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Inter-sentential code-switching and language dominance in Cantonese-English bilingual children

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Abstract

This paper examines the relationship between language dominance and the under-investigated topic of inter-sentential code-switching in Hong Kong Cantonese-English bilingual children. Longitudinal data for six children showing different dominance patterns were analysed. MLU differentials (Yip & Matthews, 2006) were adopted to measure dominance based on five criteria: methodological compatibility, typological comparability, gradient measurement, variance validity, and multi-faceted compatibility. Our results showed that bilingual children produced more inter-sentential code-switching in the context of their non-dominant language and less in their dominant-language context. We account for this asymmetry in relation to mechanisms of inhibitory control (Gross & Kaushanskaya, 2015). Further, we propose that intra-sentential and inter-sentential code-switching have a different status in bilingual children's developing grammar, underlining the methodological importance of separating the two constructs in future investigations. We also suggest that in societies where intra-sentential code-switching is a social norm, inter-sentential code-switching could serve as signs of early bilinguals' dominance status.

Keywords: code-switching, code-mixing, language dominance, Cantonese-English bilingual, bilingual children, MLU

1. Introduction

1.1 Code-switching in Bilingual Children

In code-switching, bilingual children produce words or sentences from two different languages within a single discourse. In the present study, code-switching refers to language alternation within the same speech act (following Cantone, Müller, Schmitz, & Kupisch, 2008; Genesee, Paradis & Crago, 2004; Yow, Tan & Flynn, 2018; cf. Poeste, Müller & Arnaus Gil, 2019). The present study differentiates between intra-sentential code-switching, which refers to using words from two languages within the same utterance, and inter-sentential code-switching, which refers to using one language where the other language would be expected based on the dialogical context (Poeste et al., 2019; Schmeißer, Eichler, Arnaus Gil, & Müller, 2016; cf. Genesee, Nicoladis & Paradis, 1995; Yow et al., 2018) (see Table 1; see Section 2.3 for further explanation).[1]

Table 1. Types and examples of code-switching.[2]

Types of code-switching	Examples
Intra-sentential code-switching	Child: I *teoi1* him I push him "I push him" (Timmy 2;04;07, EC[3])
Inter-sentential code-switching	Mother: What is this? Do you know what it is? Child: *ngo5 jiu3 tai2 ngo5 jiu3 tai2*

[1] In this study, we followed Yow, Tan, and Flynn (2018) and regarded "code-switching" and "code-mixing" as synonymously referring to an alternation of two languages within the speech. For an alternative view, see Poeste and Müller (2020) and Sivakumar, Müller and Arnaus Gil (2020).

[2] Cantonese is a tonal language with six lexical tones. The number at the end of each Cantonese word represents its lexical tone.

[3] "EC" stands for English dialogical context set by the interlocutor(s) with whom the child communicated; "CC" stands for Cantonese dialogical context as set by the interlocutors.

I want see I want see
"I want to see! I want to see!"
Child: I want to watch the…
(Kasen 2;05.05, EC)

Bilingual children's code-switching/mixing has been attributed to language dominance (e.g., Lanza, 2004; Petersen 1988), lexical gaps (e.g., Köppe, 1996), and parental input features (e.g., Comeau, Genesee, & Lapaquette, 2003; Lanza, 2004; Yip & Matthews, 2016), among other factors.

1.2 Language Dominance: Concepts, Operationalisation, and Measurement

Language dominance is a multi-faceted cognitive construct. Lanza (2004) defined language dominance as "a psycholinguistic phenomenon closely intermeshed with sociolinguistic parameters" (p. 172-3). More recently, Treffers-Daller (2015, 2019) interpreted language dominance as containing two key dimensions: language proficiency and language use (See also Birdsong, 2015; Grosjean, 2010, 2015). Researchers who see dominance as relative proficiency emphasise components like grammar and vocabulary, while those interpreting dominance as language use emphasise how frequently bilinguals use languages and how they use language across or within domains (e.g., home, school).

Apart from being a multi-faceted cognitive construct, language dominance has been found to be non-static, and a child's dominance patterns may change over time depending on individual experiences, such as changes in home or school environments (Yip & Matthews, 2007). For example, in De Houwer and Bornstein's (2015) study, most of the French-Dutch bilingual children showed different dominance patterns in vocabulary knowledge at 13 months and 20 months. In Section 3.2, we will discuss how dominance shift affected the developmental profile of one of our children, Kasen.

Due to its complex nature, there are multiple ways to operationalise language dominance. Researchers defining dominance as relative proficiency adopt measures such as mean length of utterance (MLU), upper bound (UB), percentage of multimorphemic utterances (MMUs), lexical access, and lexicon size (e.g., Deuchar & Muntz, 2003; Poeste et al., 2019; Schmeißer et al., 2016b; Unsworth, 2015; Yip & Matthews, 2006). Those conceptualising dominance as language use adopt experience-based variables, for instance, the child's language input and output (e.g., La Morgia, 2015; Unsworth, 2015). Some (e.g., Cantone et al., 2008) use a mixture of these measures.

As suggested by Bedore et al. (2012), the measurement choice should be guided by purpose of investigation because there is no single "best" measure which suits all groups and purposes. In this paper, we adopted MLU differentials to measure bilingual children's language dominance. Our choice of measurement was motivated by: i) methodological compatibility; ii) typological comparability; iii) gradient measurement; iv) variance validity; and v) multi-faceted compatibility.

1.2.1 Methodological Compatibility

With corpus data, MLU differentials allow effective comparison of children's languages to infer dominance status, and MLU figures are easily computed using CLAN. MLU shows high compatibility with our methodology. MLU is also one of the most widely used measures of language development in dealing with corpus data (Treffers-Daller, 2019).

1.2.2 Typological Comparability

Questions have been raised about the cross-linguistic comparability of MLU. Nevertheless, Treffers-Daller (2019) remarked that these concerns also apply to other dominance measures such as types and tokens, UB and MMU. For child Cantonese and English, Yip and

Matthews (2000, 2006) argued that MLU values are in fact comparable. For isolating languages like Cantonese, MLU is generally computed in words[4]. The authors observed that child participants' English could be treated as predominantly isolating, since inflectional morphology was not yet in place. Thus, for the Cantonese-English pair, a dominance index could be computed in words (MLUw). Moreover, Klee et al. (2004) showed that between 30 and 36 months, the baseline MLU curves for Cantonese and English intersect. Therefore, at this stage, the MLU values are closely comparable.

MLUw differential is defined as "the difference between MLU scores for a child's two languages at a given sampling point or (expressed as a mean) over a period of development" (Yip & Matthews, 2006, p. 108). Even if MLUw values are not strictly comparable across languages, MLUw differentials can still be used to compare children acquiring the same language pair and to chart changes in dominance patterns over time, as in this study.

1.2.3 Gradient Measurement

According to Treffers-Daller (2015), any dominance measure should be gradient since bilingualism is not a categorical variable (Luk & Bialystok, 2013). Degrees of bilingualism and, thus, dominance should be operationalised on gradient scales. This allows dominance to be used as a predictor in regression analysis to demonstrate the extent it explains variance in the researcher's dependent variable (Birdsong, 2015).

MLUw differentials fulfil this criterion. Section 2 will show how bilingual children can be classified on a language-dominance scale based on MLUw differentials.

[4] Cantonese is not a perfect isolating language. It has compound words containing two or more morphemes and small number of bound affixes as aspectual markers. Although counting these morphemes and sentence-final particles as words in Cantonese may inflate its MLU, other factors (e.g., presence of null subjects/objects, which are disregarded in MLU computation), can set off the inflation (Klee at al. 2004, Yip & Matthews, 2006).

1.2.4 Variance Validity

According to Flege, MacKay, and Piske (2002), a valid index of dominance should predict variance of other measures. For Cantonese-English children, MLUw differentials are, to our knowledge, the only dominance measure that has consistently predicted variance of language performance, especially in domains of syntactic transfer (Yip & Matthews, 2000, 2007). Therefore, adopting Flege et al.'s (2002) criterion, MLU differentials would be valid given their previous success in similar studies on Cantonese-English children.

1.2.5 Multi-faceted Compatibility

Language dominance has two key dimensions: language proficiency and language use. Adopting MLUw differentials in this study might suggest a narrow definition of dominance as relative proficiency of the bilingual's two languages. However, recent studies (Unsworth, 2015; Unsworth, Chondrogianni & Skarabela, 2018) suggested that MLUw differentials correlate significantly with experience-based variables. In a study of Dutch-English bilingual children, Unsworth (2015) investigated relationships between proficiency-based measures (MLUw, UB, number of verbs/nouns) and experience-based measures of dominance (proportion of English/Dutch exposure, language output). Among the proficiency-based measures, MLUw differentials were the only measure significantly correlating with three experience-based variables. In Unsworth et al. (2018), MLUw differentials correlated significantly with measures of language exposure and use. Likewise, Guerra (2008) found that MLU correlated with child utterances per recording session. This implies that MLU differentials may tap into the dimension of language use due to strong correlation with usage-based variables.

1.3 Language Dominance and Code-Switching

As noted by Treffers-Daller (2015, p. 237), language dominance is often considered an *explanans* of linguistic phenomena in bilingual children. Code-switching is one of the cross-linguistic phenomena associated with language dominance. Despite numerous attempts to understand the nature of code-switching, the relationship between bilingual children's code-switching and dominance has remained controversial.

