image: brgfx / Freepik.com

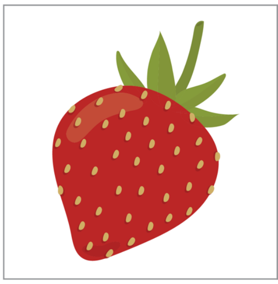


Tomato

Image: layerace / Freepik.com

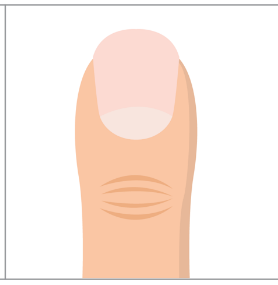
Watermelon

Image: Freepik.com

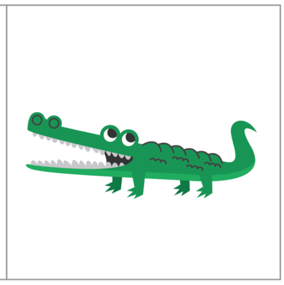


Strawberry
Image: rawpixel.com / Freepik.com

Ladybird
Image: dkfindout



Fingernail
Image: Freepik.com



Crocodile
Image: vectorpocket / Freepik.com

Cucumber
Image: rawpixel / Freepik.com

Broccoli
Image: Freepik.com

1.2 For Chinese participants

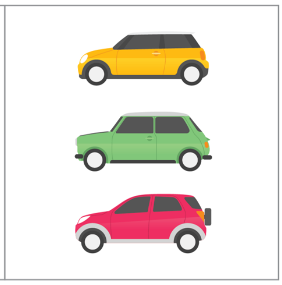
Father / Mother
Image: ddraw / flickr.com

Mouth
Image: Freepik.com

Tooth / Teeth
Image: brgfx / Freepik.com

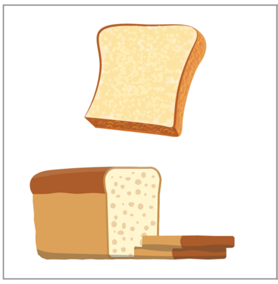
Bathing
Image: Freepik.com

Thank you
Image: rawpixel.com / Freepik.com



Three
Image: Freepik.com

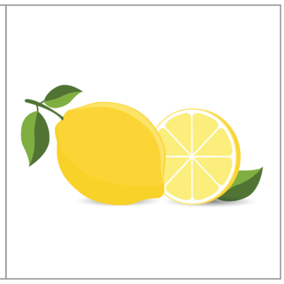
1.3 For Malay participants



Bread
Image: macrovector / Freepik.com

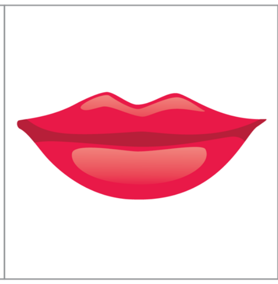
Umbrella
Image: rawpixel.com / Freepik.com

Jelly
Image: dkfindout

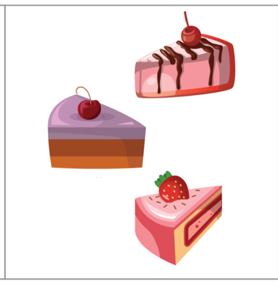


Lemon
Image: Freepik.com

Pipi
Image: Freepik.com
'Cheek'



Bibir
Image: Freepik.com
'Lips'

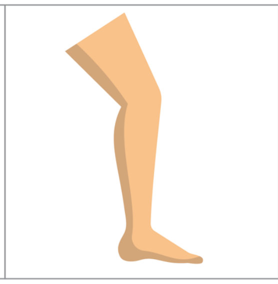


Tiga
Image: Vectorpocket / Freepik.com
'Three'

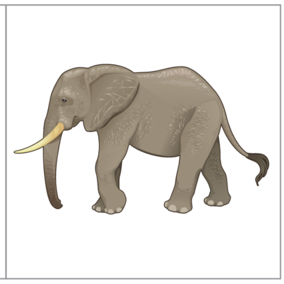
Diri
Image: Freepik.com
'Stand'

Kitab
Image: macrovector / Freepik.com
'Book'

Gigi
Image: brgfx / Freepik.com
'Teeth'



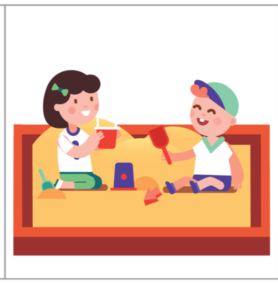
Kaki
Image: macrovector / Freepik.com
'Foot/leg'



