EMOTION LANGUAGE SKILLS AND LANGUAGE DEVELOPMENT IN TYPICALLY DEVELOPING BILINGUAL CHILDREN AND CHILDREN AT-RISK FOR A LANGUAGE IMPAIRMENT

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Thesis directed by Associate Professor Pui Fong Kan

ABSTRACT

Background/Purpose: There has been growing attention to studying emotion development in young children to promote academic success (Eisenberg et al., 2005), yet little is known about emotion language skills in bilingual children learning two languages and growing up in two cultural contexts (home and school). Emotion language skills, including our understanding and expression of emotion words (happy, sad), emerge from our culture- and language-specific experiences within a sociocultural context (Tsai, 2007). Unlike monolinguals, sequential bilingual children learn emotion words in a home language that is different from English and in a sociocultural context that is different from the mainstream school setting. Bilingual children's proficiency in each language varies, depending on when, where, how often, and with whom they are exposed to each language. Accordingly, their dual language profile may shape their emotion language skills. This research sought to examine emotion language skills and language skills in bilingual bicultural children in both languages.

Method: 5-year-old Cantonese-English sequential bilingual children who are exposed to Cantonese (L1) at home since birth and learned English (L2) in preschool participated in this research. Two studies examined two populations of bilingual children: 1) typically developing children (n = 36) and 2) children at-risk for a language impairment (LI) (n = 3). For both studies, we examined emotion comprehension and production skills using emotion labelling tasks,

emotion-elicited story-retell tasks, and emotion coding procedures in L1 and L2. Children's vocabulary and grammar skills in each language were measured using a bilingual vocabulary test and language sample analyses from the story retell task. Parents completed a Chinese parent questionnaire to collect information on demographic, language background, and emotion language experiences in the home.

Result: For Study 1, regression analysis revealed that expressive vocabulary skills in English predict children's emotion comprehension skills in English. For Study 2, results revealed different possible outcomes in the dual emotion language profiles for bilingual children at-risk for LI. Results from the parent questionnaire also showed different patterns between children at-risk for LI and their typically developing peers.

Conclusion: Findings suggest that emotion language skills in each language may vary along with the child's dual language skills and suggest further research examining emotion language development over time as language proficiency changes. This study has implications in developing more culturally-linguistically appropriate socioemotional educational curricula.

DEDICATION

To my mom and dad for their unconditional love. Thank you for supporting my dreams. Thank you for giving me confidence. Thank you for being my moral compass.

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CHAPTER I

I. INTRODUCTION

Research shows that emotion language skills, such as emotion understanding and expression, play a central role in children's academic success and social development (e.g., Conte et al., 2019; Eisenberg et al., 2005). Our conceptual representation of emotion words (happy, sad, scared) emerges from our culture-specific experiences within a sociocultural context (Keltner & Haidt, 1999; Pavlenko, 2008). Therefore, our understanding and expression of emotions may vary across languages and cultures such that there are emotion words in one language that do not have an equivalent translation or evoke a similar affective state in another language, or there are different societal values for emotion valence (positive vs. negative emotions) and intensity (excited vs. peaceful) (e.g., Lim, 2016; Tsai, 2007). This raises an important question about how bilingual children growing up learning two languages and exposed to two sociocultural contexts learn emotions words.

Unlike simultaneous bilinguals who learn and maintain both languages in a social environment that supports both languages (e.g., Singapore, Canada), sequential bilingual children are exposed to their home language since birth and then learn English as a second language in a mainstream English-dominant environment (e.g., America). Sequential bilingual children's degree of proficiency in either language can change over time (Genesee & Nicoladis, 2006; Grosjean, 1989; Hoff, 2005), and that depends on greater or lesser exposure to each language (Paradis & Jia, 2016; Wei & Lee, 2001). Previous bilingual studies showed distributed vocabulary skills (e.g., Gross et al., 2014; Oller et al., 2007), and so it is likely that bilingual children may also have distributed emotion language skills as their language skills vary. The relationship between language and emotion in sequential bilingual children remains unclear when their dual language proficiency skills and emotion language skills are moving targets.

The main goal of this study is to examine the relationship between emotion language skills in both languages and dual language skills in sequential bilingual children. Research on simultaneous bilingual children, who are learning and maintaining both languages, suggests a positive relationship between dual language skills and emotion language skills (i.e., Sun et al., 2018). Accordingly, it is also possible that in sequential bilingual children growing language proficiency in one or both languages may positively contribute to their emotion language skills. This is especially important for bilingual children who may be at risk for a language impairment (LI) because it would suggest that they may have low emotion language skills too (Nelson et al., 2011). However, an alternative theory proposed that good emotion language skills may be a potential advantage to support social and academic success and reduce behavioral problems, even if children have weaker language skills (Ren et al., 2016). Therefore, another question in this study was whether there are differences in the relationship between emotion language skills and dual language skills between typically developing (TD) bilingual children and those who may be at risk for LI.

Relatively few bilingual studies have examined emotion language skills in both languages. This is most likely due to the lack of emotion language measures that exist for languages other than English or that are validated on bilingual children (Humphrey et al., 2011). The innovation of this study is in using old tools on a new study population: we adapted well-studied emotion language measures so that they are culturally and linguistically responsive for the Cantonese-English bilingual children in our study. Our findings will have scientific and clinical implications in making educational curriculum changes that will promote optimal conditions to support bilingual children's emotion language development and in laying the foundation for more bilingual measures and tools. As concerns over children's mental health

grow due to the COVID-19 pandemic, racial trauma, and hate crimes, studying emotion development in young children is of increasing importance.

The Importance of Emotion Language Skills in Young Children

Numerous studies suggest that children's emotion language skills, including emotion comprehension and expression, are linked to their academic success (Blau & Klein, 2010; Eisenberg et al., 2005; Hernández et al., 2016), social well-being (Conte et al., 2019; Denham et al., 2003; Schultz et al., 2001), and self-regulation skills (Denham et al., 2012; Streubel et al., 2020). Emotion comprehension involves attending to information in one's environment, identifying one's own and others' feelings, reading body language and facial cues, understanding which emotions are appropriate given the situation, and recognizing emotion-related processes and their causes and consequences (e.g., Eisenberg et al., 2005; Gross & Ballif, 1991). Children's emotion comprehension skills in English increase rapidly during the preschool years, from understanding basic emotion words like happy or sad to more emotionally complex words like disappointed or fascinated (Baron-Cohen et al., 2010; Ridgeway et al., 1985). Furthermore, in a cross-sectional study examining children from 3 to 11 years of age, Pons and colleagues (2004) identified distinct components of emotion comprehension and their developmental periods, ranging from recognizing facial expressions between 3 to 5 years of age to understanding emotions that involve moral judgement around 8 years of age.

Previous research has examined the contribution of emotion understanding skills to early academic success and school adjustment (e.g., Denham et al., 2012). In a longitudinal study of 322 preschool children, Denham and colleagues (2012) implemented a series of tasks that involved identifying facial expressions and characters' emotions from short stories to examine emotion comprehension skills and used teacher questionnaires to measure learning behaviors,

and language and literacy skills. Results from regression analyses showed that emotion understanding skills in preschool predicted their school adjustment and academic success in kindergarten.

Children who understand emotions, may in turn, be better at communicating their emotions to others too. Emotion expression involves communicating feelings through displays of affect, vocalizations, body language, and verbally labeling one's own and others' internal states (Bloom, 1998; Hernández et al., 2016). Children begin describing internal states such as perception (*see, look*), physiology (*hungry, sleepy*), and volition (*want, need*) as early as 28 months, while emotion words and words describing emotion-related behaviors (*hugging, crying*) emerge more gradually (Bretherton & Beeghly, 1982). When children first start labeling facial expressions, they begin by broadly assigning a positive or negative valence (*happy, sad*), but then gradually and systematically use more narrow emotion labels (*angry, scared , disgusted*) over the preschool years (Widen & Russell, 2003, 2008).

A previous study by Hernández and colleagues (2016) examined the relationship between emotion expressivity in a school context and academic achievement in 301 English-speaking 5-year-old children. They observed and rated the intensity, frequency, and duration of positive and negative emotion expression coming from body language, facial expression, and verbal content in the classroom setting. Teachers evaluated children's social relationships, academic skills, and school engagement using a questionnaire. Findings showed that children's positive emotion expression was positively associated with teacher-reported academic success and school engagement, while negative emotion expression was negatively associated with their academic achievement. Their findings support the need to pay attention to young children' emotion expression skills in a school context to set a strong foundation for successful academic

trajectories. Given the integral role emotion language comprehension and expression has in children's developmental and academic success, it is important then to understand how they first understand the conceptual representation of an emotion word.

Emotion Domain: Specific or General?

It has long been argued whether there are existing learning mechanisms that are domain-general for language acquisition or dedicated learning mechanisms that are domain-specific and have evolved for language acquisition. The domain-general theory suggests that skills developed from one learned activity may translate into other skills not yet learned and contribute to our greater knowledge (e.g., Saffran & Thiessen, 2007). In contrary, the domain-specific theory proposes that there are independent neural networks in the brain dedicated for the acquisition of different skills and therefore may not contribute to the learning of other skills (e.g., Karmiloff-Smith, 1992; Nunes, 2004).

The question of whether the emotion domain is general or specific is complex. In accordance with the domain-general theory, the learning mechanisms for language may also be available to support learning emotions too. Evidence to support the domain-general theory comes from the literature on Semantic Bootstrapping, which suggests that children learn emotions in a sentence context by first learning its individual words (e.g., crying, smiling) and then building, or bootstrapping, from the meaning of those words (e.g., Beckwidth, 2014; Pinker, 1984). However, in accordance with the domain-specific theory, the learning skills for language acquisition may not contribute directly to the learning of emotions. Evidence for the domain-specific theory comes from studies examining nonverbal emotion skills such as facial expression recognition, voicing patterns, or body language. For example, Czaplewska & Sterczynski (2015) examined typically developing children and children with language impairment (4-6 years of age) and

compared their ability to recognize facial expressions and vocal intonations indicating emotions. Their study found that children with language impairment performed as well as their typically developing peers in identifying facial expressions of emotions, and even performed better than their typically developing peers in identifying vocal intonations of emotions.

Examining bilingual children offers a unique opportunity to explore the relationship between emotion and language because their dual language skills may vary over time. Whether and to what extent emotion language skills vary accordingly with children's dual language proficiency skills may contribute to our greater understanding about the emotion domain.

Cultural Variations in Emotion Concepts

Understanding how children acquire emotion words early in their language development is critical in supporting their emotion language skills, yet little work has examined children's conceptual representation of an emotion word, especially in bilingual children. When children begin learning the meaning of words, they link a linguistic representation of the word (e.g., "*apple*") with its conceptual representation (a round crunchy fruit) (e.g., Bloom & Markson, 1998). The association between a linguistic representation and its conceptual representation is relatively straightforward for concrete words like *apple*; however, emotion words have been considered a distinct class of words in the mental lexicon that are represented and processed differently (see Altarriba & Bauer, 2004; Altarriba et al., 1999). Conceptual representation of emotion words emerges from our repeated experiences involving physiological reactions, social interactions, self-regulation, and self-appraisals (Pavlenko, 2008). Emotion concepts may be embedded within a larger institution of social and cultural beliefs, norms, expectations, processes—all of which shape our conceptual representation of emotions in the mental lexicon.