Past studies provided inconsistent conclusions. One of the widely-cited hypotheses came from Petersen's (1988) study of an English-Danish bilingual child, who was found to apply English morphological inflection to Danish lexical items, but not vice versa. This asymmetry was attributed to the child's English dominance. Thus, Petersen (1988) hypothesised that grammatical morphemes of the dominant language may co-occur with lexical morphemes of either the dominant or non-dominant language. In a similar vein, Jisa (2000) examined code-mixing in French-English children when they first had intensive contact with English (their weaker language). Their direction of code-mixing was consistent with Petersen's (1988) hypothesis. Likewise, in a study of Norwegian-dominant children, Lanza (2004) found that bound and free Norwegian grammatical morphemes were inserted into English utterances; in contrast, English bound morphemes and function words did not co-occur with Norwegian lexical morphemes. Similarly, Bernardini and Schlyter (2004) found that when Swedish-French/Italian bilingual children code-mixed, functional categories from the stronger language were mixed into the weaker language. On the other hand, there are studies rejecting relationships between code-switching and dominance. For example, Cantone (2007) found that German-Italian children produced mixed utterances whether they had a stronger language or not. For the child Aurelio (Italian-dominant), 52% of utterances were mixed during Italian recordings, while for Marta (Italian-dominant), only 0.4% were mixed in the Italian context. Yip and Matthews (2016) calculated intra-sentential code-switching rates of Cantonese-English children and concluded that code-switching was more prevalent in the

Cantonese than English context, regardless of dominance patterns. They attributed the directionality to code-switching in the parental input rather than dominance. Therefore, past studies provided both positive and negative evidence for the relationship between dominance and code-switching.

The situation is even more complicated if we distinguish between intra-sentential and inter-sentential code-switching. Most research on bilingual children's code-switching, including the aforementioned, has focused on the intra-sentential kind. Few studies have exclusively investigated bilingual children's inter-sentential code-switching. There are a few studies encompassing both kinds of code-switching, but as with those on intra-sentential code-switching, no consistent conclusions have been drawn. For example, in Genesee et al.'s (1995) study of five English-French bilingual children (age 1;10 – 2;2), unbalanced children (n=3) produced more inter-sentential code-switching when using their non-dominant language, while all the children's intra-sentential code-switching rates remained low. However, their focus was to address the question of language differentiation, rather than revealing mechanisms of inter-sentential code-switching in relation to dominance. More recently, in a longitudinal study of German-French children, Schmeißer et al. (2016a) found that inter-sentential switching was frequent in the weaker language of an imbalanced bilingual, which seemed to suggest influence of dominance although emotional and cognitive factors were found to play critical roles. Poeste et al. (2019) studied 112 bilingual and trilingual children of different language combinations (English, French, Spanish, Italian, Russian, Arabic, Portuguese, and Catalan) and found neither intra-sentential nor inter-sentential code-switching was related to dominance. Poeste et al.'s (2019) results are not directly comparable to Schmeißer et al.'s (2016a) and Genesee et al.'s (1995) because they conducted one-time grammatical tests rather than a longitudinal study. Also, their participants were older and some were trilingual instead of bilingual, which could imply different

developmental stages and cognitive mechanisms. Furthermore, in Poeste et al.'s (2019) experiments, the children were implicitly asked to behave monolingually which is different from a naturalistic setting where bilingual children are free to select their language for communication.[5]

Despite being characterised by the same term "code-switching", it does not necessarily mean intra-sentential and inter-sentential code-switching are cognitively similar. However, it is common to find studies operating on the assumption that bilingual children's intra-sentential and inter-sentential code-switching involve similar, if not the same, cognitive mechanisms. Such an assumption is sometimes manifested in the calculation of "language mixing" rates. For example, in Deuchar and Muntz's (2003) investigation of a Spanish-English bilingual child, they calculated the child's code-mixing rates as encompassing both inter- and intra-sentential mixing. Thus, their subsequent conclusions could not accurately reflect the relationship between dominance and each type of code-switching. More recently, Yow, Tan, and Flynn (2018) used the sum of both types of code-switching to compute a general code-switching percentage for bilingual children. Such calculations could mask the effects of variables affecting only one type of code-switching. If intra-sentential and inter-sentential code-switching are in fact of different cognitive status in bilingual children's developing grammar, it would be more appropriate for future investigations to separate these constructs in calculation of code-switching rates.

In addition, most research into dominance and code-switching has been conducted in European and American contexts. As commented by Treffers-Daller (2019), research done in Asia is likely to provide new insights into dominance in bilinguals.

[5] A reviewer has pointed out that Poeste et al. (2019) differentiated between "domains" and "dimensions" of language dominance (cf. Birdsong, 2015) with tests conducted in monolingual and bilingual settings. In Schmeißer et al. (2016a), weaker language refers to the "dimensions" of language dominance. It is also worth noting that the terms "code-switching" and "code-mixing" used in these studies might not be equivalent to our usage in the present study.

To sum up, past studies on the relationship between language dominance and code-switching did not produce satisfactory conclusions. First, the evidence provided has been inconsistent. Second, a vast quantity of research has focused on intra-sentential mixing, tending to neglect inter-sentential code-switching or simply assuming the two to be cognitively similar in bilingual children. Therefore, relationships between dominance and inter-sentential code-switching, and between intra-sentential and inter-sentential code-switching in bilingual children still lack proper understanding.

The present study aimed to offer insights into these research gaps. We investigated the relationship between language dominance and inter-sentential code-switching in Hong Kong Cantonese-English bilingual children. Our study was guided by the following research questions:

1. Are there differences in bilingual children's inter-sentential code-switching between the Cantonese and English dialogical contexts?
2. What relationships hold between language dominance patterns and bilingual children's inter-sentential code-switching?
3. Does language dominance hold the same relationship with inter-sentential code-switching and intra-sentential code-switching produced by bilingual children?

2. Methodology

2.1 Subjects and Data Collection

The data came from the Hong Kong[6] Bilingual Child Language Corpus (Yip & Matthews, 2000), accessible through the Child Language Data Exchange System (CHILDES)

[6] Cantonese is the community language in Hong Kong and is spoken by approximately 90% of its residents (Yip & Matthews, 2007). Hong Kong was a former British colony for over 150 years. After the handover of sovereignty to China in 1997, English continues to be recognised in Hong Kong as an official language, alongside Cantonese and Mandarin. It is the official language policy of the city for its citizens to be "biliterate and trilingual," which

(MacWhinney, 2000). The children in the present study were also investigated by Yip and Matthews (2006, 2007, 2013, 2016), making our findings directly comparable to those published by Yip and Matthews.

The corpus contained data from nine Cantonese-English bilingual children with 478 files coded in Codes for the Human Analysis of Transcripts (CHAT) format. The age span was from 1;03 to 4;06. The total number of utterances was 57,831 in the Cantonese context and 46,382 in the English context. Six children were selected based on methodological considerations including data collection and data sufficiency. The following table shows background information of the children from Yip and Matthews (2007, p. 64; 2016, p. 2):

Table 2. Background of child participants.[7]

Child	Native Language		Age Span of Corpus (Years; Months. Days)	Number of files (Total Number of Utterances)
	Mother	Father		
Sophie	Cantonese	English	1;06.01-3;00.09	CC: 40 (12,574) EC: 40 (6,717)
Alicia	Cantonese	English	1;03.10-3;00.24	CC: 40 (6,217) EC: 40 (5,109)
Llywelyn	Cantonese	English	2;00.12-3;04.17	CC: 17 (3,831) EC: 17 (4,121)
Charlotte	Cantonese	English	1;08.28-3;00.03	CC: 19 (4,012) EC: 19 (4,621)
Kathryn	English	Cantonese	3;01.05-4;06.07	CC: 17 (4,281) EC: 14 (4,202)
Kasen	Cantonese	English	2;04.07-4;00.09	CC: 20 (5,228) EC: 20 (5,723)

In each recording, Cantonese and English utterances were elicited from the child by two Cantonese-English bilinguals. One investigator interacted with the child in Cantonese for half an hour, and the other in English for another half an hour. The children participated in daily activities such as playing and chatting. "Cantonese context" means the investigator used Cantonese to converse with the child; however, it does not mean the child always responded

refers to the ability of speaking Cantonese, Putonghua and English and being literate in English and standard written Chinese. Cantonese continues to be the lingua franca among Hong Kong people who are ethnic Chinese.

[7] Apart from Kasen, whose parents adopted the one parent-two languages strategy, all other children were raised by the one parent-one language strategy, in which each parent addressed the child in his/her native language."

in Cantonese. In fact, the children often used English in the Cantonese context, forming inter-sentential and intra-sentential code-switching. Similar situations applied to the "English context."

2.2 MLUw (Differentials)[8]

Given the five criteria in Section 1.2, we adopted MLUw differentials to measure language dominance. MLUw differential is calculated as the difference between MLUw scores for a child's two languages at a given sampling point or expressed as a mean over an extended period of development (Yip and Matthews 2006). Both types of MLUw differential were used. MLUw-fluctuation graphs included in Section 3 trace the children's MLUw changes over time. For each child, the mean MLUw differential was calculated as the mean MLUw for Cantonese minus the mean MLUw for English over the whole recording period. Yip and Matthews (2000, 2006, 2007, 2013, 2016) have shown that while an MLUw-fluctuation graph illustrates a child's own language-dominance shifts over time, which allows within-subject comparison, a mean MLUw differential value serves as a global indicator of a child's overall dominance pattern over the entire recording period, facilitating cross-subject comparison with other children.