Gajah
Image: ddraw / Freepik.com
'Elephant'

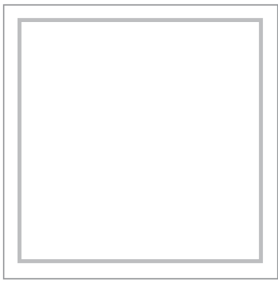
Dagu
Image: Freepik.com
'Chin'

Bapa
Image: ddraw / Freepik.com
'Father'



Pasir
Image: iconicbestiary / Freepik.com
'Sand'

Takut
Image: Freepik.com
'Afraid'



Putih

'White'

Buka

Image: macrovector / Freepik.com

'Open'

Tujuh

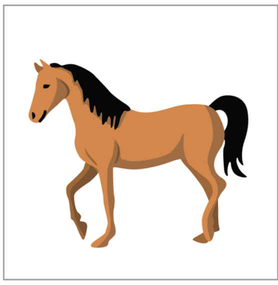
Image: terdpongvector / Freepik.com

'Seven'

Duduk

Image: Freepik.com

'Sit'



Kuda

Image: macrovector / Freepik.com

'Horse'

Gula-gula

Image: Freepik.com

'Candies'

Gatal

Image: Freepik.com

'Itchy'

Mahal

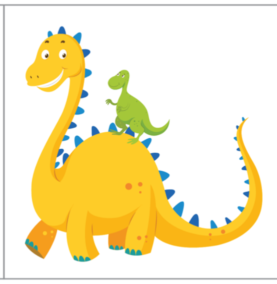
Rawpixel / bluemoon1981 / Freepik

'Expensive'

Panggil

Image: brgfx / flickr.com

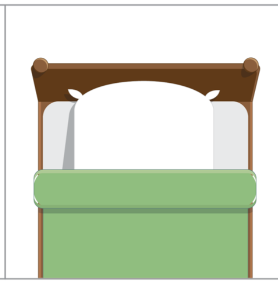
'To call'



Kecil

Image: brgfx / Freepik.com

'Small'



Bantal

Image: vvstudio / Freepik.com

'Pillow'

Bakul

Image: macrovector / Freepik.com

'Basket'

Baldi

Image: Freepik.com

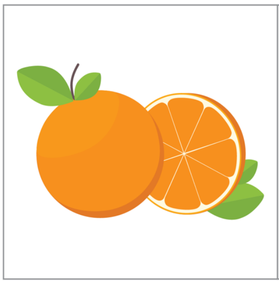
'Pail'

Salji

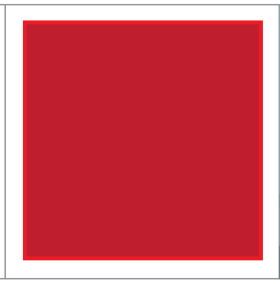
Image: Freepik.com

'Snow'

1.4 For Indian participants



Orange
Image: smithytomy / Freepik.com



Red

Rain
Image: makyzz / Freepik.com

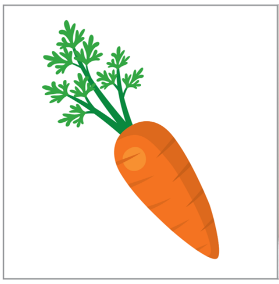
Rock
Image: dkfindout

Toothbrush
Image: cornecoba / Freepik.com

Dress
Image: Freepik.com

Drum
Image: brgfx / Freepik.com

Crayons
Image: Freepik.com



Carrot
Image: Freepik.com

Towel
Image: Freepik.com

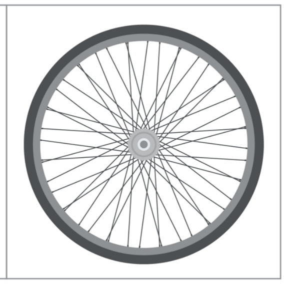
Oven
Image: vectorpocket / Freepik.com

Party
Image: rawpixel / Freepik.com

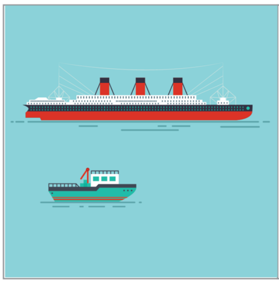
Flower and Vase
Image: dkfindout

Van
Image: Freepik.com

Auntie
Image: Freepik.com

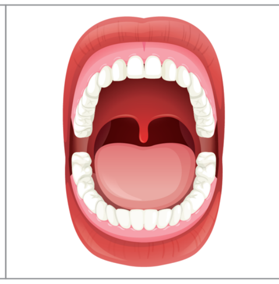


Wheel
Image: brgfx / Freepik.com



Kappal
Image: macrovector / Freepik.com
'Ship'