Our understanding and expression of emotions are constructed and shaped through our interactions with other people and within a social cultural context (e.g., Keltner & Haidt, 1999; Mesquita & Boiger, 2014; Mesquita et al., 2016; van Kleef et al., 2016). Cultural factors create a framework for understanding and expressing emotions in a way that will help individuals successfully navigate and meet the demands of their social environment (Mesquita et al., 2016). Through engagement in and exposure to social and cultural practices, people gradually internalize their culture's emotion norms and value of emotions (Lim, 2016; Tsai, 2007; Wege et al., 2014). For example, American and East Asian cultures differ in their value of high-arousal (e.g., excitement, enthusiasm) and low-arousal (e.g., peace, calm) positive affective states, and these values are reflected in popular American magazines which contain more excited smiles and fewer calm smiles compared to those in China (Tsai, 2007). In another example, children's books can be an important resource displaying emotions that are appropriate within the sociocultural context. Wege and colleagues (2014) examined cultural norms of emotions in children's storybooks and found that characters in American books displayed more negative powerful emotions (e.g., *anger*) and less negative powerless emotions (e.g., *sadness*) compared to the characters in Turkish and Romanian children's books. Analyzing the social functions of emotions from different perspectives—from the individual level to the level of the collective (Keltner & Haidt, 1999; Mesquita et al., 2016)—provides a more comprehensive understanding about how one's conceptual representation of emotions is shaped by the sociocultural context.

Emotion concepts may vary across languages such that some emotion words used in one language may not have an equivalent translation in another language or may not evoke the same affective state in a different sociocultural context (Keltner & Haidt, 1999; Pavlenko, 2008; Wong & Tsai, 2007). For example, Bedford (2004) interviewed Taiwanese Mandarin speakers and

found that there are subtypes of words for "guilt" in Mandarin that discriminate between public vs private shame that are indistinguishable in English. We would expect that cultures that differ in important ways (e.g., collectivist vs. individualistic societies) would encode and construct emotion words differently. Unlike monolingual Chinese speakers living in China and monolingual English speakers living in in America, Cantonese-English sequential bilingual children grow up learning both languages while living in America. The differences in the conceptual representation of emotions across cultures and languages raise an important question about how bilingual children exposed to two languages and sociocultural contexts learn emotion concepts.

Development of Emotion Language Skills in Bilingual Bicultural Children

One of the earliest contexts in which children are first exposed to emotion language is in their home environment through parent-child interactions. Studies showed that parental discourse that is rich in referencing others' and their child's mental states (*think, feel, know, etc.*) later predicts children's theory of mind and mental state language skills (e.g., Harris et al. 2005; Sourn-Bissaoui & Hooge-Lespagnol; 2006; Taumoepeau & Ruffman, 2008). Additionally, parent-child conversations about emotion states and causes contribute to better emotion understanding, expression, and regulation (e.g., Dunn et al., 1991; LaBounty et al., 2008; Mazzone et al., 2017). Unlike monolingual English-speaking children, bilingual children learn emotions from their parents in a home language and in a sociocultural context that differs from the mainstream school setting. Many immigrant children or children of immigrant families growing up in the United States are sequential bilingual children who have been exposed to their home language (L1) since birth, and then learn English later in school. Parents' socialization of

emotions with their bilingual bicultural child in the home may contribute to their child's dual language and cultural experiences and shape their emotion language learning.

In our recent study, Huang and Kan (2021) examined 16 Chinese American immigrant parents' emotion talk with their Cantonese-English sequential bilingual bicultural child. We analyzed emotion words using a Chinese parent questionnaire about emotion language in the home and parents' language samples in Cantonese collected from storytelling tasks that elicited different types of negative emotion words (e.g., sad, angry, scared). Results showed that Chinese American immigrant parents in our study did not talk about guilt emotions with their child as often as they do with other emotions. Additionally, parents used different types of negative emotion words with similar frequency. Interestingly, these results contradicted previous studies that highlighted the importance of guilt emotions in social functioning in Chinese culture (e.g., Bedford, 2004; Fung, 1999) and anger emotions in maintaining harmony in Chinese society (e.g., Fivush & Wang, 2005; Wang, 2003). However, since the parents in our study are Chinese American immigrants, our findings support that they may be in the process of orienting and adapting to both Chinese and American cultures (i.e., Tao et al., 2013), and therefore suggest that immigrant parents' dual cultural experiences may in turn influence how they socialize emotions with their bilingual bicultural child (see Huang & Kan, 2021).

Sequential bilingual children's language and emotion language skills can be visualized as a moving target because of their varying and distributed language skills. Dual language learners' degree of language proficiency varies depending on when, where, how often, and with whom they are exposed to each language (Cheung et al., 2018; Paradis & Jia, 2016). In sequential bilingual children, L1 development in the context of a dominant L2 environment may cause some competition between the two languages, such that L1 may undergo delay, stagnation, and

then attrition, while L2 grows stronger with greater language input (e.g., Wei & Lee, 2001). Moreover, previous work shows a positive relationship between bilingual children's age and time spent in school, suggesting that older children are getting more English language exposure in the school settings (e.g., Huang & Kan, 2021, Kan et al., 2020, Pearson, 2007). Consequently, varying language skills may impact bilingual children's development of emotion language skills too. Consistent with previous theories on distributed vocabulary skills in bilingual children (e.g., Gross et al., 2014; Oller et al., 2007), we may expect that bilingual children's varying language proficiency also contributes to their distributed emotion vocabulary across languages.

There is evidence that bilingual children's dual language skills and social-emotional behavioral skills have a positive relationship (e.g., Sun et al., 2018). Sun and colleagues (2018) examined 805 Singaporean simultaneous bilingual preschool children' dual language exposure and use in the home using a parent questionnaire and their social-emotional behavioral strengths and difficulties in school using a teacher questionnaire. Their results showed that greater bilingual vocabulary skills and active use of both languages were significantly related to better social-emotional behavioral skills in the classroom (Sun et al., 2018). Their findings support the positive relationship between bilingual children's dual language proficiency and their social and emotion language skills. They suggest that children with greater language proficiency in one or both languages may access more positive social interactions, which helps them develop and implement appropriate strategies to communicate their emotions. In turn, emotion competency skills may facilitate language learning such that children with better emotion regulation abilities may be able to engage in more complex conversations in their social environment.

It is important to keep in mind that the children in Sun and colleagues' (2018) study are simultaneous bilinguals growing up in Singapore where they learn and maintain both English

and their heritage language (i.e., Mandarin, Malay, and Tamil) at school and in their community. The relationship between language and emotions may be less straightforward for sequential bilingual children whose language proficiency and emotion language skills are moving targets as they get older and are exposed to varying language input between the home and school.

Emotion Language Skills in Children at Risk for a Language Impairment

In monolingual children, language impairment is conventionally identified on the basis of low language skills in the absence of any obvious accompanying developmental disorders (e.g., Autism, hearing impairment, etc.) (Leonard, 1998). However, since typically developing bilingual children are exposed to varying levels of input in each language, they may have lower language skills in one or both languages at a single point in development (e.g., Bialystok, 2010; Oller et al., 2007)—skills that might look similar to those of monolingual children with a language impairment. Consequently, clinicians, educators, and healthcare professionals often experience challenges in diagnosing bilingual children with a language disorder, or even identifying bilingual children at risk for a language impairment (Kohnert, 2010). Examining bilingual children's unique language profile, in both typically developing children and those at risk of language impairment (LI), may offer insight into the relationship between language skills and emotion language development. If dual language proficiency skills are positively related to social and emotional skills in bilingual children (e.g., Sun et al., 2018), then the opposite explanation would suggest that low language skills in both languages or either language may negatively impact emotion competency skills too.

Many studies suggest that early language difficulties may be a contributing factor to problems with different aspects of emotion competency, including emotional behavior and language skills (e.g., Lindsay & Dockrell, 2012; Spackman, 2006; St Clair et al., 2019; Yew and

O'Kearney, 2013). A metanalysis and systematic review of prospective studies found that children with specific language impairment experience more severe and frequent emotional, behavioral, and attentional problems, and at a clinical or disorder level, compared to children who are typically developing (see Yew and O'Kearney, 2013). Another aspect of emotion competency is emotion language comprehension and expression. Children with language impairment are also less accurate in labeling emotions in others and produce less sophisticated language when explaining emotions compared to typically developing children (Spackman, 2006).

Nelson and colleagues (2011) investigated the relationship between language delays, emergent academic skills, and early emotion comprehension skills in 4-year-old preschool children (n = 336) who were White, Black, or Latino and whose home language was English or Spanish. They analyzed whether the degree of children's language delay (mild, moderate, severe) predicted children's academic skills and early emotion comprehension skills. Results showed a strikingly consistent pattern: the severity of language delay was strongly associated with systematically decreasing academic and emotion comprehension skills. They concluded that children who carry the "double risk" of both low language skills and low emotion comprehension skills may have reduced opportunities to interact with peers at school and difficulties with social skills and emotion competency skills (Nelson et al., 2011).

It is important to point out that although their study included children from different racial/ethnic backgrounds and whose home language was Spanish, their study did not focus on dual language learners. Notably, they did not measure bilingual children's dual language skills which could vary at different developmental points and appear like low language skills seen in monolingual English-speaking children with a language disorder. Few studies have examined

bilingual children who are at risk of LI and the relationship between their low language skills and emotion language skills. If the "double risk" holds for bilingual children, then we should expect that children who have weaker language skills in both languages or either language may in turn have lower emotion language skills too.

Alternatively, it is also possible that even if bilingual children who are at risk of LI have low language skills in both or either language, good emotion competency skills may be a potential advantage to support their social and academic success. This is especially important for newly arrived immigrant children or children of newly arrived immigrant families who may mainly use their home language for social interactions and are beginning to learn English as a second language. When they transition into a school setting whose culture and language differs from that of their home environment, they may be ill-equipped to access the school curriculum and may have difficulty navigating peer interactions (e.g., Baker and Páez, 2018; Commins, 1989; Heath, 1982). Supporting rapid gains in English may not be enough, but rather supporting emotion competency skills may promote better school adjustment and social well-being in the classroom for bilingual children.

Indeed, a study with Mandarin-English sequential bilingual preschool children found that regardless of whether children had advanced or limited English proficiency skills, children who were rated by their teachers as having high emotion regulation skills remained low in their behavioral problems (Ren et al., 2016). Their findings indicate that bilingual children with limited English language skills may not display serious behavioral problems if they can effectively appraise the social situation and regulate their emotions positively, suggesting that emotion competency skills may serve as a potential advantage in those with low English language skills. Understanding whether and to what extent low language skills in both or either

language impact emotion language skills in bilingual children could have implications in identifying strategies and approaches that will support immigrant children's academic outcomes, social well-being, and school adjustment.