Since the MLUw and MLUw-differential (MLU_{diff}) values of the six children were already computed by Yip and Matthews (2007, 2013, 2016), we adopted the values directly from these publications. For example, Sophie showed mean MLUw values of 2.58 for Cantonese and 1.73 for English, giving MLU_{diff} of 0.85, while Charlotte showed mean MLUw values of 1.74 for Cantonese and 2.33 for English, giving MLU_{diff} of -0.59. Based on

[8] To calculate MLUw, we followed the assumption of MLUw as a non-context-sensitive variable which, pre-theoretically, measures a child's language proficiency (Yip & Matthews, 2006).

their results, the children were placed into a continuum of language dominance (Figure 1)[9]. A positive value means Cantonese dominance, whereas a negative value implies English dominance. Therefore, Sophie, Alicia, Kasen, and Llywelyn were Cantonese-dominant; Charlotte was English-dominant. The greater the MLU_{diff}, the more dominant the language.

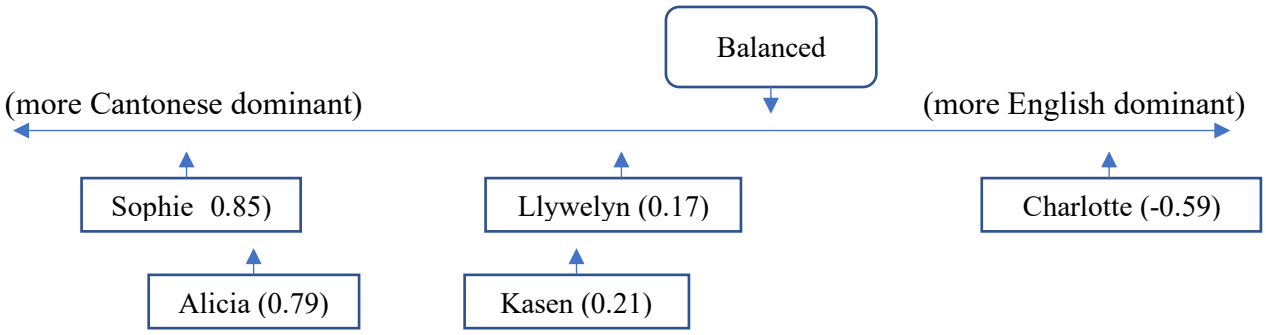

Figure 1. Continuum of language dominance of the bilingual subjects based on MLU_{diff}.

Kathryn was a special case since her period of recording was from age 3;01 to 4;06. According to Scarborough, Rescorla, Tager-Flusberg, Fowler, and Sudhalter (1991), MLU correlates well with other measures of grammatical development until around age 3. Yip and Matthews (2007) noted that Kathryn's MLU figures were unreliable since they "soon reach a ceiling…above which MLU ceases to be a reliable predictor of grammatical development" (p. 79-81). Yiu (2005) used UB and lexical diversity to determine that Kathryn was a balanced child[10]. Kathryn's MLU, UB and lexical diversity remained at a steady level and did not show observable developmental changes. This suggests that Kathryn was approaching a 'ceiling'.

2.3 Defining Inter-sentential Code-switching (Rate)

[9] Please refer to Yip and Matthews (2007) for details on the computation of the MLUw of Sophie, Alicia, Llywelyn and Charlotte.
[10] The concept of "balanced bilingualism" is controversial in recent literature. For an overview, please refer to Treffers-Daller (2015, 2019).

For this study, inter-sentential code-switching was defined as:

> *The use of one language in a context where the use of the other language would be expected based on the dialogical context*

This definition refers to the use of a non-context language which is not desired by the adult interacting with the child (Poeste et al., 2019; Schmeißer et al., 2016a). Below are some examples. In (1) to (2), the child produced an English utterance in Cantonese dialogical context. In (3) to (4), the child produced a Cantonese utterance in English dialogical context.[11]

(1) Investigator: *wong4 sik1*

yellow colour

"[Is it] yellow?"

Child: She look white. Look!

Investigator: *aa1 hai6 wo3 baak6 sik1 gaa3 wo3*

SP yes SP white colour SP SP

"Oh yes! It is white." (Charlotte 1;09.12, CC)

(2) Child: *hei3 kau4 jap6 bin1 gang2 hai6 mou5 je5 laa1*

balloon inside of course no thing SP

"Of course, there's nothing inside the balloon."

Investigator: *tai2 m4 dou2 nei5 go3 joeng6*

see not SP you CL appearance

"You can't see yourself [on the balloon]."

Child: I want see!

[11] SP stands for "sentence particle", ASP for "aspect particle" and CL for "classifier."

Investigator: *waa1 nei5 zou6 me1 aa1*

SP you do what SP

"Wow! What are you doing?" (Alicia 2;10.15, CC)

(3) Investigator: What's that?

Child: a diaper!

ngo5 zoek3 ngo5 zoek3 fu3 fu3 aa1

I wear I wear pants pants SP

"Let me change the diaper!"

Investigator: Oh, you want to change diaper for him! (Charlotte 1;09.12, EC)

(4) Mother: What is this? Do you know what it is?

Child: *ngo5 jiu3 tai2 ngo5 jiu3 tai2*

I want see I want see

"I want to see! I want to see!"

Child: I want to watch the… (Kasen 2;05.05, EC)

Inter-sentential code-switching rate was defined as:

The number of utterances in one language where another language would be expected for that context divided by the total number of utterances produced by the child in that context

For example, in an English context, if a child produced 1000 utterances of which 50 were in Cantonese, his/her Inter-sentential code-switching rate would be 50/1000 = 5%.

To ensure code-switching was initiated by the child, and not triggered by events in the immediate context like language choices of other speakers, instances such as the following

were excluded ("immediate context" was defined as five utterances before and after the code-switched utterance):

(5) Investigator: *faan1 heoi 3 naa4*

"[Shall we] go back?"

Investigator: Let's go! Let's go!

"She's not here."

Child: Let's go!

Investigator: *hai6*

"Yes!" (Charlotte 1;8.28, CC)

In (5), the investigator initiated code-switching rather than the child. Another pragmatic factor removed was the presence of monolingual interlocutors where the child would naturally switch to the language of the monolingual interlocutor. Because our purpose was to investigate effects of language dominance, it was necessary to remove this external pragmatic factor. For instance, in (6), Sophie's father was a native English speaker. His presence might have triggered Sophie to switch to English in the Cantonese context.

(6) Investigator: *nei5 jau6 heoi3 bin1 aa3*

"Where are you going again?"

Brother: *de1*

"Father."

Investigator: *de1*

"Father."

Child: Come here. Come here.

Child: The ant is coming.

Father: Once again.

Child: To me. To me. (Sophie 2;03.14, CC)

Also excluded were (i) cases where it was difficult to tell whether the child knew the words belonged to different languages (e.g. tag switching, abbreviations and proper nouns) and (ii) utterances whose syntactic structure could not be analysed (e.g. incomplete utterances).

2.4 Hypothesis

To examine the relationship between language dominance and inter-sentential code-switching, we formulated a hypothesis:

> *Inter-sentential Code-switching Hypothesis*: Inter-sentential code-switching is related to the child's language dominance. When the child is in the dialogical context of his/her weaker language, the child will have a higher tendency to resort to the stronger language, forming inter-sentential code-switching.

The "weaker" language is defined as the language with shorter MLUw. If a child is weaker at English, his/her English MLUw would be shorter than Cantonese MLUw, and vice versa.

To reveal the interaction between code-switching and dominance, we identified two methods of data analysis: across-language-context and within-language-context comparison. Across-language-context comparison means to compare the rate of code-switching in the Cantonese context with that in the English context. If a child was Cantonese-dominant, for instance, such comparison would predict his/her code-switching rate in the English context to be higher than in the Cantonese context. In other words, comparison would be made between the code-switching rates of the two language contexts. However, we also noticed that language dominance sometimes interacted with code-switching in a subtler way, especially when a child experienced language-dominance changes. For example, when a child became less Cantonese dominant (i.e. more English dominant), his/her inter-sentential code-switching rate in the Cantonese context would rise. All the bilingual children were assessed using the across-language-context comparison as it was a more direct method of comparison. We only

resorted to the within-language-context comparison when coming across subtle interaction or dominance shifts.

3. Results

We analysed the results of three groups of children of different dominance patterns: Cantonese-dominant, balanced, and English-dominant. For each child, we present a MLUw-fluctuation graph, figure of inter-sentential code-switching rates, and table of average inter-sentential code-switching rates.

3.1 Cantonese-dominant Children: Sophie (MLU_{diff}: 0.85), Alicia (MLU_{diff}:0.79), Llywelyn (MLU_{diff}: 0.17)

Tables of average inter-sentential code-switching rates show global patterns of code-switching over the recording periods. Sophie, Alicia, and Llywelyn demonstrated higher rates of inter-sentential code-switching in the English context (Tables 3 – 7). Sophie and Alicia were strongly Cantonese-dominant. Sophie's average inter-sentential code-switching rate in the English context was 10 times higher than Cantonese context. Likewise, Alicia's average inter-sentential code-switching rate in the English context was 8 times higher than Cantonese context. As for Llywelyn, his MLU_{diff} was only 0.17, indicating slight Cantonese dominance, which could explain the smaller difference between his English-context and Cantonese-context code-switching rates. The global pattern here shows in the English dialogical context, the Cantonese-dominant child (despite being addressed in English) switched to Cantonese utterances, as predicted by our Inter-sentential Code-switching Hypothesis.

Graphs of MLUw and inter-sentential code-switching rates show detailed similarities and differences among the children. Sophie and Alicia had similar MLUw profiles as their Cantonese MLUw was consistently ahead of English MLUw. This Cantonese-dominant

tendency explained why their code-switching rates remained relatively low in the Cantonese context. Sophie rarely produced inter-utterance code-switching in the Cantonese context, and most of Alicia's switching rates were below 5%.