Kal
Image: freeiconspng.com
'Stone'



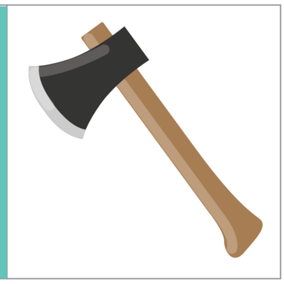
Parkal
Image: brgfx / Freepik.com
'Teeth'

Manal
Image: iconicbestiary / Freepik.com
'Sand'

Paal
Image: starline / Freepik.com
'Milk'

Thaal
Image: Freepik.com
'Paper'

Naal
Image: makyzz / Freepik.com
'Day'



Kodari
Image: Freepik.com
'Axe'

Eri
Image: brgfx / Freepik.com
'Burn'

Ezhlu
Image: terdpongvector / Freepik.com
'Seven'

Pazhlam
Image: Freepik.com
'Fruit'

Nari
Image: Freepik.com
'Fox'

Kiru
Image: vvstudio / Freepik.com
'Scratch'

Kattu
Image: macrovector / Freepik.com
'Tie'

Pari
Image: Freepik.com
'Snatch'

Mottu
Image: Freepik.com
'Flower bud'

Thottu

Image: macrovector / Freepik.com

'Touch'

Athhai

Image: Freepik.com

'Aunty'

Eli

Image: vvstudio / Freepik.com

'Rat'

Vali

Image: macrovector / Freepik.com

'Pain

Panthu

Image: terdpongvector / flickr.com

'Ball'

Ainthu

Vectorpocket / macrovector / Freepik

'Five'

Sali

Image: Freepik.com

'Mucous'

MATERIALS FOR THE PICTURE DESCRIPTION TASK[20]

2.1 For Chinese participants

[20] All images were taken from freepik.com

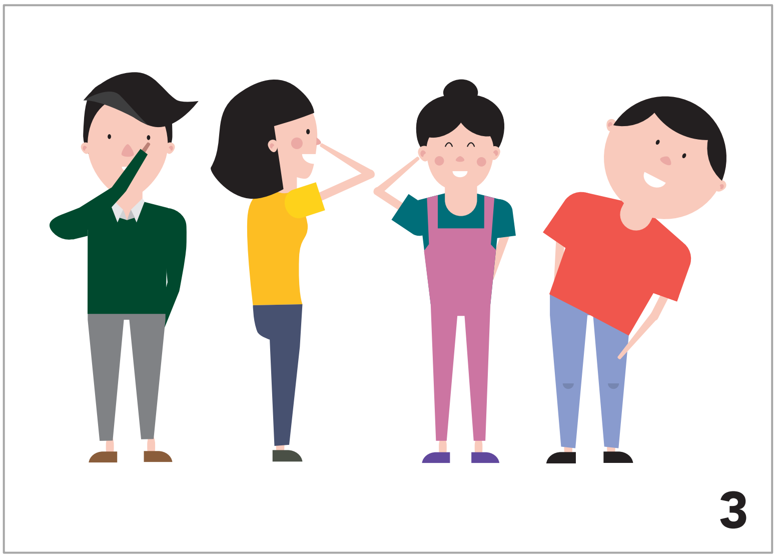
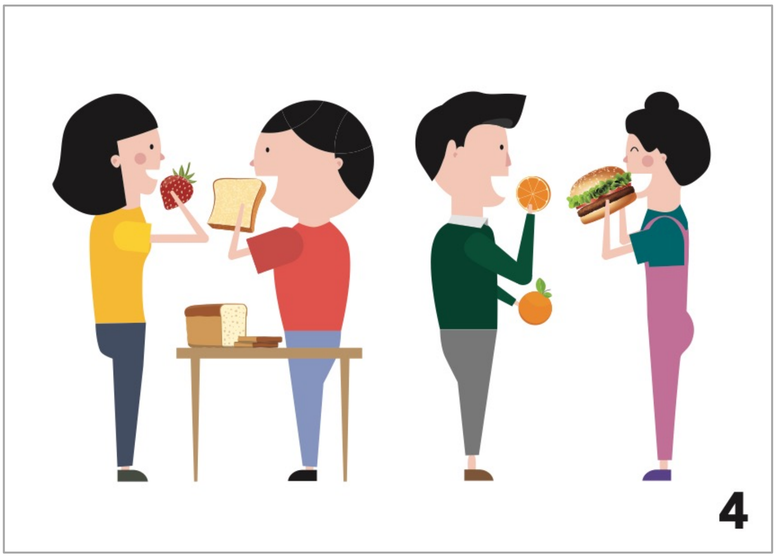
2.2 For Malay participants

2.3 For Indian participants

3.1 For all children

Set	Picture card
Trial	
1	
2	

[21] All images were taken from freepik.com

Set	**Picture card**
3	
4	
5	

Set **Picture card**

6

7

8

Set	Picture card
9	
10	

3.2 For Malay children

Set	Picture card
1	
2	
3	

4

Who would you save?