Measuring Emotion Language Skills in Both Languages

The increasing attention to emotion competency skills in young children has resulted in the development and use of a variety of measures, tools, and tasks to examine differential areas of emotion competency (see review in Humphrey et al., 2011). Tools like video clips (Blau & Klein, 2010; Gross & Ballif, 1991) to elicit emotions from children and parent questionnaires (Shields and Cicchetti, 1997; Mazzone et al., 2017) to examine the home environment, or other measures like story comprehension and storytelling tasks to assess emotion comprehension (Pons and Harris, 2004; Ribordy et al., 1988; Schultz et al., 2001) and emotion expression (Pavlenko, 2008; Wang & Leichtman, 2000; Wang et al., 2000), have been commonly used in the affective science literature to examine emotions in young children. For example, a study by Bierman and colleagues used existing and well-studied measures such as the *Assessment of Children's Emotions Skills* (ACES; Schultz et al., 2004) and the *Emotion Recognition Vignettes* (ERV; Ribordy et al., 1988) to assess emotion comprehension and social-cognitive skills in preschool children in Head start schools. Additionally, the emotion word categorical model proposed by Aneta Pavlenko (2008; see Method for more details) has subsequently been used by many researchers in child development, language, and cognitive science fields to analyze children's emotion word knowledge (e.g., Wu et al., 2021; Zhang et al., 2017).

Notably, many of the social-emotional measures have been implemented on or validated on monolingual English-speaking children. As Humphrey and colleagues (2011) pointed out in their systematic review of social-emotional measures, there has been little analysis of the

applicability of these measures on children from culturally-linguistically diverse backgrounds. Due to the lack of standardized bilingual tests, tools, and measures, clinicians and educators must instead rely on tests normed on monolingual children—tests that are not sensitive to two languages and cultures (Gutierrez-Clellen & Peña, 2001; Kohnert, 2010). There are many limitations in using tests normed on monolingual children on bilingual children, including inaccurate translations or cultural biases (e.g., Bedore & Peña, 2008; Thordardottir et al., 2006; also see Huang, 2016). The obvious solution would be to develop new standardized bilingual measures that take into consideration dual language development, are culturally-linguistically unbiased, and are normed on bilingual children. However, developing novel tools may not be a realistic option either because it will require extensive time and money to validate them, which may cause further delays in research on bilingual children. In the affective science field, researchers suggest that rather than reinvent tools for which sufficient resources currently exists, researchers may consider adapting these measures and developing new procedures to expand the use of these standardized and well-studied measures (see Coan & Allen, 2007). Existing measures of emotion competency skills may serve as the foundation for bilingual researchers to carefully adapt and improve these tools such that they are culturally-linguistically appropriate and applicable to wider groups of children.

There is a growing number of studies that have modified validated emotion competency measures such that they are culturally-linguistically appropriate to implement on minority populations. For example, parent and/or teacher questionnaires like the *Emotion Regulation Checklist* (Shields & Cichetti, 1997), which was originally developed for monolingual-English speaking children, has been administered to Chinese monolingual children (Chang et al., 2003; Xu & Zhang, 2008) and Mandarin-English bilingual children (Ren et al., 2016; Ren et al., 2018).

Additionally, the *Strengths and Difficulties Questionnaire* (Goodman, 1997) used to evaluate social, behavioral, and emotional regulation skills has been translated into numerous languages (e.g., Chinese, Kannada, Farsi, etc.). Most recently, Huang & Kan (2021) implemented a Chinese parent questionnaire to examine Cantonese-English bilingual preschool children's exposure to emotion language in the home environment, which was previously adapted from the *Questionnaire of Parent Child Conversations about Emotions* (Mazzone et al., 2017) for French-speaking children in Belgium. Studies have also used a similar emotion coding method (Pavlenko, 2008) to analyze emotion word categories in other languages besides English, including Chinese (e.g., Lin & Yao, 2016; Ng et al., 2019) and Spanish (e.g., Aznar & Tenenbaum, 2013; Shiro et al., 2020). Additionally, cross-linguistic studies have implemented storytelling tasks in different languages to analyze emotion language skills in children's language samples. For example, Wang and Leichtman (2000) compared Chinese children from Beijing and White American children using a series of picture stories and recalling emotional memory tasks to elicit emotions in each language. Unlike cross-linguistic studies that compare different languages in monolingual children, sequential bilingual children grow up learning and maintaining two languages. Few studies have implemented tools and/or tasks to measure bilingual children's emotion language skills in both languages. Cultural and linguistic adaptation and modification of existing measures for bilingual children may serve as a steppingstone and could have implications in accelerating emotion research on children from different cultural and language backgrounds.

Current Study

This study examined the relationship between emotion language skills and dual language skills in sequential bilingual children who are exposed to Cantonese (L1) at home since birth and

learned English (L2) in preschool. This study focused on 5-year-olds (5;0 to 5;11 years) because children at this age can accurately identify basic emotions (Baron-Cohen et al., 2010; Gross & Ballif, 1991; Ridgeway et al., 1985). Following previous studies (e.g., Aznar & Tenenbaum, 2013; Huang & Kan, 2021; Pavlenko, 2008) we examined emotion language skills using a parent questionnaire, emotion labelling tasks, emotion-elicited story retell tasks, and emotion coding procedures. Children's vocabulary and grammar skills in each language were measured using a bilingual vocabulary test developed for this population (Kan et al., 2020) and language sample analyses from the story retell task. We analyzed whether varying language proficiency skills in Cantonese and English contributed to bilingual children's emotion language skills in either language.

Two studies examined two populations of bilingual children: typically developing children and children at risk of a language impairment. Both studies followed the same procedures and used the same measures and tools. Henceforth, the dissertation will be divided into STUDY 1 (typically developing children; TD) and STUDY 2 (children at risk for a language impairment, LI). Please refer to the Table of Contents for page numbers for each study's corresponding sections.

CHAPTER II

II. STUDY 1 - TYPICALLY DEVELOPING BILINGUAL CHILDREN

The purpose of Study 1 was to examine the emotion language skills and the language skills in typically developing (TD) sequential bilingual children who were exposed to Cantonese (L1) at home since birth and started to learn English (L2) in a school setting. The first research question lays the foundation by investigating the emotion comprehension and production skills and language skills in each language. Since bilingual children's proficiency skills in each

language may change over time (e.g., Cheung et al., 2018; Paradis & Jia, 2016), varying language skills may in turn impact bilingual children's development of emotion language skills too. Therefore, I predict that TD children's language skills, along with their emotion language skills, will be different across L1 and L2. Furthermore, given the different sociocultural environments in which bilingual children learn emotions words from their parents, teachers, and peers, I expect that there will be some emotions words that children know in one language but not in the other (e.g., Gross et al., 2014; Keltner & Haidt, 1999; Oller et al., 2007).

Another important question in Study 1 is whether there is a relationship between emotion language and language skills in L1 and L2. I predict there will be a complex relationship between emotion and language skills in each language. Although previous research postulates that emotion words are considered a separate class of words in the mental lexicon (Altarriba & Bauer, 2004; Altarriba et al., 1999), suggesting that there may not be a relationship between emotion and language, the current study goes beyond vocabulary and investigates broader emotion language areas and in dual language learners. Therefore, I expect there to be a relationship between emotion and language skills, but only in English (L2) and not in Cantonese (L1). Consistent with previous studies that suggest growing English language skills in older children (e.g., Huang & Kan, 2021; Paradis & Jia, 2016; Pearson, 2007), I anticipate that 5-year-old children in our study who have been exposed to their mainstream English classroom for a longer period may have had many opportunities to engage in peer interactions and learn more emotion words. Meanwhile, I expect that bilingual children's L1 will begin to weaken over time (Flores, 2015; Wei & Lee, 2001), and so their emotion language skills will be lower in L1 compared to in L2.

The third research question is whether language skills predict emotion language skills in one or both languages. Our study examines different language areas in Cantonese and English including receptive and expressive vocabulary skills and grammar skills as measured by mean length utterance. Previous research showed that growing bilingual vocabulary skills and active use of both languages are significantly related to better social-emotional behavioral skills in simultaneous bilingual (e.g., Sun et al., 2018). Therefore, it is possible that vocabulary and/or grammar skills may be a predictor of emotion language skills in TD sequential bilingual children too.

Study 1 has three research questions:

1) What are the emotion language skills and the language skills in Cantonese (L1) and English (L2) in typically developing bilingual children?
2) What is the relationship between emotion language skills and language skills in L1 and L2?
3) Which language skills predict emotion language skills?

Method

Participants

A total of 36 typically developing 5-year-old sequential bilingual children (11 boys, 25 girls; Mean = 64.64 months; *SD* = 4.04; Range = 60-71) who speak Cantonese as a home language (L1) and learned English as a second language (L2) were recruited for Study 1. At the time of testing, children spent 21.61 months in school. Children were recruited from Chinese communities (e.g., Chinatown) in Boston, Houston, and San Francisco. Please refer to Appendix 1 for more details on the recruitment process. Children are typically developing with normal

language and developmental history as reported by parents. See *Table 1* for participant inclusion and exclusion criteria for Study 1.

Table 1. Participant inclusion and exclusion criteria for STUDY 1.

Inclusion Criteria	Exclusion Criteria
• Parents/caregivers must speak Cantonese as a home language. • Children speak Cantonese as a home language (L1) and learned English (L2) in school. • Must be between 5;0-5;11 years of age. • Normal language and developmental history, as reported by parents and/or teachers.	• Parents/caregivers whose dominant language at home is a language other than Cantonese (e.g., Toisanese). • Clinical diagnosis of a language impairment. • Concerns related to speech, language, hearing, cognition or development, as reported by parents and/or teachers. • Concerns with social or emotional behavioral difficulties, as reported by parents and/or teachers

Language Distribution in the Home

Parents reported the child's language background including which languages are used in the home and the amount of language input from each family member living in the home. Each household varied in the number of family members. All parents reported Cantonese as the primary language used in the home by all family members. See Table 2 below for distribution of language input across different family members living in the home. Majority of the mothers and

fathers reported using 80% to 100% Cantonese in the home. Parents who reported living with their grandmother and/or grandfather reported that the grandparents used 100% Cantonese. Younger siblings spoke 80% to 100% Cantonese in the home, while older siblings used an increasing amount of English in the home (20% to 80%), possibly due to increasing exposure to English in school. See Appendix 2 for a sample of the questionnaire about language distribution in the home.

Table 2. Language distribution across family members reported in percentage in typically developing children.