On the other hand, Sophie's developmental profile of inter-sentential code-switching rates in the English context was qualitatively different from Alicia's. Sophie often code-switched in the English context from age 1;06.01 to 2;03.01, with switching rates reaching as high as 71.12% at age 1;06.28. However, from age 2;03.01, her switching rates remained low until the end of recording period, which means over 9 months, Sophie hardly code-switched in the English context. In contrast, Alicia's inter-sentential code-switching rates in the English context fluctuated throughout the recording period, with most switching rates above 10% and some above 20%; at several development points, she even code-switched at rates beyond 30%. Her behaviour demonstrated the typical pattern we would expect from a Cantonese-dominant child.

We observed declines in code-switching over significant periods. Besides Sophie, such declines were also found in other children (Llywelyn, Kasen, Kathryn and Charlotte). According to Figure 7, Llywelyn started to show a decline in code-switching in the English context from age 2;06.20, with most switching rates below 5%. We attribute these declines in code-switching to growing pragmatic awareness which intermeshes with language dominance. In Section 4, we will discuss the intermeshing factors in greater detail.

To further illustrate the interactive relationship between dominance and inter-sentential code-switching, one period (age 2.04.12 – 2;10.04) was selected from Llywelyn's developmental profile for closer inspection (Table 6). During that period, Llywelyn's Cantonese dominance was the strongest over the entire research span. Table 6 shows that the difference between his average inter-sentential code-switching rates in English and

Cantonese contexts was 3.17%, significantly higher ($p < 0.05$) than the overall 2.10% in Table 5.

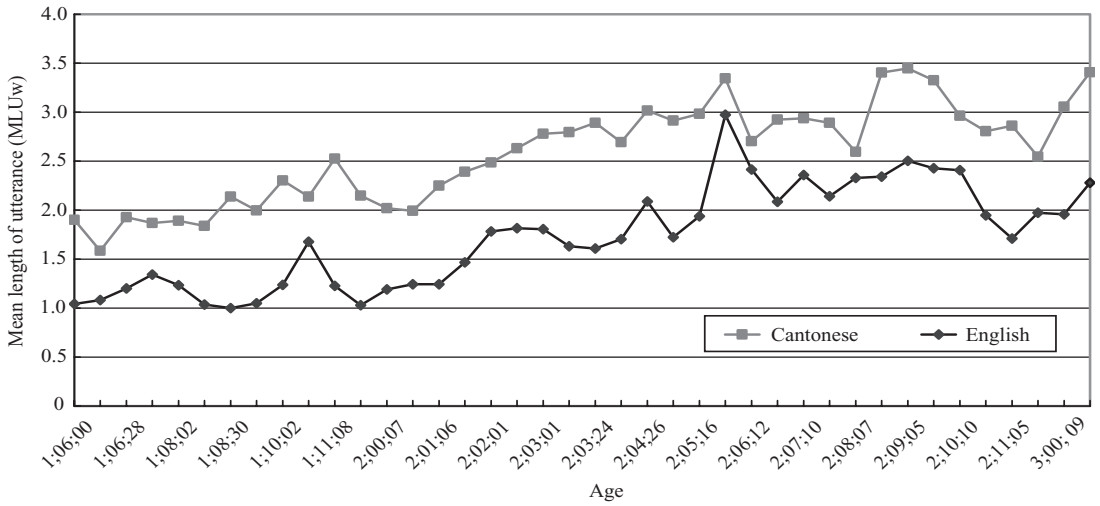

Figure 2. Sophie's MLUw-fluctuation graph (Yip and Matthews, 2007, p. 77).

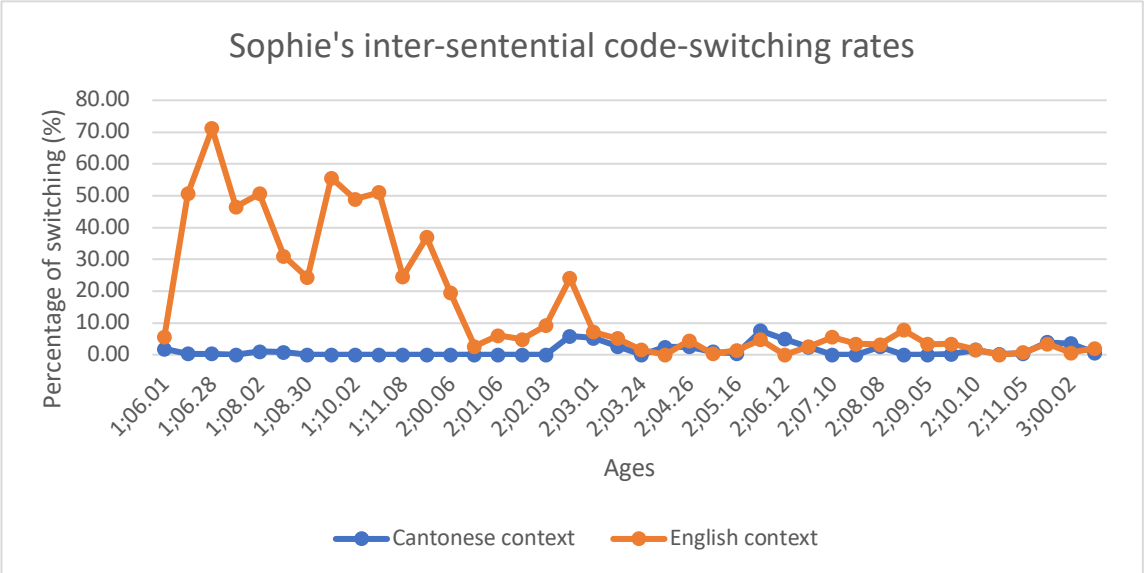

Figure 3. Sophie's inter-sentential code-switching rates.

Table 3. Sophie's average inter-sentential code-switching rates.

	Average inter-sentential code-switching rate (age 1;06.01-3;00.02)
Cantonese context	1.14% (132/11601)
English context	12.30% (820/6669)

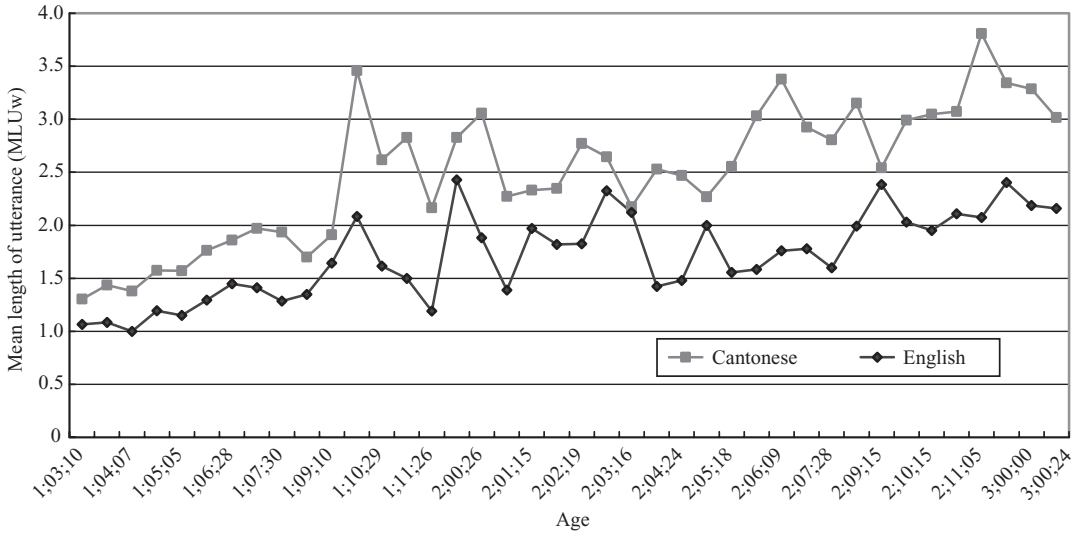

Figure 4. Alicia's MLUw-fluctuation graph (Yip and Matthews, 2007, p. 78).

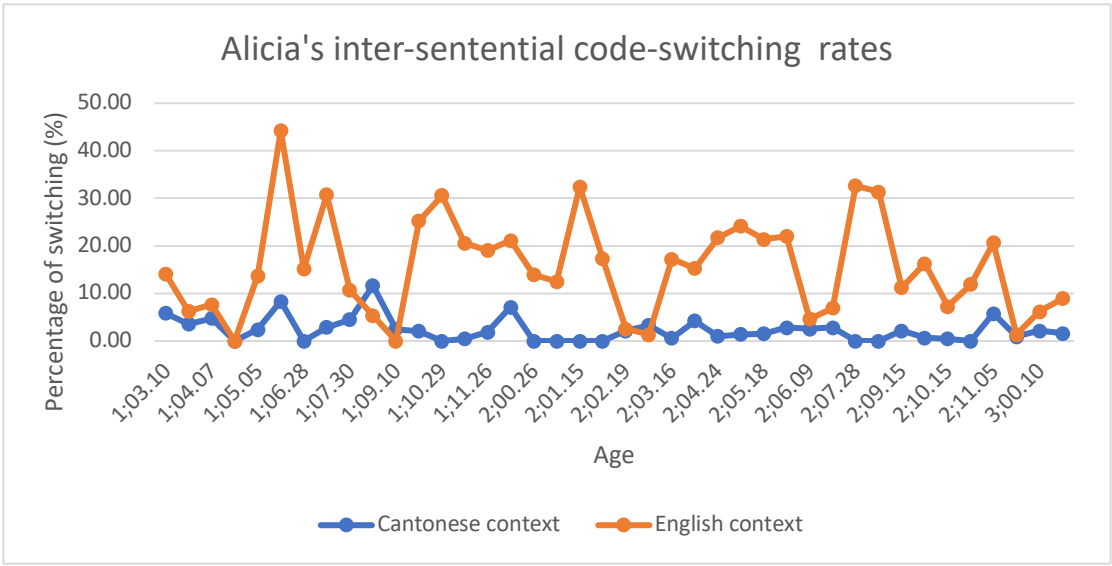

Figure 5. Alicia's inter-sentential code-switching rates.