You're on a ship. The ship is sinking. There is an uninhabited island a few miles away, but the waters are shark-infested. You and your spouse got in the only lifeboat, and **6 other people** can fit in the life boat with the two of you. You know you have to pick the right people because you will be **stuck on the island for the next 6 months.**

1	**Peter, 16** – a delinquent on probation for stealing money. He is very charming, friendly and helpful when he wants to be but cannot be trusted.
2	**Tiru, 45** – a nurse and single mother. However, she is an alcoholic and gets violent when drunk.
3	**Timothy, 41** – chairs a few charitable organisations, He had a traumatic experience and he hears voices when he isn't medicated.
4	**Pete, 27** – has survival techniques being an army regular. However, he has a short temper and was charged with attacking a fellow soldier last year, but otherwise has excellent leadership skills when calm.
5	**Kimberly, 30 –** an ex-swimmer and navy diver who is also good at fishing. However, she has an overwhelming fear of social situations and once attacked a stranger for staring at her.
6	**Professor Joel, 55 –** in good health, except that he cannot walk due to a car accident. He is an expert in plants but is arrogant and loves to show off his knowledge.
7	**Kit, 14 –** a teenager who but extremely lazy and stubborn. She watches her weight so she eats very little.
8	**Aeriel, 19 –** a pregnant teenager who is friendly and helpful. She is expected to give birth in 2 months' time.
9	**Faith, 65** – a farmer for 40 years. However, she has difficulties in moving and has severe dementia.
10	**Arthur, 34** – a professional wrestler. Bulky and strong. Works part-time as a bouncer for a local club. Needs a lot of food to maintain his strength.

ETHICS APPROVAL FORM

UNIVERSITY OF CAMBRIDGE
School of the Humanities and Social Sciences

Jill Noble
Ethics Committee Secretary

Jasper Sim
Department of Theoretical and Applied Linguistics
Sidgwick Site
Cambridge

12 March 2019

Dear Jasper

Ethical approval: 19/199: Phonological acquisition of variable input

The Chair of the Ethics Committee for the School of the Humanities and Social Sciences, acting on the Committee's behalf, has considered the documentation you provided, which followed the procedures concerning ethical approval of research.

I am able to inform you that approval, with respect to ethical considerations, has now been given to your project. Please note that this clearance is based on the documentation you have submitted. You must resubmit your application to the Ethics Committee should you subsequently make any substantive changes relating to matters reviewed by the Committee.

This approval is given for the duration of the project, which is due to end on **24 June 2019.** Should the project be extended, please contact the Ethics Committee Secretary to request an extension to the ethical approval.

We are content for this letter to be forwarded to your grant sponsors, National Institute of Education, Nanyang Technological University.

Yours sincerely

[Signature redacted]

Jill Noble
Ethics Committee Secretary

cc Sam Oliver, Departmental Administrator
Brechtje Post, Student supervisor

17 Mill Lane
Cambridge CB2 1RX

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Fax: +44 (0) 1223 760433
Email: cshssethics@admin.cam.ac.uk
www.cshss.cam.ac.uk

UNIVERSITY OF CAMBRIDGE
Faculty of Modern and Medieval Languages

Participant Information Sheet – General Information

Before you decide to take part in this study it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully. The researcher can be contacted if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part. If you have any questions, please contact **Jasper Sim,** [Email redacted]

Project Title: The acquisition of variable speech sounds and sound patterns by young children

Principal investigator: Jasper SIM Hong, Dr Brechtje POST (research supervisor)

Purpose of study

The purpose of this study is to understand how Singaporean children acquire speech sounds and sound patterns from their parents. This study is part of a larger PhD study that explores the acquisition of speech sounds by children growing up in multi-lingual, multi-dialectal Singapore.

Voluntary participation

Participation is completely voluntary. If you do not wish to continue with the study at any point, you may withdraw from it without needing to provide any reason. A decision to not participate or stop the study will not affect any current or future relationship with the researchers or the University of Cambridge, nor involve any penalty or loss, now or in the future.