	L1 (Cantonese) / L2 (English) Use Across Family Members							
	Reported	100% L1	80% L1 20% L2	60% L1 40% L2	50% L1 50% L2	40% L1 60% L2	20% L1 80% L2	100% L2
Mother	36	38.90	41.67	5.56	13.89	0	0	0
Father	27	40.74	37.04	14.81	0	3.70	3.70	0
Older Sibling(s)	19	10.52	42.11	15.79	0	5.26	26.31	0
Younger Sibling(s)	15	20	46.67	6.67	0	6.67	20	0
Grandmother	17	100	0	0	0	0	0	0
Grandfather	14	100	0	0	0	0	0	0

Home Storytelling Activities

In addition to the child's demographic information and language distribution in the home, the first half of the questionnaire collected information on home storytelling activities to understand the context in which the child is exposed to emotion words. The questionnaire was adapted from a previous questionnaire about parent language input and home activities in

Cantonese-English bilingual children (Cheung et al., 2018). Parents reported the hours spent on different story telling activities (i.e., reading stories, telling stories aloud, or watching shows) and the percentage of input in each language for each activity. See Appendix 3 for a sample of the questionnaire about storytelling activities. Although the majority of the participants reported that Cantonese was the primary language using during home storytelling activities, there was variation in the amount of L1 and L2 used across activities. See Table 3 below for distribution of language amount across storytelling activities. When reading stories, 60% of parents reported that they use about 80% to 100% Cantonese. When telling stories aloud, about 76% of parents reported that they use 80% to 100% Cantonese. Watching television or movies has the greatest variation in the amount of L1 and L2 exposure. About forty-three percent of parents reported that the child is exposed to 80% to 100% Cantonese on tv, while 20% reported that the child is exposed to 100% English. This range in language exposure may be due to children watching American shows in English and family members (e.g., grandparents) watching Chinese television channels.

Table 3. Language distribution across storytelling activities reported in percentage in typically developing children.

L1 (Cantonese) / L2 (English) Use Across Storytelling Activities								
	Reported	100% L1	80% L1 20% L2	60% L1 40% L2	50% L1 50% L2	40% L1 60% L2	20% L1 80% L2	100% L2
Reading Stories	35	28.57	31.43	5.71	11.43	5.71	8.57	8.57
Telling Stories Aloud	34	41.18	35.29	2.94	8.82	0	2.94	8.82
Watching TV/Movies	35	14.29	28.57	8.57	11.43	5.71	11.43	20

Parent Questionnaire on Emotion Language Experiences

The purpose of the parent questionnaire was to gather information about bilingual children's emotion language experiences in the home environment. It was available to parents in either Chinese (the written form of Cantonese) or in English. The parent questionnaire was previously implemented on Cantonese-speaking parents of bilingual preschool children (Huang & Kan, 2021). The questionnaire was divided into two sections: 1) Language background and demographic information and 2) Emotion language input in the home. The parent questionnaire was adapted from previous questionnaires on parent language input in bilingual children (Cheung et al., 2018) and parent-child emotion-related conversations (Mazzone et al., 2017). All the parents completed the questionnaire in Chinese and completed it in approximately 10-15 minutes.

The first part of the questionnaire collected information about the child's language background and demographic information. Questions included background information about parents' education level and current occupation, who lives in the home, and when the child started preschool. Parents reported any concerns about their child's speech, language, hearing, or learning abilities, whether their child was born in the U.S., what languages are used in the home, and which language the child feels comfortable speaking. The questionnaire also collected information about the amount of language input from each family member in the home and during storytelling activities.

The second part of the questionnaire collected information about emotion language input in the home environment. Parents reported which language the parent and the child feel comfortable using when discussing emotions. Using a Likert rating scale, parents rated how frequently they explained and labeled emotions with their child in the past two weeks (e.g., 1-2

times, 3-4 times). For example, one question asked, “When my child asked me questions about someone being sad, we talked about why that person was sad.” The Likert rating scale portion of the questionnaire was adapted from a previous questionnaire about parent-child conversations about emotions (Mazzone et al., 2017). See Appendix 4 for a sample of the questionnaire about the parent and child’s emotion language choice and the Likert rating scale.

The questionnaire also included an emotion word checklist to identify the range of emotion words that parents use with their child. See Appendix 5 for the emotion checklist from the questionnaire. The checklist included five categories of emotions (i.e., Happy, Sad, Angry, Guilt, and Scared), and each category had 9 to 12 emotion words for parents to select. There was a total of 51 emotion words on the checklist for parents to choose from. Parents had the opportunity to add in additional emotion words that they use with their child in each category. Only two parents reported an additional emotion word in the angry category. However, neither word counted as an emotion word according to our coding criteria, and therefore were not included in the analysis.

To date, there are no standardized norms on Cantonese-English bilingual children’s emotion word development. Therefore, the emotion words in the checklist were selected based on previously normed data on the comprehension and production of emotion words in monolingual English-speaking children (i.e., Baron-Cohen et al., 2010; Ridgeway et al., 1985) and monolingual Chinese-speaking children (i.e., Li & Yu, 2015). Additionally, the emotion words were selected in consultation with a native Cantonese-speaking research assistant to ensure that the words were culturally, linguistically, and developmentally appropriate for this study’s population. First, I compiled a list of emotion words that children understood and used between 18-71 months (Ridgeway et al., 1985) and a list of the emotion words that children

understood between the 4-6 years age range (Baron Cohen et al., 2010). Second, I eliminated the emotion words in which only 50% of children (or less) understood and/or used the words. Third, I consulted with a native Cantonese research assistant to determine whether the remaining words were culturally-linguistically appropriate in Cantonese language. The research assistant and I discussed if there is a Chinese equivalent word, if the word is commonly used in Chinese communities, and if the word is developmentally appropriate for preschool aged children.

Measures of Emotion Competency Skills

Assessment of Children's Emotion Skills (ACES)

This study adapted the Assessment of Children's Emotion Skills (ACES; Schultz et al., 2004) to evaluate Cantonese-English bilingual children's emotion recognition of facial expressions. For each language there were 16 test items or colored photographs of preschool and elementary-aged children posing a facial expression that depicted either Happy, Sad, Mad, or Scared. The children in the selected photographs are of different genders and racial and ethnic backgrounds including Black, White, and Southeast Asian. To counterbalance the presentation of the photographs, the location of the photograph on the screen switched between right and left each time. The children heard the following directions, "*I'm going to show you some faces, you tell me how they feel.*" After presenting each photograph, the examiner asked the child, "*Does the child feel Happy, Sad, Mad, or Scared?*" The order of the emotion words also rotated for each test item to prevent biases in selecting the first or last choice. The ACES began with two trial items to ensure that the child understand the directions and is oriented to how the test items are presented on the screen. Following the trial items, the examiner presented 16 test items one at a time. The correct answer for each test item was randomized. See Figure 1 below for sample photographs from the English and Cantonese ACES test and their corresponding prompts.

The Cantonese and English ACES tests developed for this study were adapted from the ACES test originally developed by Schultz and colleagues (2004). The photographs used in this study were originally from the Facial Recognition subtest as part of the full ACES test. The photographs from the Facial Recognition subtest were validated on 205 college students (Schultz, unpublished data). See Appendix 6 for the table of publicly available data from three college validation studies. For this study, I selected 16 additional photographs for the Cantonese ACES test to examine children's emotion comprehension skills in Cantonese. The publicly available ACES tool contained extra photographs for me to choose from.

Does he feel Sad, Mad, Scared, Happy?

她是什么感觉? 嬲, 惊, 開心, 唔開心?

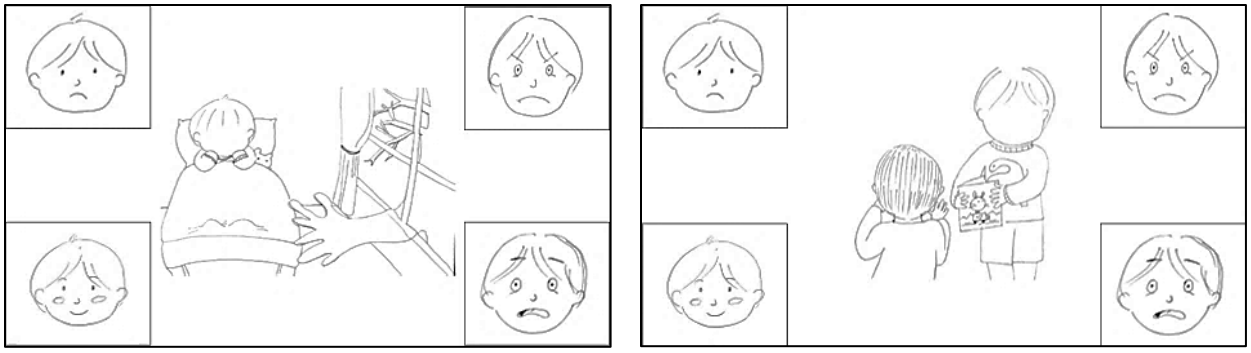
Figure 1. Sample photographs from the English and Cantonese ACES tests.

Emotion Recognition Vignettes (ERV)

This study adapted the Emotional Recognition Vignettes (ERV; Ribordy et al., 1988) to evaluate Cantonese-English bilingual children's emotion comprehension skills in English and in Cantonese. For each language, there was a total of 16 test items or short vignettes that described emotion-related situations about a character, covering 4 basic emotions: Happy, Sad, Mad, Scared. To reduce the language and memory demands, I added illustrations that accompany each vignette. The child heard the following direction: "*I am going to tell you some stories about Johnny and Susie, you tell me how they feel."* The examiner read the vignette to the child and then presented the emotion choices on the corners of the screen one at a time. The child was

prompted to pick a feeling that best represents how the character feels. The order in which the emotion choices appeared on the corners of the screen rotated for each test item, and they were always presented in a clockwise order. The correct answer for each test item was randomized. The ERV test began with a trial item so that the child is oriented to how the test items and choices are presented on the screen. Following the trial, the examiner presented the 16 vignettes one at a time. See Figure 2 below for samples of Cantonese and English test items and their corresponding vignettes.

The Cantonese and English ERV tests developed for this study were adapted from the ERV test originally created by Ribordy and colleagues (1988). See Appendix 7 for the original vignettes. Ribordy and colleagues (1988) validated the emotion vignettes on 5- and 6-year-old children from different racial backgrounds and from predominantly lower- and middle-class socioeconomic backgrounds. The validation process involved children accurately identifying the emotion that best represented the character in the vignette. The vignettes were then scored for a percentage of correct responses. Consistent with previous studies (i.e., Bierman, et al., 2008; Martins et al., 2016), I used the top 4 vignettes that scored the highest percentage of correct responses from the *Happy, Mad, Sad, and Scared* emotion categories only, and adapted them for my population.



"Johnny was in his room at night. The room was very dark. He saw a tree outside that looked like hand coming into the window."

"*Johnny* 非常努力咁制作精美卡片比佢最好嘅朋友. 佢最好嘅朋友话张卡片好靓."

Figure 2. Samples of the English (left) and Cantonese (right) test items.

Emotion Elicitation Story-Retell Task

Each child participated in 2 story retell tasks—one administered in Cantonese and one in English. Children listened to a story script from the wordless picture book, "*There's a Witch Under the Stairs*" (Smith, 1991). The book is about a young girl who attempts to get rid of a witch living under her stairs, and it elicited a range of emotion words like *Scared, Sad, Nervous, Happy, and Angry.* The original book was modified by removing the words and translating the title into Chinese characters. Henceforth, this book will be labeled "Witch book" for simplicity. The colored pictures from the Witch book were presented one at a time on Zoom and each picture had a story script. See Figure 3 for an example of the examiner's view on Zoom when administering the task. The examiners told a story to the child following a script either in English or in Cantonese. The story scripts were developed in consultation with Cantonese-English research assistants and parents of bilingual Cantonese-English children. Additionally, the story scripts were based on parent's language samples collected in my previous study (Huang & Kan, 2021; see below for more details). The Cantonese script was not a direct translation of the English script and vice versa. See Appendix 8 for samples of the English and Cantonese story

scripts. After hearing the story, children retold the story using the pictures from the book for support. During the story retell, the examiners asked limited questions to encourage the children to continue their story retell (e.g., *and then?, what happened next?*). Children's story retells were video and audio recorded for later transcription and coding.