Table 4. Alicia's average inter-sentential code-switching rates.

	Average inter-sentential code-switching rate (age 1;03.10-3;00.10)
Cantonese context	2.02% (121/5979)
English context	16.10% (737/4579)

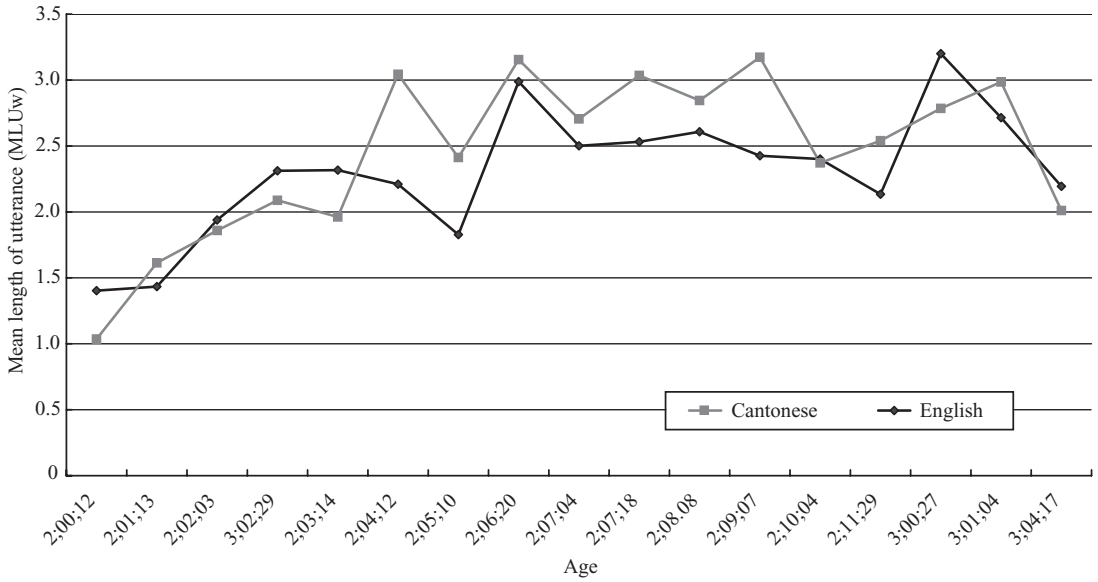

Figure 6. Llywelyn's MLUw-fluctuation graph (Yip and Matthews, 2007, p.78).

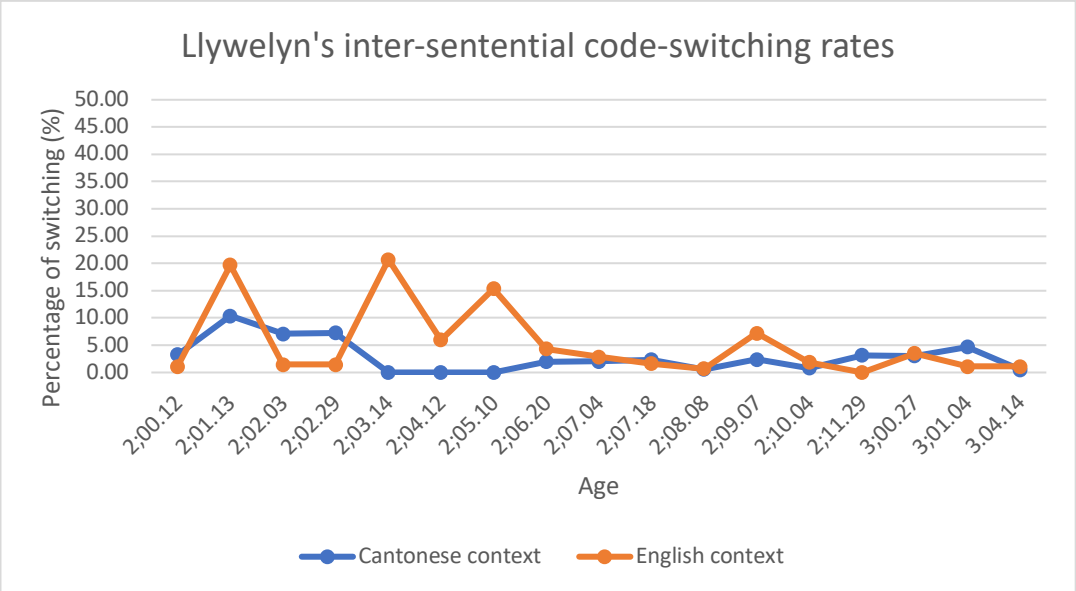

Figure 7. Llywelyn's inter-sentential code-switching rates.

Table 5. Llywelyn's average inter-sentential code-switching rates.

	Average inter-sentential code-switching rate (age 2;00.12-3;04.14)
Cantonese context	2.75% (114/4138)
English context	4.85% (201/4145)

Table 6. Llywelyn's average inter-sentential code-switching rates.

	Average inter-sentential code-switching rate (age 2;04.12-2;10.04)
Cantonese context	1.35% (31/2301)
English context	4.52% (105/2324)

3.2 Cantonese-dominant child: Kasen (MLU_{diff}: 0.21)

Being a Cantonese-dominant child, our hypothesis predicted Kasen's average inter-sentential code-switching rate to be higher in the English context. Unexpectedly, Table 7 shows Kasen's average code-switching rate in the Cantonese context was higher than that in the English context.

Table 7. Kasen's average inter-sentential code-switching rates.

	Average inter-sentential code-switching rate (age 2;04.07-4;00.09)
Cantonese context	12.98% (679/5231)
English context	3.68% (211/5727)

Figure 8. Kasen's MLUw-fluctuation graph (Yip and Matthews, 2013).

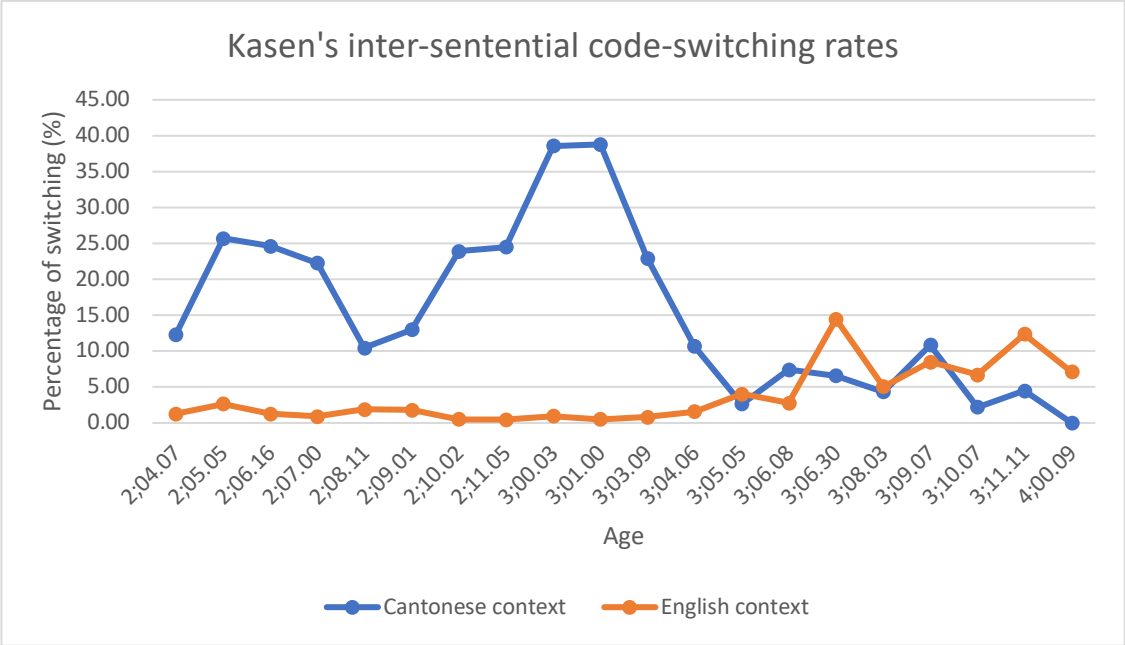

Figure 9. Kasen's inter-sentential code-switching rates.

We argue that Kasen's idiosyncratic pattern reflects dominance shifts that he experienced over time. His average code-switching rate over the entire period could not accurately reveal the interaction between his shifts of dominance and inter-sentential code-switching. As discussed in Section 1.2, dominance is subject to change over time. To show effects of dominance shifts, we followed Yip and Matthews's (2013) methodology and divided Kasen's MLUw differentials into three phases, corresponding to different dominance stages (Table 8).

Table 8. Kasen's developmental phases and language dominance.