The study

The study examines acquisition of speech of children in Singaporean families (of all three main ethnic groups) that meet the following criteria:

- Firstborn should be 2 years to 5 years 11 months old and developing typically
- Both parents and the firstborn should be born and raised in Singapore
- Parents should have Mandarin, Malay, or Tamil as their ethnic mother tongue.

If you decide to participate in the study, data will be collected at your home, and this will involve you, your spouse, and your child(ren) taking part in simple activities. Specifically:

Children from 2 years to 5 years 11 months

Parents will be asked to complete questionnaires about their language background and the child's language experience. You will also be asked to indicate the words that your child can speak and understand by indicating on a checklist. Then, you and your spouse will be asked to read a list of words and sentences, engage in a conversation with the researcher, and take part a discussion with each other. Parents will then play with the child, describe a picture to the child, and the mother will also read the book *Duck and Goose* by Tad Hills to the child. *The speech of you, your spouse, and your child will be recorded.*

The project has received ethical approval from the Faculty's Research Ethics Committee
If you have any questions or complaints about the ethical aspects of this study, please contact ethics@mml.cam.ac.uk

Children from about 4 years to 5 years 11 months

In addition to the above, children in this age range will take part in a picture-naming task with the mother that involves the child naming objects on picture cards. Then, the mother and child will take part in an information gap activity that involves the child giving clues to the mother about what he/she sees on picture cards. Finally, your child will take part in character play in a variety of situations (e.g., child pretending to be a teacher) that involves his/her toys, and his/her mother or the researcher. *These will be recorded using an audio and a video recorder.*

These two parts are expected to take about 2 hours.

Finally, **for a small group of participants,** you *may* also be asked to perform the picture-naming task and information gap activity you did with your child again, but this would be in your ethnic mother tongue and in your own time. Only audio recording is required for this. Finally, you *may* also be asked to record the audio of some of their verbal interactions with their children in a variety of day-to-day activities (up to the discretion of you and your spouse) without the presence of the researcher.

Confidentiality and risks

You and your family will remain anonymous. The data collected will be identified by a random code, password protected and kept in a secure location only accessible by the researcher. Personal data will also be encrypted. The data will be kept strictly confidential; they will not be used or made available for any purposes other than the research project. If needed, only data that will not lead to the identification of any participant will be shared with other researchers, published in scientific journals or presented at conferences, and this will also be done entirely anonymously. There is no foreseeable risk or discomfort resulting from this study. At any point in time, you may withdraw any part of the data from the study, or withdraw from the study altogether, without giving any reason. You may do so by contacting the researcher using the email stated in the consent form.

Retention and destruction of data

In line with University policy, data will generally be kept till the completion of the project + 10 years. After this, it will be destroyed. However, as this is one of the first studies on the acquisition of children in Singapore, your permission to allow the researcher to consolidate the child's speech data with the others obtained from this study in a corpus for future studies will be asked. Only audio data, age, gender and information about the child's language background will be retained to ensure anonymity of the children, if permission is given.

Costs and benefits

You will receive an economical compensation for participating in the study, according to the time spent, in S$10–S$30 worth of vouchers. The child will receive a small toy.

Ethical approval

The project has been given ethical approval by the Research Ethics Committees of the Faculty of MML and the School of Humanities and Social Sciences of the University of Cambridge.

The project has received ethical approval from the Faculty's Research Ethics Committee
If you have any questions or complaints about the ethical aspects of this study, please contact ethics@mml.cam.ac.uk

UNIVERSITY OF CAMBRIDGE
Faculty of Modern and Medieval Languages

Consent form

Project title: **The acquisition of variable speech sounds and sound patterns by young children**

Research team: **Jasper SIM Hong** and **Dr Brechtje POST**

If you have any questions, please contact **Jasper Sim,** [Email redacted]

- ☐ I confirm that I have read and understand the information sheet dated 13/03/2019 for the above-mentioned study and have had the opportunity to ask questions.
- ☐ I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, and without my rights being affected.
- ☐ I understand that any data that are collected will be used and stored anonymously, in accordance with the Data Protection Act. Results are normally presented in terms of groups of individuals. If any individual data were presented, the data would be completely anonymous, without any means of identifying the individuals involved.
- ☐ I understand that these data may be used in analyses, publications, and conference presentations by researchers at the University of Cambridge and their collaborators at other research institutions. I give permission for these individuals to have access to these data.
- ☐ I understand that personal information (such as age, gender, occupation, and language background of my family) will be collected as part of this research. Full data will only be accessible to the research team. However, anonymised data may be used in analyses, publications and conference presentations. For full details on how we use your personal information, see *https://www.information-compliance.admin.cam.ac.uk/data-protection/research-participant-data*
- ☐ I have been given a copy of this form to keep.
- ☐ I agree to take part in this study.