The Witch book selected for the current study was used in my previous study that examined Cantonese-speaking parents use of emotion words in a parent-child story telling task (Huang & Kan, 2021). Results from the previous study showed that parents produced significantly higher mean length utterance with the Witch book than with the other books used ($F(1,15) = 7.33, p < .01$). Therefore, the Witch book was selected for the current study since it is likely to elicit higher mean length utterance and emotion words in the children too.

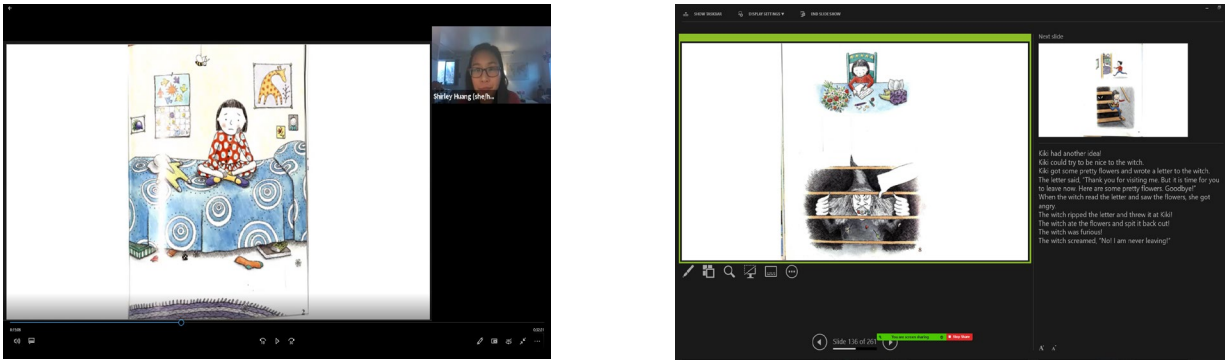


Figure 3. Example of the child's view (left) and examiner's view (right) on Zoom.

Measures of Bilingual Language Skills

Language Sample Transcription

Children's narrative recordings from the emotion-elicited story retell task were transcribed in Cantonese and English using the Systematic Analysis of Language Transcripts Software program (SALT; Miller & Iglesias, 2020). The language samples were transcribed by trained research assistants who were native speakers of either Cantonese and/or English. Following the SALT software manual, utterances in the Cantonese and English language

samples were segmented into communication units. Utterances were also based on significant pauses (more than 2 seconds) and/or ending intonations (falling for statements and rising for questions). Additionally, although there were few, utterances with coordinating conjunctions (*and, but, or*) were segmented into separate communication units, while utterances with subordinating conjunctions (*because, when*) were not. SALT was initially designed to assess language samples in English, but for this study SALT was adapted to analyze the language samples in Cantonese too. The narrative recordings in Cantonese were first transcribed into Chinese characters. One Chinese character represents one syllable. The language samples were then converted into Romanized language samples based on pronunciation. Each syllable in a Chinese character is spelled out using the Roman alphabet system for analysis. For example, the Chinese character '跌,' is spelled out using the Roman alphabet as *dit3* ('fall').

Receptive and Expressive Bilingual Vocabulary Test

Children's receptive and expressive vocabulary were measured using the *Kai Ming Head Start* Vocabulary Test. The tests include a Picture Identification Task and a Picture-Naming task in Cantonese and English. The tasks were developed in collaboration with the teachers at Kai Ming Head Start in San Francisco, California, where many children were exposed to Cantonese as a home language. There are 103 items in the picture naming task, and 90 items in the picture identification task (identify from an array of 4 items). Children were asked to name and point to pictures. The Kai Ming Vocabulary Test is considered an accurate measure of Cantonese-English sequential bilingual children's vocabulary skills and growth (see Kan, Huang, Winicour, and Yang, 2020 for test details). See Appendix 9 for sample images from the Kai Ming Vocabulary Test.

Procedures

Each child participated in the Cantonese and English tasks on two different days. To control for order, the language of administration (L1-L2 or L2-L1) was counterbalanced across participants. There was a time interval of at least one week between administrations of the tasks in each language. Individual testing sessions in each language were conducted on the Zoom online conferencing platform using a password-protected link. Testing took place on either a computer or a tablet (e.g., iPad). Each testing session lasted about 52-75 minutes, depending on the child's behavior and attention span. Younger children (~5;0-5;5) needed more breaks and positive reinforcements and so they took longer to complete the tests. Older children (~5;6-5:11) have a longer attention span and are more familiar with the Zoom routine in school, and so they took less time to complete the tasks.

All the parents completed and returned the questionnaire before the first testing session. All the tests were administered in the same order for every child to ensure consistency. The testing order was the following: 1) Picture Naming Task, 2) Assessment of Children's Emotion Skills (ACES), 3) Emotion-Elicited Story Retell Task, 4) Emotion Recognition Vignettes (ERV), and 5) Picture Identification Task. See Table 4 below for a summary of the children's testing procedures. Please see Appendix 10 for a summary of project challenges and solutions.

Table 4. Summary of children's testing procedures for STUDY 1.

	Task	**Time to Complete**
English	Picture Naming Task	10-15 minutes
	Assessment of Children's Emotion Skills	7-10 minutes
	Break (if needed)	
	Emotion-Elicited Story Retell Task	10-15 minutes
	Emotion Recognition Vignettes	10-15 minutes
	Break (if needed)	
	Picture Identification Task	15-20 minutes
	Task	**Time to Complete**
Cantonese	Picture Naming Task	10-15 minutes
	Assessment of Children's Emotion Skills	7-10 minutes
	Break (if needed)	
	Emotion-Elicited Story Retell Task	10-15 minutes
	Emotion Recognition Vignettes	10-15 minutes
	Break (if needed)	
	Picture Identification Task	15-20 minutes

Data Scoring

Parent Questionnaire: The items on the questionnaire include Likert-style items, fixed responses, or closed-ended questions that require a one-word response. Parents' responses on the questionnaire were input as a numerical code for data analysis. The following questions were coded categorically (e.g., 7, 6, 5): family members living in the home (e.g., 7 represented mother,

2 represented younger sibling), languages spoken in the home, the amount of language input from different family members (e.g., 7 represented 100% Cantonese use at home while the number 1 reported 100% English use at home), frequency of talking about emotions with their child (e.g., 4 indicated talking about an emotion 5x or more in the past two weeks), education levels, and employment. The following questions were coded using a binary code (i.e., 0, 1): gender, no/yes questions, concerns about a speech, language, learning, or hearing disorder.

Emotion Recognition Vignettes (ERV): There is a total of 16 test items. Each test item was scored a 2 if the child correctly identified the character's emotion; scored a 1 if the child correctly identified the correct emotion valence (e.g., mistaking scared for anger is still within negative valence); or scored a 0 if the child did not identify the correct emotion or valence. The scoring procedures were consistent with previous studies (Bierman et al., 2008; Martins et al., 2016). A total raw score and a percentage of correct responses was calculated for each child.

Assessment of Children's Emotions Skills (ACES): There is a total of 16 test items. Each test item was scored a 1 if the child correctly identified the emotion or a score of 0 if the child incorrectly identified the emotion. A total raw score and a percentage of correct responses was calculated for each child.

Receptive and Expressive Bilingual Vocabulary Test: The Kai Ming Vocabulary test includes 103 items in the Picture Naming Task and 90 items in the Picture Identification Task. Each test item will be scored a 1 for a correct response or a score of 0 for an incorrect response. Each child will receive a total score in Cantonese and in English. A total raw score and a percentage of correct responses was calculated for each child.

Coding Emotion Terms

This study used the SALT software program and coded the following emotion terms in the English and Cantonese story retell language samples: 1) Emotion Words, 2) Emotion-Laden Words, and 3) Emotion-Related words. A native English- or Cantonese-speaking research assistant coded the English and Cantonese language samples, respectively. The criteria for identifying the three categories of emotion terms were based on the framework developed by Pavlenko (2008) and is consistent with the coding methodology used in a previous study that organized Chinese emotion words (Ng et al., 2019). See *Figure 4* below for a visual representation of the coding criteria developed by Ng and colleagues (2019). The first category is Emotion Words. Emotion words directly refer to emotion states (e.g., "*happy," "angry*") or processes (e.g., *"to worry," "to rage*"), and typically fit in the sentence context, "*I am… or I feel…"* The second category is Emotion-Laden Words. These words may include swearwords or expletives ("*damn*"), insults ("*jerk," "loser*"), child reprimands ("*behave," "naughty*"), endearments ("*sweetie*"), aversive words ("*death*"), or interjections ("*yuck," "ouch*"). The third category is Emotion-Related Words. Emotion-related words describe behaviors related to particular emotions without naming the emotion state. These words may include words describing facial expressions ("*smile," "frown*"), bodily symptoms (*"cry," "shiver"*), or actions ("*to scream," "to escape*"). Also see Table 5 for the definition, example, and corresponding SALT codes for each emotion term.

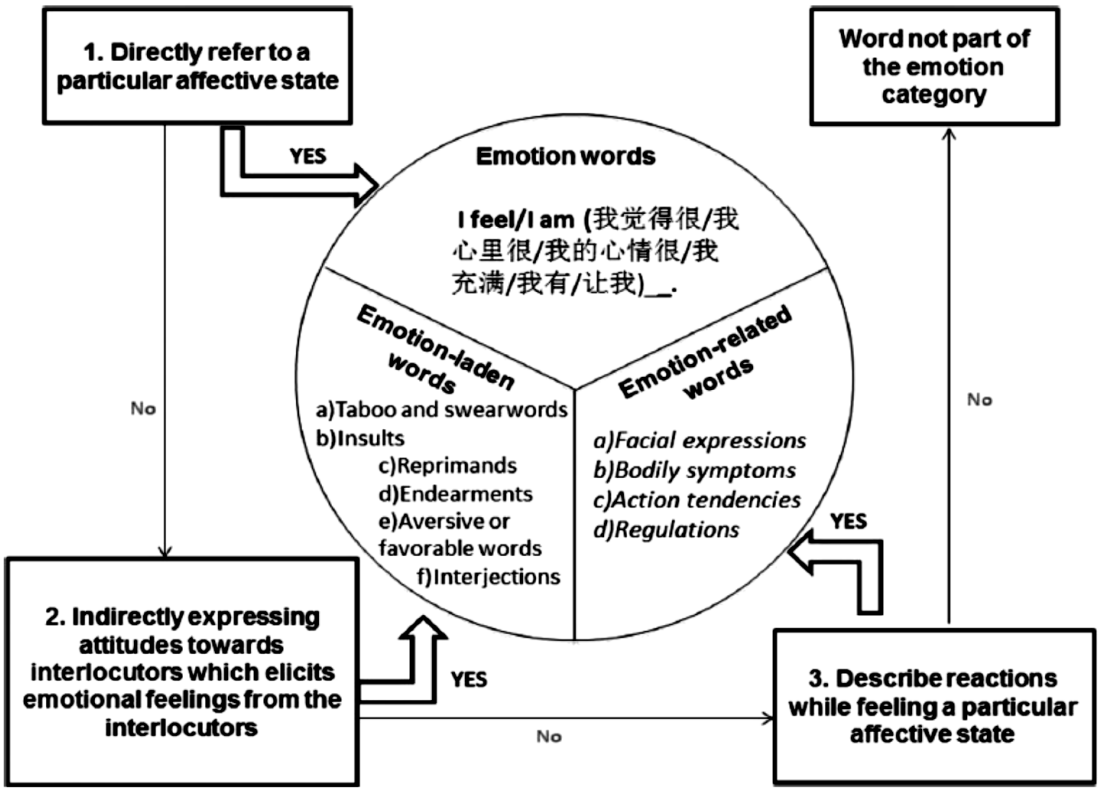


Figure 4. Framework for identifying emotion terms from Ng et al., 2019.