Phase	Age range	MLU_{diff}(Cantonese MLUw – English MLUw)	Dominant language
I	2;04-2;09	+0.35	Cantonese
II	2;10-3;04	-0.71	English[12]
III	3;05-4;00	+0.79	Cantonese

Table 9 shows that Kasen's dominance shifts mirror changes in inter-sentential code-switching rates in the Cantonese context. When Kasen changed from Cantonese-dominant to English-dominant from Phase I to Phase II, his inter-sentential code-switching rate increased from 17.19% to 25.35% ($p < 0.05$), confirming our prediction that English dominance increases a child's likelihood to code-switch in the Cantonese context. When Kasen became Cantonese-dominant in Phase III, his inter-sentential code-switching rate in the Cantonese context decreased from 25.35% to 4.06% ($p < 0.05$), suggesting that Cantonese dominance decreased likelihood of code-switching in the Cantonese context.

[12] In Phase II, Kasen started attending a pre-school which adopted English as the medium of instruction, which could have explained his change from Cantonese to English dominance.

Table 9. Kasen's inter-sentential code-switching rates in the Cantonese context.

Phase	Age range	MLU_{diff} (Cantonese MLUw – English MLUw)	Dominant language	Inter-sentential code-switching rate
I	2;04-2;09	+0.35	Cantonese	17.19% (268/1559)
II	2;10-3;04	-0.71	English	25.35% (312/1231)
III	3;05-4;00	+0.79	Cantonese	4.06% (99/2441)

On the other hand, Table 10 shows when Kasen became English-dominant in Phase II, his inter-sentential code-switching rate in the English context decreased from 1.53% to 0.71% ($p < 0.05$). When Kasen became Cantonese-dominant in Phase III, his inter-sentential code-switching rate in the English context increased from 0.71% to 7.70% ($p < 0.05$).[13]

[13] The within-language-context analysis as discussed in Section 2.4 is adopted here. If the across-language-context analysis was adopted, the effects of dominance would be revealed in both Phase II (English-dominant) and Phase III (Cantonese-dominant): in Phase II, Kasen produced significantly ($p < 0.05$) more inter-sentential code-switching in the Cantonese context, typical of an English-dominant child; in Phase III, Kasen produced significantly ($p < 0.05$) more inter-sentential code-switching in the English context, typical of a Cantonese-dominant child. This method of comparison did not account for Kasen's code-switching behaviour in Phase I. Nevertheless, the within-language-context analysis has shown the subtle interaction between Kasen's language dominance and inter-sentential code-switching throughout his developmental period.

Table 10. Kasen's inter-sentential code-switching rates in the English context.

Phase	Age range	MLU_{diff} (Cantonese MLUw – English MLUw)	Dominant language	Inter-sentential code-switching rate
I	2;04-2;09	+0.35	Cantonese	1.53% (23/1505)
II	2;10-3;04	-0.71	English	0.71% (14/1962)
III	3;05-4;00	+0.79	Cantonese	7.70% (174/2260)

Besides dominance shifts, Kasen showed a period of decline in code-switching (Figure 8). From age 3;05.05 to the end of recording period, Kasen's inter-sentential code-switching rates in the Cantonese context were much lower than before.

3.3 Balanced Child: Kathryn

Figure 10 shows Kathryn's inter-sentential code-switching rates and Table 11 average rates for language contexts. As discussed in Section 2.2, since Kathryn's MLUw was found by previous studies to be an unreliable indicator of dominance due to her age and developmental stage, we do not include her MLU graph here.

Table 11 shows that Kathryn produced inter-sentential code-switching in both language contexts at a low rate. The difference between average rates in Cantonese (2.32%) and English (1.94%) contexts was not significant ($p > 0.05$). Figure 10 illustrates detailed fluctuation of Kathryn's code-switching rates. Kathryn's highest code-switching rate was 8.94% in the Cantonese context at age 3;02.19, and most code-switching rates were below 5%.

Kathryn's data confirmed our prediction that balanced children were not subject to effects of dominance. Moreover, Kathryn seemed to show declines in switching from age 3;09.25 in the Cantonese context and age 4;01.19 in the English context, after which she hardly showed fluctuation in code-switching rates.

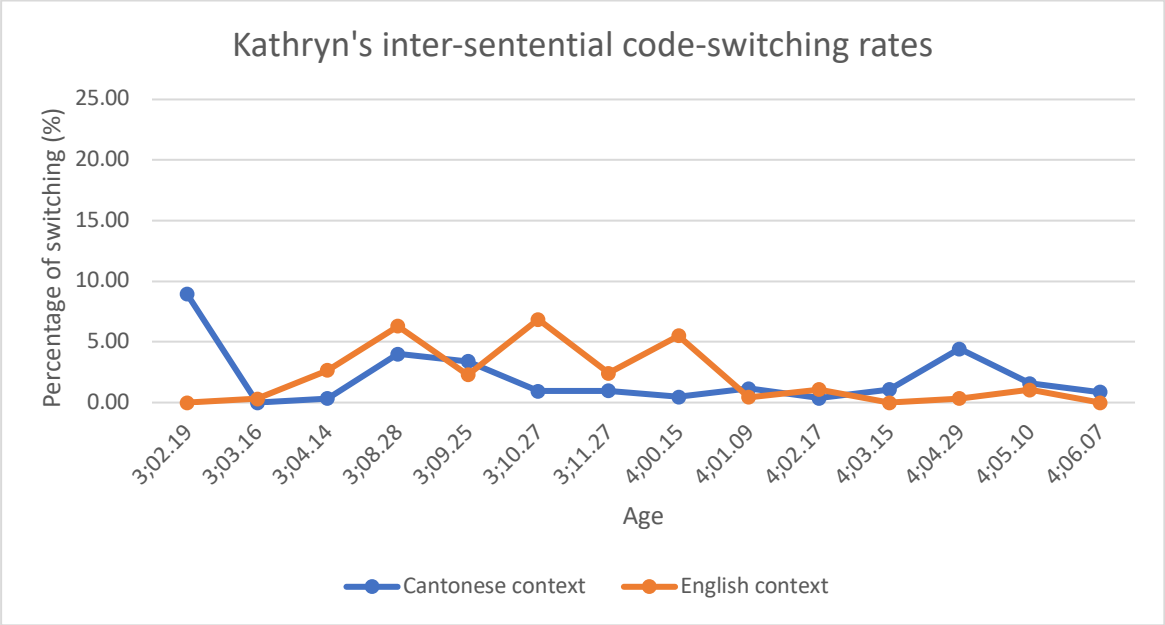

Figure 10. Kathryn's inter-sentential code-switching rates.

Table 11. Kathryn's average inter-sentential code-switching rates.

	Average inter-sentential code-switching rate (age 3;02.19-4.06.07)
Cantonese context	2.32% (85/3668)
English context	1.94% (68/3502)

3.4 English-dominant Child: Charlotte (MLU$_{diff}$: -0.59)

Figure 11 shows Charlotte's MLUw, Figure 12 inter-sentential code-switching rates, and Table 12 average rates for each language context. According to Table 12, Charlotte's average inter-sentential code-switching rate in the Cantonese context was 16 times as high as that in the English context. Figure 12 shows while Charlotte's inter-sentential code-switching rates

in the English context consistently fell below 10% except at age 1;09.12, most code-switching rates in the Cantonese context were above 30%. Her global pattern shows consistently more inter-sentential code-switching in the Cantonese context. This illustrates that in the Cantonese dialogical context, the English-dominant child (despite being addressed in Cantonese) switched to English, as predicted by our hypothesis.

Figures 11 and 12 show some subtle interaction between Charlotte's MLUw development and inter-sentential code-switching, especially using the within-language-context comparison. For example, Charlotte experienced a period of Cantonese dominance from age 2;03.17 to 2;06.16, corresponding to her relatively low code-switching rate in the Cantonese context. As she became English dominant from 2;06.16 onwards, her code-switching rate in the Cantonese context rose again.

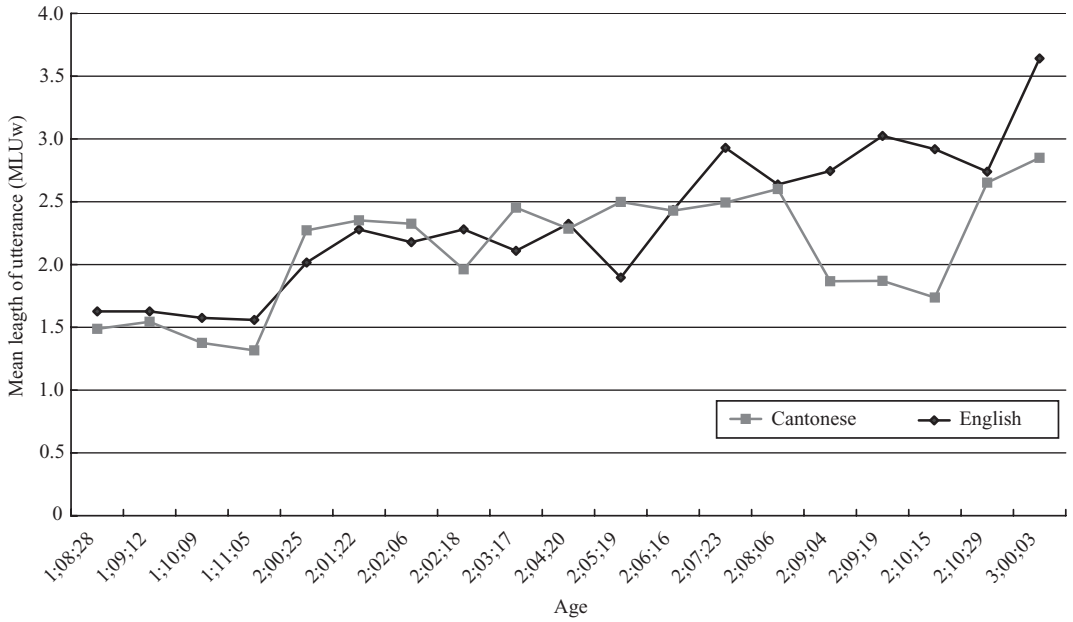

Figure 11. Charlotte's MLUw-fluctuation graph (Yip and Matthews, 2007, p. 79).