I ____ agree to participate in the above-mentioned study run by Jasper Sim Hong, a PhD candidate at the Faculty of MML at the University of Cambridge.

______________________________ ________________
Date Signature of participant

______________________________ ________________ ______________________
Name of researcher Date Signature of researcher

The project has received ethical approval from the Faculty's Research Ethics Committee
If you have any questions or complaints about the ethical aspects of this study, please contact ethics@mml.cam.ac.uk

Full regression models for Experiment 3 Appendix 3

1. Regression coefficients of a full mixed-effects logistic regression model fit to the realisation of coda laterals of mothers with realisation (l-less or retained) as response.

Fixed factors	**Level**	***n***	***B***	***SE***	**Odds Ratio**	**[95% CI]**	***p***
(Intercept)			1.45	0.89	4.25	0.74 – 24.37	0.10
Formality	Formal	509	-0.69	0.39	0.50	0.24 – 1.08	0.08
Neighbouring consonant	Coronal	263	0.40	0.33	1.49	0.78 – 2.85	0.23
	Glottal	14	1.13	0.77	3.08	0.69 – 13.87	0.14
	Labial	134	-1.11	0.41	0.33	0.15 – 0.74	**0.008**
	Glide	30	0.26	0.57	1.30	0.43 – 3.97	0.64
	Velar	25	-0.78	0.79	0.46	0.10 – 2.17	0.33
Lexical stress	Stressed	440	-0.89	0.70	0.41	0.10 – 1.62	0.20
Vowel height	Close-mid	274	0.36	0.72	1.43	0.35 – 5.90	0.62
	Open	17	1.50	1.35	4.48	0.32 – 63.15	0.27
	Open-mid	263	-0.26	0.54	0.77	0.27 – 2.22	0.63
Vowel advancement	Central	232	-2.13	0.90	0.12	0.02 – 0.69	**0.02**
	Front	221	-0.39	0.53	0.67	0.24 – 1.91	0.46
BLP			-0.01	0.01	0.99	0.97 – 1.02	0.64
SES			0.37	0.22	1.44	0.95 – 2.20	0.09
Age of child			0.04	0.04	1.05	0.96 – 1.13	0.28
Gender of child	Female	199	0.55	1.29	1.73	0.14 – 21.72	0.67
Formality × SES			-0.31	0.20	0.74	0.49 – 1.09	0.13
Formality × BLP			0.01	0.01	1.01	0.99 – 1.04	0.16
Formality × Age of child			-0.01	0.04	0.99	0.92 – 1.07	0.83
Formality × Gender of child			-1.61	1.22	0.20	0.02 – 2.16	0.18

Note: CI = confidence interval. Response variable is l-less (0) or retained (1). Reference category for formality is informal (n = 167), neighbouring consonant is pause (n = 210), lexical stress is unstressed (n = 236), vowel height is close (n = 122), vowel advancement is back (n = 223), gender of child is male (n = 477). **Full model**: Observations = 676, marginal R2 = 0.20, conditional R2 = 0.57, AIC = 750.08. **Reduced model**: Observations = 676, marginal R2 = 0.06, conditional R2 = 0.56, AIC = 744.45.

2. Regression coefficients of a full mixed-effects logistic regression model fit to the realisation of coda laterals of fathers with realisation (l-less or retained) as response.

Fixed factors	**Level**	***n***	***B***	***SE***	**Odds Ratio**	**[95% CI]**	***p***
(Intercept)			1.31	0.75	3.70	0.85 – 16.05	0.08
Formality	Formal	408	-0.42	0.46	0.66	0.26 – 1.64	0.37
Neighbouring consonant	Coronal	160	-0.55	0.32	0.58	0.31 – 1.08	0.09
	Glottal	22	0.40	0.66	1.48	0.41 – 5.37	0.55
	Labial	87	-1.30	0.43	0.27	0.12 – 0.63	**0.003**
	Glide	25	0.30	0.62	1.35	0.40 – 4.59	0.63
	Velar	28	-1.60	0.65	0.20	0.06 – 0.71	**0.01**
Lexical stress	Stressed	322	0.63	0.53	1.88	0.66 – 5.34	0.24
Vowel height	Close-mid	266	0.01	0.58	1.01	0.32 – 3.15	0.99
	Open	9	0.77	1.21	2.15	0.20 – 23.06	0.53
	Open-mid	164	-0.77	0.49	0.46	0.18 – 1.20	0.11
Vowel advancement	Central	208	-1.40	0.68	0.25	0.07 – 0.93	**0.04**
	Front	165	-1.52	0.44	0.22	0.09 – 0.52	**< 0.001**
BLP			0.0003	0.01	1.00	0.99 – 1.01	0.96
SES			0.005	0.15	1.00	0.75 – 1.34	0.98
Age of child			-0.05	0.04	0.95	0.89 – 1.02	0.19
Gender of child	Female	179	1.11	0.80	3.03	0.63 – 14.53	0.17
Formality × SES			-0.13	0.15	0.88	0.65 – 1.18	0.38
Formality × BLP			0.001	0.01	1.00	0.99 – 1.01	0.82
Formality × Age of child			0.09	0.04	1.09	1.02 – 1.17	**0.01**
Formality × Gender of child			0.38	0.78	1.46	0.32 – 6.77	0.63