Table 5. Summary of SALT codes, definition, and examples of emotion term (based on Ng et al., 2019 and Pavlenko, 2008).

Emotion Terms	SALT Code	Definition	Examples
Emotions Words	[EM]	Words that directly refer to affective states or processes, and function to either describe or express them. Words that generally fit in the syntactic context, "I am/I feel."	Happy, angry To worry, to rage She is sad, I feel sad
Emotion-Laden Words	[EL]	Words that do not refer to emotions directly but instead express or elicit emotions from interlocuters.	Jerk, loser Cancer, malignant Taboo and swear words, insults, endearments, reprimands, aversive or favorable words, and interjections
Emotion-Related Words	[ER]	Words that describe the behaviors related to particular emotions without naming the actual emotions. Includes facial expressions, bodily symptoms, and action tendencies.	Smile, frown Tears, shiver To scream, to escape

Language Sample Analysis

Language sample analyses included calculating Mean Length Utterance (MLU), Total Number of Words (TNW), Number of Different Words (NDW), and Type Token Ratio (TTR) using the SALT software program (Miller & Iglesias, 2020). See Table 6 below for a summary of the language sample measures in Cantonese and English for typically developing children. TNW refers to the total number of words that children produced during the story retell tasks and NDW refers to the number of different words produced. TTR is the percentage of different words the child produced out of all the words produced, and this is calculated by dividing the TNW by the NDW.

For the English language samples, MLU was calculated in morphemes because it is considered a sensitive measure of grammatical development for English-speaking preschool children (Miller & Chapman, 1981). MLU in English was calculated by the total number of morphemes divided by the total number of utterances in the language sample. MLU in English was calculated in morphemes using the MLU-Morpheme analysis function in SALT. For the Cantonese language samples, MLU is also considered a valid index for assessing preschool children's morphosyntactic development (Cheung, 1998). In Chinese, some single syllables can be combined to create a compound word with a new meaning that is different from the meaning of its individual syllables. For example, in the compound word 開心 *hoi1sam1*, individually *hoi1* means 'open' and *sam1* means 'heart', but when combined *hoi1sam1* is the word, 'happy'. Compound words were counted as a single unit. Since English morphemes (e.g., past-tense -*ed,* plural -*s*) are generally absent in the Cantonese language samples, MLU was calculated in words using the MLU-Word analysis function in SALT. MLU in Cantonese was calculated by the total number of words divided by the total number of utterances in the language sample.

Table 6. Summary of typically developing participants' dual language skills from the story retell task.

	Cantonese (L1)		English (L2)	
	Mean	*SD*	Mean	*SD*
MLU – Words	3.60	.88	--	--
MLU – Morphemes	--	--	5.34	1.72
Total Number of Words	181.81	84.21	235.64	122.30
Number of Different Words	79.47	23.92	80.14	35.93
Type Token Ratio (%)	47.20	9.46	38.70	14.77

Note: MLU = Mean Length Utterance

Data Analysis

Study 1 used a combination of descriptive and inferential statistics to analyze our data. For the parent questionnaire, we used descriptive statistics to describe the average, standard deviation, and range of the number of emotions words parents reported that they and their child uses on the emotion checklist. We also used Pearson's correlation to examine the relationship among how frequently parents talk about different emotion words with their child. For the emotion language and language measures, we employed different statistical analyses to address each research question.

For our first research question, an Analysis of Variance (ANOVA) was conducted to analyze the differences among emotion language and language skills between Cantonese and English. Measures of emotion language comprehension included the ACES and ERV tasks and the measures of emotion language production included the frequency of emotion words, emotion-related words, and emotion-laden words. Measures of dual language skills included

MLU, and picture naming and picture identification vocabulary skills. To address our second research question, we conducted a Pearson's correlation analysis to examine relationship among emotion language and language skills within each language and across Cantonese and English.

For our third research question, an enter regression model was conducted using SPSS to examine which language factors predict emotion language comprehension skills. Following the correlation analysis, we identified variables to include in the regression analysis. The dependent variables were Emotion Recognition Vignettes in English and in Cantonese (% correct). The following predictors in English or Cantonese were included in each model: Picture Identification, Picture Naming, and MLU-Words or MLU-Morphemes. The regression model included all 3 candidate predictors entered into the equation at the same time. MLU from the storytelling task was included as a predictor because it is considered a sensitive measure of grammatical development for English-speaking preschool children, especially in 5-year-old children (Miller & Chapman, 1981). Picture Identification and Picture Naming skills from the vocabulary tasks, rather than TNW, NDW, and TTR, were included in the model to represent children's vocabulary skills. Since TNW, NDW, and TTR measures were taken from the same storytelling task that measured MLU, they were not included in the model. Moreover, TNW, NDW, and TTR in English were significantly correlated with Picture Identification and Picture Naming skills in English (see Appendix 11). This study's population is relatively homogenous with similar L1 and L2 input, and so language input was not included in the model because there was little variation.

Result

Parent Questionnaire on Emotion Language Experiences

Parents reported that Cantonese was the language that parents and their child felt most comfortable using when discussing emotions. Parents rated how frequently they talked about certain situations related to emotions in the last two weeks on a scale of 0 times to 5 times or more. Pearson's correlation analysis revealed that all the emotion words were significantly related to each other, indicating that parents talk about all the emotion words with similar frequency. See Table 7 for relationships among how frequently parents talk about emotions with their child.

For the emotion word checklist, parents selected which emotion words they use with their child and that their child uses with parents. The emotion checklist included a total of 51 words to choose from five categories: happy, sad, angry, guilt/shame, and scared/worried. On average, parents reported that they use 26.31% of the emotion words on the checklist (*SD* = 13.95%, Range = 7.84–74.51%), while their child uses 18.63% of the emotion words on the checklist (*SD* = 8.59%, Range = 5.88–37.25%). Table 8 presents the average proportion of emotion words that parents reported using with their child in each category. Table 9 presents the average proportion of emotion words that parents reported their child uses with them in each category.

Table 7. Relationships among how frequently parents talk about emotions with their typically developing child.

	Sad	Happy	Angry	Scared	Surprised	Guilty
Sad	--	--	--	--	--	--
Happy	.84**	--	--	--	--	--
Angry	.67**	.61**	--	--	--	--
Scared	.68**	.71**	.85**	--	--	--
Surprised	.48**	.58**	.67**	.76**	--	--
Guilty	.53**	.52**	.60**	.66**	.70**	--

*$p < 0.05$, **$p < 0.01$

Table 8. Average proportion of emotion words parents reported they use in the emotion word checklist in each category.

	Mean	*SD*	Range
Happy	0.39	0.24	0.11 – 1
Sad	0.30	0.18	0.09 – 0.91
Angry	0.26	0.19	0.11 – 1.00
Scared	0.24	0.16	0 – 0.75
Guilt	0.21	0.14	0 – 0.63

Table 9. Average proportion of emotion words parents reported their child uses in the emotion word checklist in each category.

	Mean	*SD*	Range
Happy	0.27	0.17	0 – 0.67
Scared	0.18	0.13	0 – 0.42
Sad	0.17	0.09	0.09 – 0.38
Angry	0.17	0.11	0.11 – 0.63
Guilt	0.16	0.12	0 – 0.50

Emotion Language and Language Skills in Cantonese and English

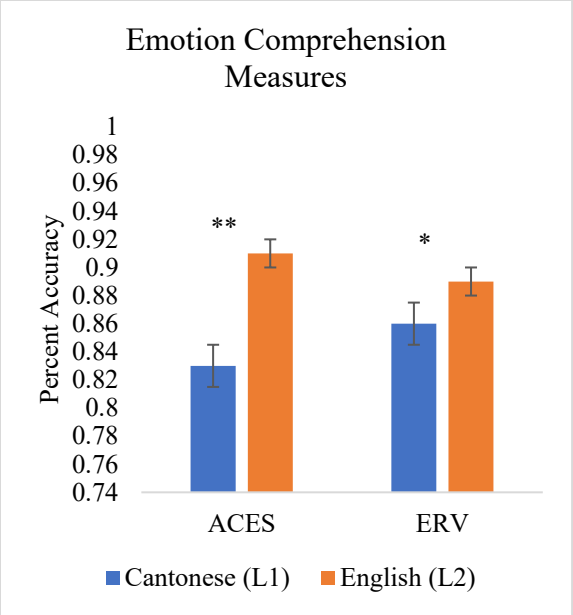
ANOVA statistical model was conducted to calculate the differences in emotion comprehension, emotion production, and language measures between Cantonese and English. For the emotion comprehension measures (*Figure 5*, left), there was a significant difference between languages in children's performance on the ACES task ($F(1,35) = 11.21$, $p < .01$, $\eta p^2 = .24$) and ERV task ($F(1,35) = 4.71$, $p < .05$, $\eta p^2 = .12$) measures. For the emotion production measures (*Figure 5*, right), there were no significant differences between languages for emotion words ($F(1,35) = 2.68$, $p > .05$, $\eta p^2 = .72$), emotion-related words ($F(1,35) = .96$, $p > .05$, $\eta p^2 = .85$), or emotion-laden words ($F(1,35) = .17$, $p > .05$, $\eta p^2 = .90$). For the dual language measures, there was a significant difference between languages in children's MLU ($F(1,35) = 40.74$, $p < .001$, $\eta p^2 = .54$) (*Figure 6*, right) and picture naming vocabulary skills ($F(1,35) = 25.17$, $p < .001$, $\eta p^2 = .42$) (*Figure 6*, left), but no significant difference in their picture identification skills ($F(1,35) = .08$, $p > .05$, $\eta p^2 = .002$). A possible reason why there were no significant differences between languages in the picture identification task is that the children probably reached ceiling effects for this task. Overall, children's performance was significantly higher in English than in

Cantonese on emotion comprehension and language measures. See Table 10 for a comparison of emotion and language measures between Cantonese and English.