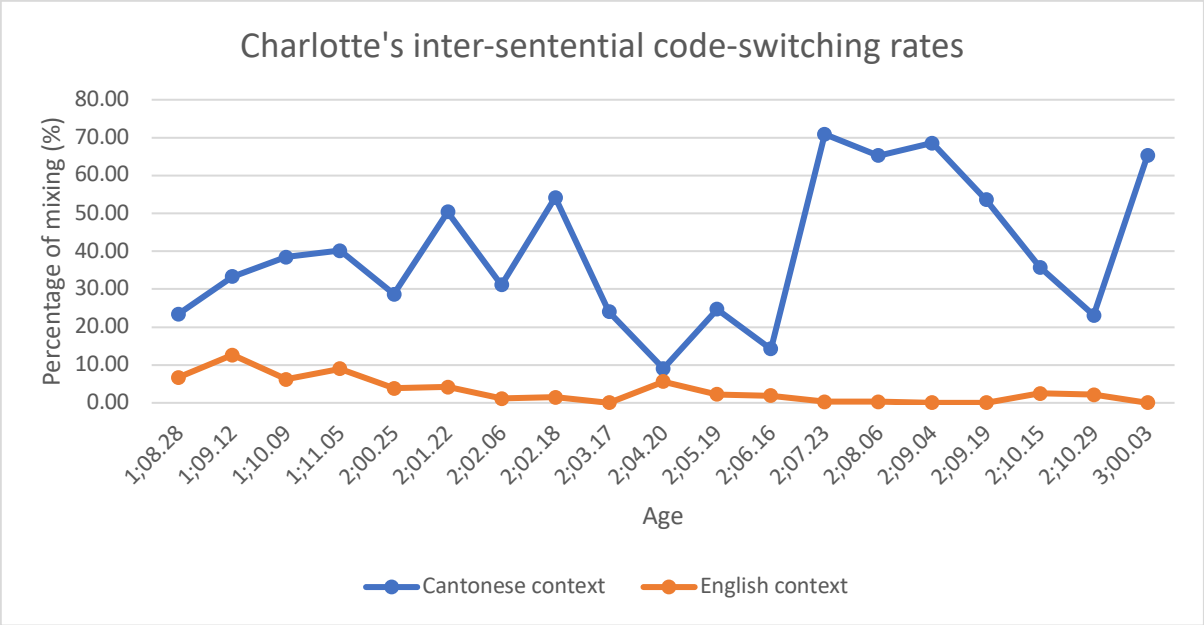

Figure 12. Charlotte's inter-sentential code-switching rates.

Table 12. Charlotte's average inter-sentential code-switching rates.

	Average inter-sentential code-switching rate (age 1;08.28-3;00.03)
Cantonese context	36.70% (1217/3316)
English context	2.24% (91/4060)

Table 13. Overall summary of results.

Overall language dominance	Children	MLUw differential (Cantonese MLUw - English MLUw)	Average inter-sentential code-switching rate		Ratio of inter-sentential code-switching rate in Cantonese context to English context
			Cantonese context	English context	
Cantonese-dominant	Sophie	0.85	1.14% (132/11601)	12.30% (860/6669)	1:10.79*
	Alicia	0.79	2.02% (121/5979)	16.10% (737/4579)	1:7.97*
	Kasen	0.21	12.98% (679/5231)	3.68% (211/5727)	3.53:1*
	Llywelyn	0.17	2.75% (114/4138)	4.85% (201/4145)	1:1.76*
Balanced	Kathryn	/ (Balanced)	2.32% (85/3668)	1.94% (68/3502)	1.20:1
English-dominant	Charlotte	-0.59	36.70% (1217/3316)	2.24% (91/4060)	16.38:1*

*indicates significant differences in average mixing rates between Cantonese and English contexts ($p < 0.05$)

Table 13 shows three patterns: (i) Cantonese-dominant children engage in inter-sentential code-switching more in the English than the Cantonese dialogical context. The difference is significant ($p < 0.05$), although the ratio of code-switching rates varies greatly, from 1:10.79 in Sophie's data to 1:1.76 for Llywelyn. (ii) The balanced child does not differ significantly in her inter-sentential code-switching rates between the two language contexts.

(iii) The English-dominant child engages in inter-sentential code-switching significantly more in the Cantonese context than English context.

Table 14. Bivariate correlation between mean MLU_{diff} and average inter sentential code-switching rates for five children (Sophie, Alicia, Kasen, Llywelyn, Charlotte)[14].

	MLUw differentials	
	r	**p-value**
Inter-sentential code-switching rates (Cantonese context)	-0.904	0.0352
Inter-sentential code-switching rates (English context)	0.870	0.0549

Table 14 shows bivariate correlations between the children's mean MLU_{diff} and average inter-sentential code-switching rates. In the Cantonese context, there is significant negative correlation between their mean MLU_{diff} and average inter-sentential code-switching rates ($r = -0.904$, $p < 0.05$). This means the more Cantonese-dominant the child, the less likely he/she is to code-switch in the Cantonese context. In contrast, in the English context, there is strong positive correlation between the children's MLU_{diff} and average inter-sentential code-switching rates ($r = 0.870$). The correlation approaches significance, suggesting that the more Cantonese-dominant the child, the more likely he/she is to code-switch in the English context. The correlational analysis provides further evidence for our hypothesis.

4. Discussion

The present study investigated the relationship between inter-sentential code-switching and language dominance. By analysing Hong Kong Cantonese-English bilingual data, the study

[14] The data were tested for normal distribution before correlational analysis.

responded to calls for more language-dominance research in Asian contexts (Treffers-Daller, 2019). Our findings have implications on the current understanding of dominance, code-switching, and bilingual cognitive processing and pragmatic awareness.

4.1 Language Dominance, Inter-sentential Code-switching, and Bilingual Cognitive Control

Our findings suggest a strong relationship between children's inter-sentential code-switching and language dominance: bilingual children are more likely to produce inter-sentential code-switching in the weaker-language context. This relationship is even clearer considering the sharp difference between strongly Cantonese-dominant children, Sophie and Alicia, and strongly English-dominant child, Charlotte. While Sophie and Alicia showed much higher inter-sentential code-switching rates in the English context than Cantonese context, Charlotte showed exactly the opposite pattern. This is consistent with studies supporting general relationships between dominance and code-switching (e.g., Lanza, 2004; Schmeißer et al. 2016a).

All our children were engaged by investigators in similar task activities and the investigators were instructed to react to children's code-switching by continuously using the designated contextual language (Lanza's (2004) *Move On Strategy*)[15]. Thus, we do not consider the nature of activities to be convincing explanations for the children's differences in inter-sentential code-switching behaviour. Rather, our findings suggest that the interaction between the children's two languages in the form of inter-sentential code-switching is modulated by language dominance as a property of the mind (Lanza, 2004; Yip & Matthews, 2007).

Additionally, our study demonstrates that language dominance is subject to variation over the developmental trajectory of the two languages (Cantone et al., 2008; De Houwer &

[15] Those instances where investigators did not comply with this strategy (e.g. investigators initiating code-switching) were excluded from the code-switching rates.

Bornstein, 2015; Lanza, 2004; Schmeißer et al., 2016b; Treffers-Daller, 2015). As shown by MLUw graphs, the children experienced changes in dominance over time. Among them, Kasen's case was particularly worth discussing because his average code-switching rates did not comply with our hypothesis. Whereas one might take his case as an exception, detailed analysis in Section 3.2 revealed close interaction between his dominance shifts and inter-sentential code-switching. Such an interactive relationship between dominance shifts and code-switching was also witnessed in Llywelyn and Charlotte. Similar to the present study, Schmeißer et al. (2016a) included an unbalanced child whose language dominance changed over time; nevertheless, they found that the child's inter-sentential mixing did not follow the language-dominance hypothesis, and they attributed it to emotional factors of language preference. For example, a child could show preference for the language of the interlocutor even if it was the child's weaker language. While more studies are needed to reconcile the different findings between the present study and Schmeißer et al. (2016a), one possible factor could be the relationship between the interlocutor and the child. For instance, if the child had strong bonding with the interlocutor, especially when the interlocutor was the child's family member, the emotional factor of language preference could be stronger; on the other hand, if the bonding was not strong enough, such emotional factors might not arise, and in this case, the effect of language dominance would appear.

The fact that we could trace dominance shifts and relate them to inter-sentential code-switching in turn illustrates the effectiveness of using MLUw to measure language dominance of Cantonese-English bilingual children. While we are aware of the availability of different measurement tools for dominance, we believe it is important to select one suitable for investigative purposes and children's language profiles, rather than confusing the results with several measures, some of which might not be appropriate. The importance of selecting the right measurement tool is discussed by Solís-Barroso and Stefanich (2019), who found

that different measurement tools may tap into different dimensions of dominance as a multi-faceted construct. The use of MLUw for the data in the Hong Kong Bilingual Child Language Corpus has been successful in explaining the language phenomena of Cantonese-English bilinguals (Yip & Matthews, 2000, 2006, 2007, 2013, 2016). We attribute the success to the fact that MLUw fulfils the five criteria proposed in Section 1.2: methodological compatibility, typological comparability, gradient measurement, variance validity, and multi-faceted compatibility. We recommend that these criteria to be adopted in future investigations when determining appropriate measurements for dominance.