Note: CI = confidence interval. Response variable is l-less (0) or retained (1). Reference category for formality is informal (*n* = 126), neighbouring consonant is pause (*n* = 212), lexical stress is unstressed (*n* = 212), vowel height is close (*n* = 95), vowel advancement is back (*n* = 161), gender of child is male (*n* = 355). **Full model**: Observations = 534, marginal R^2 = 0.25, conditional R^2 = 0.54, AIC = 620.36. **Reduced model**: Observations = 534, marginal R^2 = 0.15, conditional R^2 = 0.60, AIC = 621.57.

3. Regression coefficients of a full mixed-effects linear regression model fit to the consonantal laterals across entire dataset with F2–F1 (Bark) as response.

Fixed factors	**Level**	***n***	***β***	***B***	**SE**	***t***	***p***
(Intercept)			0.05	7.43	0.31	24.38	**< 0.001**
Formality	Formal	754	0.01	0.01	0.19	0.06	0.95
Position	Coda	537	0.01	0.02	0.25	0.06	0.95
Vowel context			0.47	0.39	0.03	15.09	**< 0.001**
Neighbouring consonant	Coronal	369	0.05	0.08	0.10	0.82	0.42
	Glottal	26	0.03	0.05	0.22	0.22	0.83
	Labial	310	-0.27	-0.43	0.13	-3.24	**0.001**
	Glide	31	0.21	0.33	0.21	1.57	0.12
	Velar	60	-0.14	-0.22	0.17	-1.29	0.20
Lexical stress	Stressed	905	0.02	0.032	0.14	0.22	0.82
Lateral duration (log)			0.04	0.11	0.07	1.58	0.11
Parent	Mothers	539	0.08	0.12	0.25	0.47	0.64
BLP			0.03	0.001	0.002	0.54	0.59
SES			0.05	0.03	0.04	0.81	0.42
Age of child			-0.01	-0.001	0.01	-0.09	0.93
Gender of child	Female	321	0.15	0.24	0.21	1.17	0.24
Formality × Parent			0.17	0.27	0.27	1.01	0.31
Formality × Position			-0.20	-0.31	0.35	-0.90	0.37
Parent × Position			-0.21	-0.33	0.35	-0.95	0.34
Formality × Parent × Position			-0.70	-1.10	0.50	-2.17	**0.03**

Note: Reference category for formality is informal (n = 342), syllable position is onset (n = 559), neighbouring consonant is pause (n = 300), lexical stress is unstressed (n = 191), parent is fathers (n = 557), and gender of child is male (n = 775). Observations = 1096, marginal R2 = 0.37, conditional R2 = 0.70, AIC = 3425.02.

4. Regression coefficients of a full mixed-effects linear regression model fit to the consonantal laterals produced by mothers with F2–F1 (Bark) as response.