Table 10. Comparison across languages in dual language emotion and language measures reported in mean (SD) in typically developing children.

		Cantonese (L1)	English (L2)	*F(1,35)*
Emotion Comprehension	Assessment of Children's Emotion Skills (%)	82.99 (14.53)	91.15 (7.67)	11.21**
	Emotion Recognition Vignettes (%)	86.02 (8.92)	88.89 (6.82)	4.71*
Emotion Production	Emotion Words	3.53 (2.62)	4.31 (3.03)	2.68
	Emotion-Related Words	15.92 (8.28)	14.22 (8.40)	.96
	Emotion-Laden Words	27.08 (11.17)	26.22 (10.86)	.17
Dual Language Skills	Mean Length Utterance	3.60 (.88)	5.34 (1.72)	40.74***
	Picture Naming (%)	63.86 (10.71)	77.91 (10.80)	25.17***
	Picture Identification (%)	87.75 (5.67)	87.38 (7.48)	0.08

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$



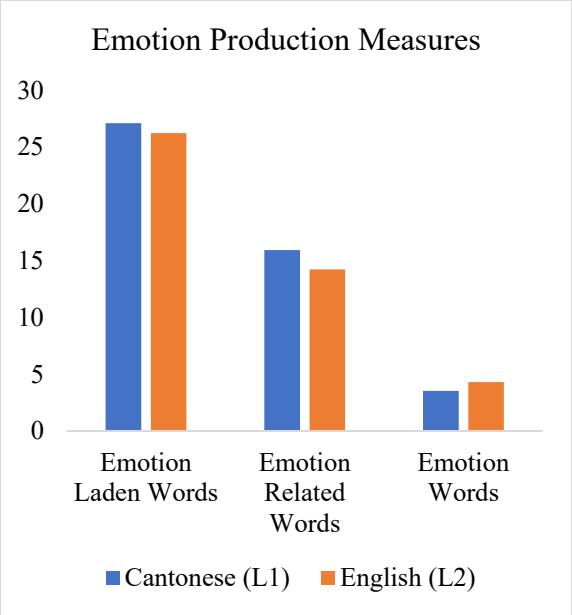
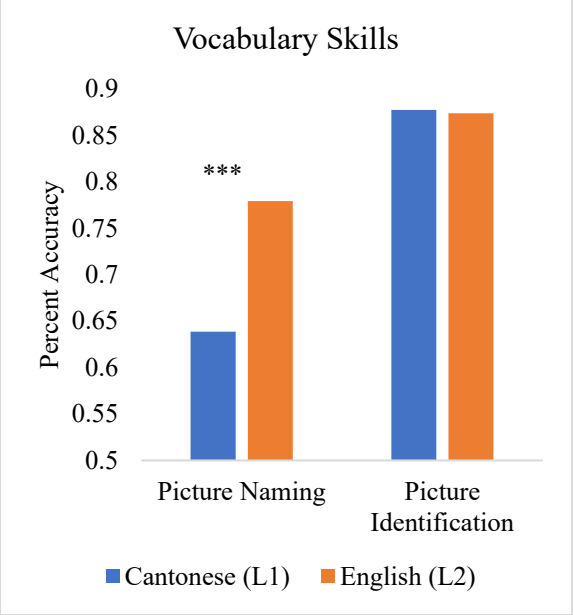


Figure 5. Comparison of emotion comprehension skills (left) and emotion production skills (right) between Cantonese and English.



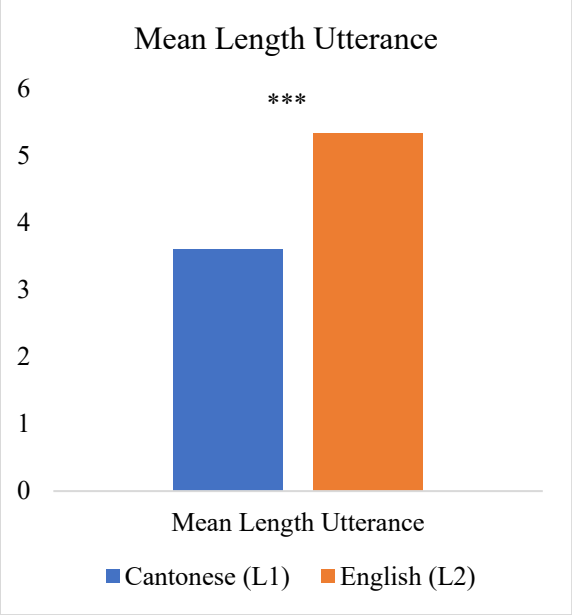


Figure 6. Comparison of vocabulary skills (left) and grammar skills (right) between Cantonese and English.

Relationships between Emotion Language and Language Skills

Pearson's correlation analysis was used to examine the relationships among the emotion language and language measures. For emotion comprehension, we examined whether vocabulary and grammar skills in each language were related to their performance on the ACES and ERV tasks in either language (see Table 11). Children's Picture Naming skills in English, but not in Cantonese, were significantly related to their performance on the ERV in both English ($r = 0.53$, $p < 0.01$) and in Cantonese ($r = 0.40$, $p < 0.05$). See Figure 7 for scatterplots depicting relationships between Picture Naming and ERV in Cantonese and English. MLU-Morphemes in English, but not MLU-Words in Cantonese, was significantly related to children's performance on the ERV in both English ($r = 0.43$, $p < 0.01$) and in Cantonese ($r = 0.36$, $p < 0.05$). See Figure 8 for scatterplots depicting relationships between MLU and ERV in Cantonese and English.

For emotion production, we examined whether vocabulary and grammar skills in each language were related to their use of different emotion category types (emotion-related words, emotion-laden words, and emotion words) in either language (see Table 12). When examining vocabulary skills in English, children's Picture Naming skills were significantly related to the number of emotion-laden ($r = 0.47$, $p < 0.01$) and emotion-related ($r = 0.49$, $p < 0.01$) words produced in English, but not to the number of emotion words. See Figure 9 for scatterplots depicting relationships between Picture Naming and each emotion category type in English. Similarly, children's Picture Identification skills in English were significantly related to the number of emotion-laden ($r = 0.45$, $p < 0.01$) and emotion-related ($r = 0.41$, $p < 0.05$) words produced in English, but not to the number of emotion words. See Figure 10 for scatterplots depicting relationships between Picture Identification and each emotion category type in English. In Cantonese, however, neither Picture Naming nor Picture Identification vocabulary skills were

related to any of the emotion category types (see Figure 9 and Figure 10). When examining grammar skills in English, MLU-Morphemes were significantly related to emotion-related (r = 0.46, $p < 0.01$) and emotion-laden (r = 0.48, $p < 0.01$) words in English. In Cantonese, MLU-Words were also significantly related to emotion-related (r = 0.46, $p < 0.01$) and emotion-laden (r = 0.44, $p < 0.01$) words in Cantonese.

Table 11. Relationships among emotion comprehension and language measures in STUDY 1.

		Cantonese (L1)			English (L2)		
		Picture ID	Picture Naming	MLU-Words	Picture ID	Picture Naming	MLU-Morphemes
Cantonese (L1)	Assessment of Children's Emotion Skills	0.47**	0.08	0.04	0.06	0.18	-0.01
	Emotion Recognition Vignettes	0.05	-0.09	0.23	0.19	0.40*	0.36*
English (L2)	Assessment of Children's Emotion Skills	0.14	0.03	0.40*	0.03	0.25	0.21
	Emotion Recognition Vignettes	0.09	-0.03	-0.04	0.33	0.53**	0.43**

Table 12. Relationships among emotion production and language measures in STUDY 1.

		Cantonese (L1)			English (L2)		
		Picture ID	Picture Naming	MLU-Words	Picture ID	Picture Naming	MLU-Morphemes
Cantonese (L1)	Emotion Words	0.13	-0.14	0.23	-0.10	-0.10	-0.02
	Emotion-Related Words	0.19	0.03	0.46**	0.11	-0.01	0.08
	Emotion-Laden Words	0.29	0.01	0.44**	0.19	0.14	0.16
English (L2)	Emotion Words	0.05	-0.02	0.29	0.15	0.11	0.09
	Emotion-Related Words	0.20	-0.05	0.26	0.41*	0.49**	0.46**
	Emotion-Laden Words	0.13	-0.30	0.35*	0.45**	0.47**	0.48**

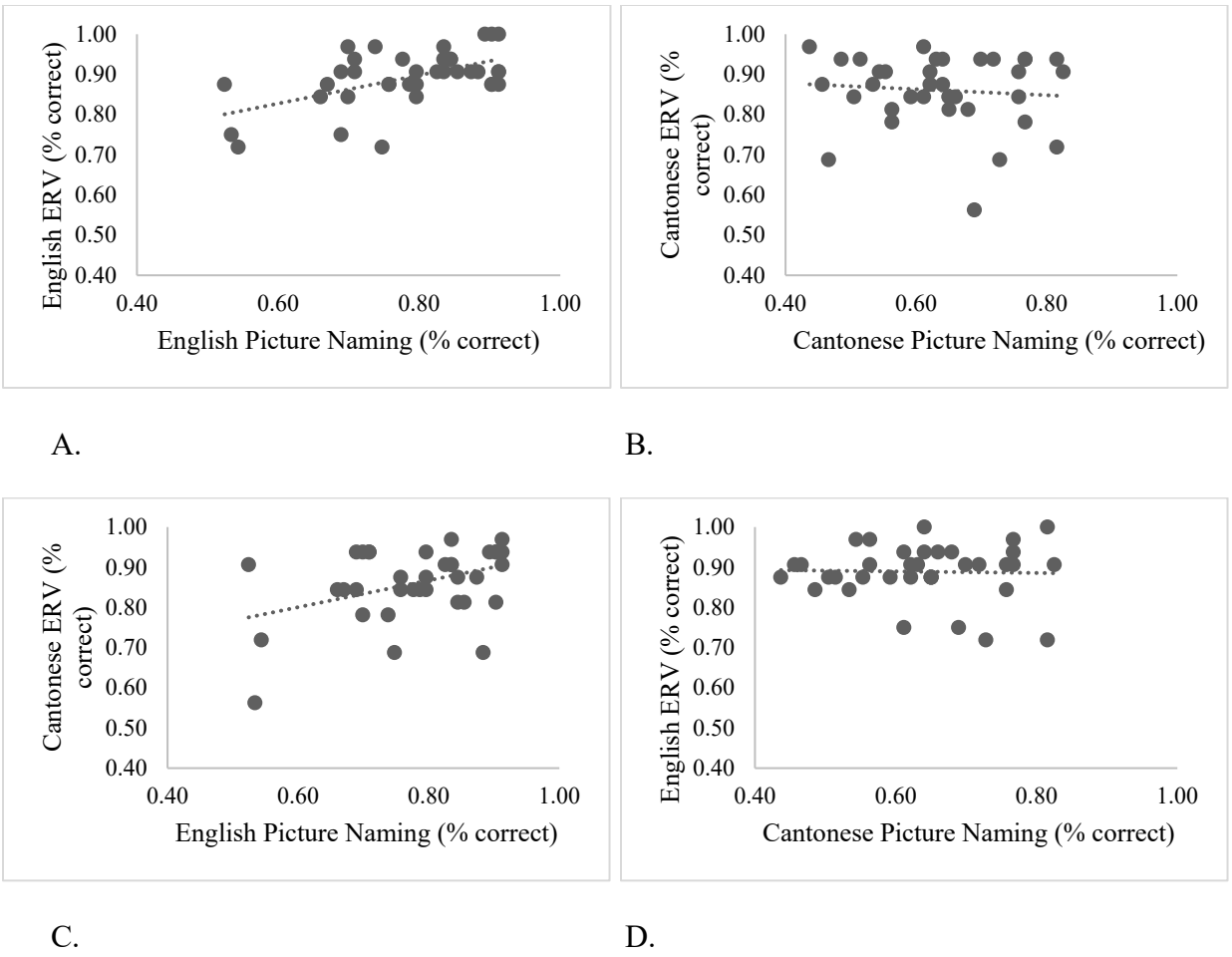


Figure 7. Relationships between Picture Naming Skills and Emotion Recognition Vignettes in English (A and C) and Cantonese (B and D).