Our study considers dominance to be a cognitive factor mediating language performance of bilingual children's inter-sentential code-switching. The findings can be explained in the wider context of bilingual language processing through cognitive-control mechanisms. Green's (1998) Inhibitory Control (IC) model explains how bilingual adults control interference from the non-target language during language switching. According to the model, a bilingual's dominant language (e.g., L1) has higher activation and needs greater cognitive inhibition for switching to the weaker language (e.g., L2). On the other hand, the bilingual's weaker language has lower activation and less inhibition is required for its suppression. A recent study by Gross and Kaushanskaya (2015) suggested that the IC model is applicable to bilingual children. English-Spanish bilingual children were tested in picture-naming tasks. The study found significant switching costs with longer naming latencies when the children switched to the other language than staying in the same language. Further, the study found significant switching costs in the children's dominant language, but not in the non-dominant language. Their results suggest that language switching in bilingual children is subject to inhibitory-control mechanisms which slow down lexical access and children inhibit their dominant language to perform switches to the non-dominant language. To apply this mechanism to our findings, we suggest that in the dialogical context of the children's

dominant language, in order for them to switch to their non-dominant language, significant switching costs are imposed cognitively to inhibit the dominant language. This explains why our Cantonese-dominant children, Sophie and Alicia, produced low switching rates in the Cantonese context. In contrast, when they code-switched in the dialogical context of their non-dominant language, no significant switching costs were required for language inhibition, explaining the high code-switching rates found in Sophie's and Alicia's English contexts.

Since the inter-sentential code-switching in our study involved full utterances, most of which extended beyond single words, the switching costs involved would likely to be higher than those measured by Gross and Kaushanskaya's (2015) naming tasks, which mostly required single words and phrases. Further, if full utterances require more cognitive demands to inhibit than single phrases, it follows that there would be greater difference between the dominant and non-dominant language contexts in inter-sentential than intra-sentential code-switching. In other words, effects of dominance on intra-sentential code-switching might not be as visible as those on inter-sentential code-switching. This might be a reason for the existence of dominance effects on inter-sentential code-switching found in the present study which were not identified in some past studies on intra-sentential code-switching.[16]

4.2 Inter-sentential code-switching and pragmatic awareness

Besides language dominance, the findings also suggested presence of other developmental factors, adding to the complexity of the issue. As discussed in Section 3, towards the end of

[16] A reviewer has suggested an alternative view based on Schmeißer et al. (2016a) that inter-sentential "code-mixing" (and turn-specific mixing in Sivakumar et al., 2020) in the early years is not a case of code-switching, but non-adult-like language choice or non-recognition of the interlocutor's language choice due to the fact that inhibiting the stronger language is costlier than the weaker one. Please refer to the two studies for information on how these authors distinguish between code-switching and code-mixing, whose distinction is not pursued in the present study.

the recording periods, a decline in code-switching was observed in five children, for which dominance did not seem to provide satisfactory explanation.

Such a decline may have been caused by increasing pragmatic awareness. Past studies have demonstrated that bilingual children possess pragmatic competence. For example, Comeau, Genesee and Lapaquette (2003) showed that two-year-old bilingual children were sensitive to the language choices of interlocutors and adjusted mixing rates accordingly. Likewise, in Lanza (2004), the two-year-old child Siri code-switched in bilingual but not in monolingual situations, showing sensitivity to social demands of conversation. Genesee, Boivin, and Nicoladis (1996) showed that bilingual children modified their language on-line in response to the linguistic characteristics of their interlocutors. In our study, we found similar situations. As discussed in Section 2.3, we deliberately excluded cases where monolingual speakers were present because the children would tend to speak in the monolingual's language. We considered those instances not motivated by dominance. Nevertheless, they were evidence of our children's developing pragmatic awareness of the interlocutor and dialogical context. As the children grew older, it would be reasonable to expect that they had higher pragmatic awareness which enabled them to comply with the dialogical context negotiated by the research assistants, and therefore, showed gradual drop in switching rates towards the end of the recording period. By considering pragmatic awareness, we recognise the complexity of inter-sentential code-switching which is subject to multiple developmental factors, with dominance being an important factor shaping global code-switching patterns.

We suggest that future research can focus on the pragmatic factors of code-switching in bilingual children and see how pragmatic factors shape a child' code-switching patterns.

4.3 Inter-sentential and intra-sentential code-switching as different phenomena

Despite being characterised by the same linguistic term "code-switching", intra-sentential and inter-sentential code-switching are not necessarily the same cognitive phenomenon. Combining our findings with Yip and Matthews (2016), we can show that inter-sentential and intra-sentential code-switching are different phenomena on the bilingual mind. Yip and Mathews (2016) used the same data corpus as the present study, making our studies comparable.

Yip and Matthews (2016) focused on Cantonese-English bilingual children's intra-sentential mixing. They generalised that intra-sentential switching was more prevalent in the Cantonese than English context, regardless of the child's dominance patterns. Parts of their results are presented in Table 15.

Table 15. Rates of intra-sentential code-switching (Yip & Matthews, 2016, p.7).

Child	**Dominant language**	**Intra-sentential code-switching (Cantonese context)**	**Intra-sentential code-switching (English context)**
Sophie	Cantonese	0.6%	0.3%
Llywelyn	Cantonese	2.0%	0.4%
Charlotte	English	4.5%	0.8%
Kathryn	Balanced	4.0%	1.0%

Yip and Matthews (2016) observed asymmetries in the directionality of intra-sentential code-switching: English items were mixed into Cantonese sentences more frequently than vice versa. They attributed such directionality to parental language input as intra-sentential code-switching is part of adult Cantonese in Hong Kong, with English words being commonly inserted in Cantonese discourse. Yip and Matthews (2016) provided evidence by comparing two children's intra-sentential code-switching rates with those of their parents (Table 16):

Table 16. Rates of intra-sentential code-switching (Yip & Matthews, 2016, p. 8).

Context	Kasen			Darren		
	Mother	**Father**	**Child**	**Mother**	**Father**	**Child**
Cantonese	1.4%	13.2%	9.4%	0.76%	1.5%	1.1%
English	0.7%	0%	0.9%	0.25%	0%	0.5%

In the Cantonese context, Kasen's father produced a high intra-sentential code-switching rate of 13.2%, closely matching Kasen's rate of 9.4%. In contrast, Darren's much lower intra-sentential code-mixing rate was consistent with those of his parents. Yip and Matthews (2016) also analysed the distribution of syntactic categories produced by the children together with morpho-syntactic patterns which were found to share similarities with their parents. The comparison suggested that Cantonese-English bilingual children's intra-sentential code-switching could be explained by parental input[17], which is ascribed to wider social-discourse features.

If Yip and Matthews (2006, 2016) were correct that dominance was not an important factor for intra-sentential code-mixing, how can we reconcile their findings with ours which have demonstrated a clear relationship between dominance and inter-sentential code-switching? We propose that intra-sentential and inter-sentential code-switching are cognitively different in the bilingual child's developing grammar and are, thus, motivated by different cognitive and pragmatic factors. In Hong Kong, intra-sentential code-mixing is a common practice. As commented by Treffers-Daller (2015), the mixed use of both languages in conversations, even when discussing one topic with the same interlocutor, is the norm in some bilingual communities, such as urban Wolof speakers in Dakar and Lingala-French bilinguals in Belgium. Bilingual children acquire this form of mixed code from their parents,

[17] The idea that language input influences a bilingual child's intra-sentential mixing is also formulated as the modelling hypothesis (Comeau, Genesee, & Lapaquette, 2003).

whether they are dominant in one language or not. Therefore, dominance would not explain the qualitative and quantitative aspects of children's intra-sentential code-switching. However, since families provide first social environment, and interaction with parents is highly influential in socialising children's language use (Lanza, 2004), parental input would have impact on children's intra-sentential code-switching. On the other hand, inter-sentential code-switching is not a common social practice in Hong Kong. We speculate that for our children, inter-sentential code-switching is related to their readiness, competency, and preference of speaking the designated language of the dialogical context. Therefore, inter-sentential code-switching can be affected by dominance. This finding implies that in societies where intra-sentential code-switching is a norm, inter-sentential code-switching might serve as signs of a bilingual child's language-dominance status.

The hypothesis that intra- and inter-sentential code-switching are cognitively different in bilingual children has methodological implications. As discussed previously, it is common to find studies adopting a single switching rate that encompasses both intra- and inter-sentential code-switching to explain children's language behaviour. Such operation carries an underlying assumption that intra- and inter-sentential code-switching are cognitively similar. As we and Schmeißer et al. (2016a) have suggested that the two kinds of code-switching are cognitively different, it would be more appropriate for future studies to separate these constructs when compiling code-switching rates.

5. Conclusion

This study aimed to elucidate the relationship between bilingual children's inter-sentential code-switching and language dominance. It shows that when bilingual children are in the non-dominant-language context, they are more likely to use the dominant language, forming inter-sentential code-switching. In contrast, bilingual children tend to produce less inter-

sentential code-switching in the dominant-language context. This asymmetry can be explained by inhibitory-control mechanisms in relation to dominance. Further, the study shows how rates of inter-sentential code-switching reflect changes in dominance over time.

We have proposed that intra-sentential and inter-sentential code-switching are cognitively different in a bilingual child, raising the methodological importance of separating the two constructs in future investigations. We further suggest that in societies like Hong Kong, where intra-sentential code-switching is a social norm, inter-sentential code-switching could serve as signs of early bilinguals' dominance status.

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