Fixed factors		***n***	***β***	***B***	**SE**	***t***	***p***
(Intercept)			0.26	8.32	0.53	15.72	**< 0.001**
Formality	Formal	360	0.15	0.28	0.35	0.81	0.42
Position	Coda	255	-0.18	-0.28	0.56	-0.50	0.62
Vowel context			0.44	0.39	0.04	10.50	**< 0.001**
Neighbouring consonant	Coronal	208	-0.05	-0.10	0.17	-0.60	0.55
	Glottal	9	-0.02	-0.04	0.45	-0.10	0.92
	Labial	144	-0.20	-0.38	0.22	-1.75	0.08
	Glide	13	0.26	0.49	0.37	1.32	0.19
	Velar	26	-0.23	-0.42	0.30	-1.42	0.15
Lateral duration (log)			0.07	0.23	0.11	2.19	**0.03**
Lexical stress	Stressed	458	-0.05	-0.09	0.26	-0.35	0.73
BLP			-0.18	-0.01	0.01	-1.22	0.22
SES			0.05	0.03	0.11	0.31	0.75
Age of child			-0.19	-0.03	0.02	-1.34	0.18
Gender of child	Female	129	-0.24	-0.45	0.66	-0.67	0.50
Formality × Position			-0.77	-1.45	0.77	-1.89	0.06
Formality × BLP			-0.001	0.00	0.01	-0.01	1.00
Formality × SES			0.04	0.03	0.10	0.25	0.80
Formality × Age of child			0.15	0.03	0.02	1.08	0.28
Formality × Gender of child			0.23	0.42	0.66	0.63	0.53
Position × BLP			-0.08	-0.003	0.01	-0.32	0.75
Position × SES			0.01	0.01	0.19	0.04	0.97
Position × Age of child			0.29	0.05	0.04	1.21	0.23
Position × Gender			0.23	0.42	1.15	0.37	0.71
Formality × Position × BLP			-0.01	-0.001	0.02	-0.03	0.98
Formality × Position × SES			0.09	0.06	0.25	0.25	0.80
Formality × Position × Age of child			-0.58	-0.10	0.05	-1.79	0.07
Formality × Position × Gender of child			-0.55	-1.02	1.51	-0.67	0.50

Note: Reference category for formality is informal (*n* = 179), syllable position is onset (*n* = 284), neighbouring consonant is pause (*n* = 139), lexical stress is unstressed (*n* = 81), and gender of child is male (*n* = 410). **Full model**: Observations = 539, marginal R^2 = 0.47, conditional R^2 = 0.76, AIC = 1918.67. **Reduced model**: Observations = 539, marginal R^2 = 0.42, conditional R^2 = 0.75, AIC = 1820.74.

5. Regression coefficients of a full mixed-effects linear regression model fit to the consonantal laterals produced by fathers with F2–F1 (Bark) as response.

Fixed factors		***n***	***β***	***B***	**SE**	***t***	***p***
(Intercept)			-0.05	7.08	0.37	19.36	**< 0.001**
Formality	Formal	394	-0.07	-0.15	0.18	-0.83	0.41
Position	Coda	282	0.07	0.04	0.25	0.17	0.86
Vowel context			0.47	0.35	0.04	9.85	**< 0.001**
Neighbouring consonant	Coronal	161	0.14	0.16	0.12	1.40	0.16
	Glottal	17	0.05	0.07	0.24	0.27	0.78
	Labial	166	-0.37	-0.44	0.15	-2.87	**< 0.01**
	Glide	18	0.17	0.21	0.24	0.87	0.38
	Velar	34	-0.12	-0.14	0.20	-0.69	0.49
Lateral duration (log)			0.01	0.02	0.08	0.25	0.81
Lexical stress	Stressed	447	0.16	0.19	0.16	1.14	0.26
BLP			0.10	0.003	0.003	0.84	0.40
SES			0.26	0.10	0.07	1.42	0.16
Age of child			-0.05	-0.01	0.02	-0.30	0.77
Gender of child	Female	192	0.19	0.22	0.39	0.58	0.56
Formality × Position			-0.20	-0.18	0.29	-0.63	0.53
Formality × BLP			-0.12	-0.003	0.003	-1.07	0.28
Formality × SES			-0.21	-0.08	0.07	-1.24	0.22
Formality × Age of child			-0.01	-0.001	0.02	-0.05	0.96
Formality × Gender of child			0.20	0.24	0.35	0.69	0.49
Position × BLP			-0.03	-0.001	0.003	-0.28	0.78
Position × SES			-0.19	-0.07	0.06	-1.10	0.27
Position × Age of child			0.04	0.004	0.02	0.27	0.79
Position × Gender			0.06	0.07	0.39	0.18	0.86
Formality × Position × BLP			0.15	0.004	0.004	0.90	0.37
Formality × Position × SES			0.04	0.02	0.10	0.16	0.87
Formality × Position × Age of child			0.02	0.002	0.02	0.08	0.94
Formality × Position × Gender of child			-0.19	-0.22	0.54	-0.41	0.68

Note: Reference category for formality is informal (n = 163), syllable position is onset (n = 275), neighbouring consonant is pause (n = 161), lexical stress is unstressed (n = 110), and gender of child is male (n = 365). **Full model**: Observations = 557, marginal R^2 = 0.26, conditional R^2 = 0.60, AIC = 1670.76. **Reduced model**: Observations = 557, marginal R^2 = 0.25, conditional R^2 = 0.59, AIC = 1552.50.

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