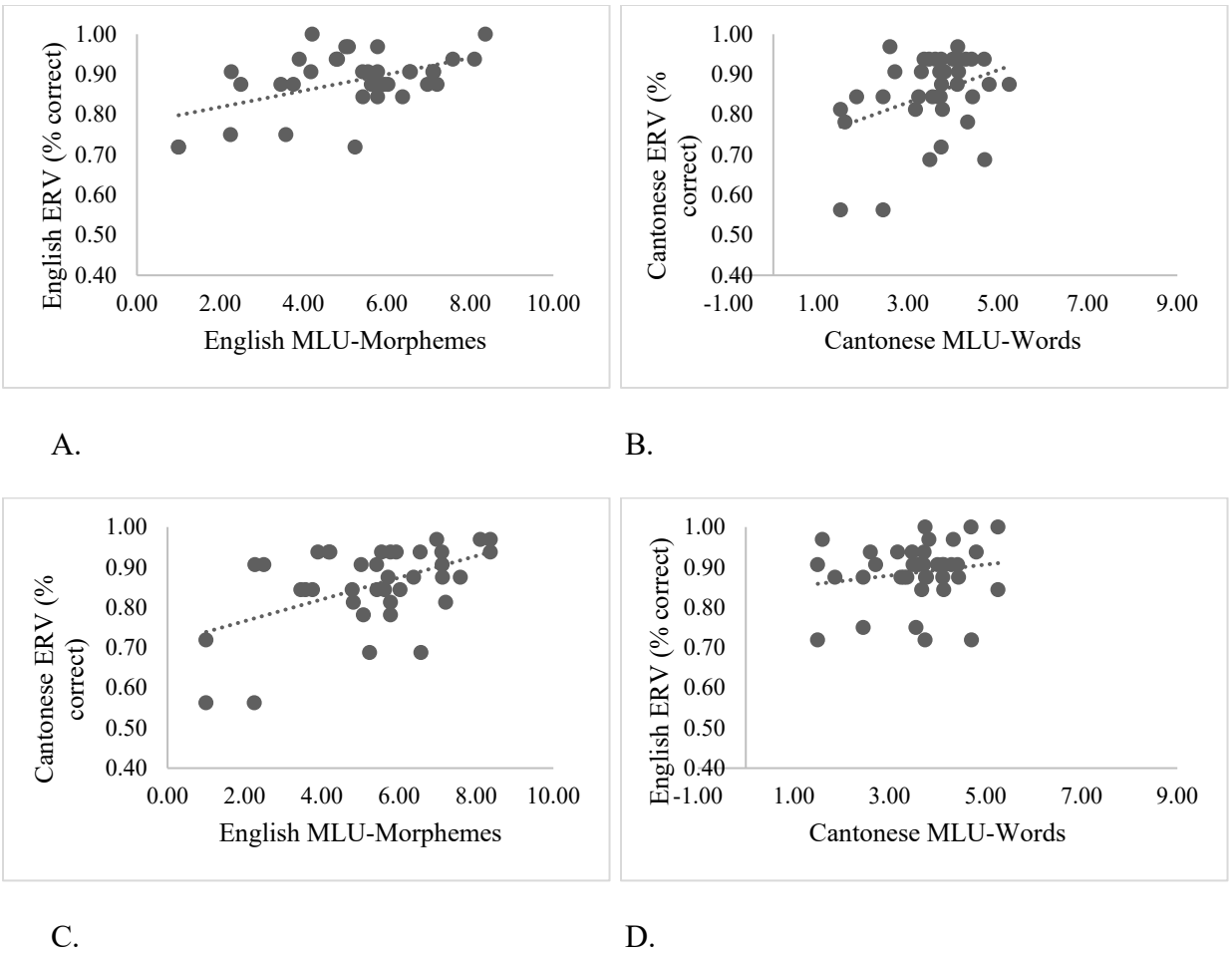
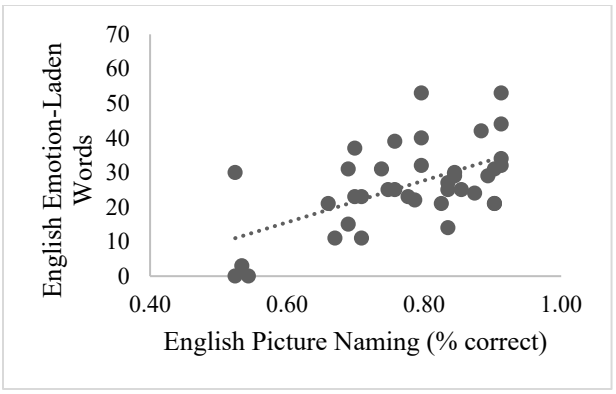


Figure 8. Relationships between MLU and Emotion Recognition Vignettes in English (A and C) and Cantonese (B and D).



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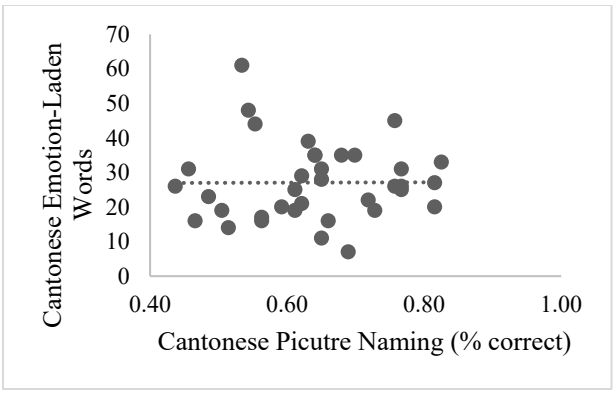

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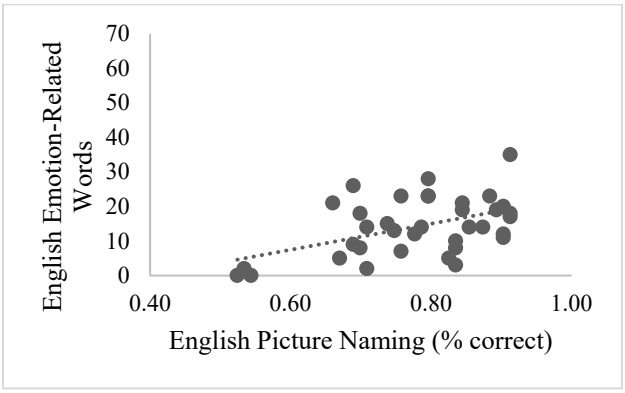

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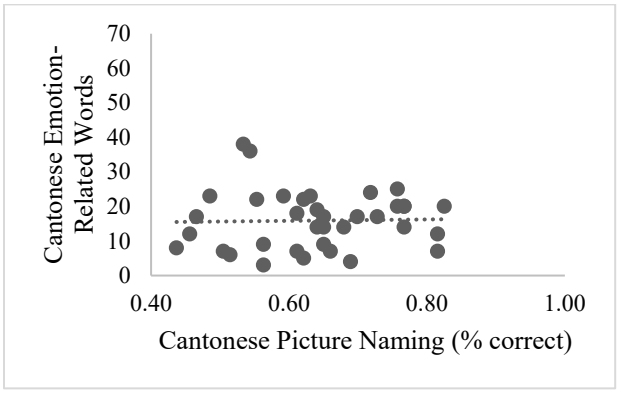

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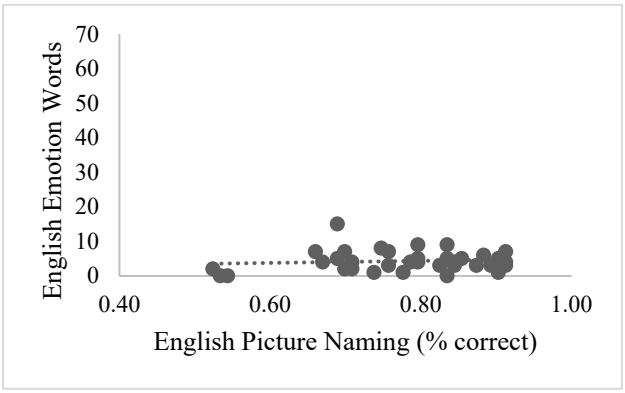

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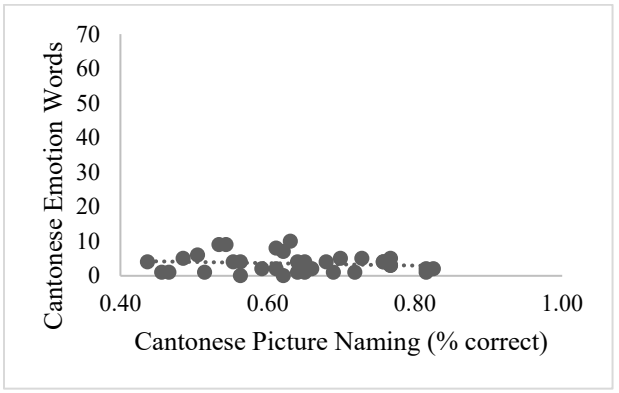

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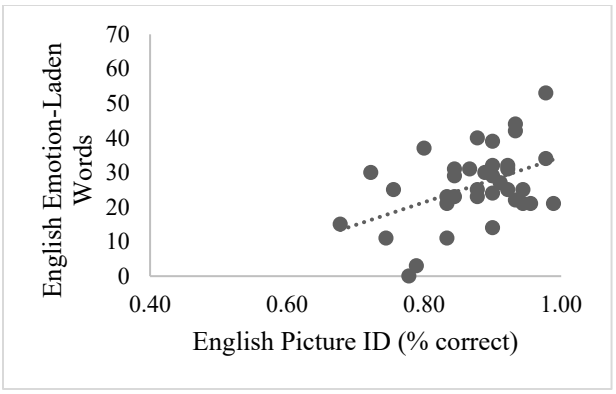
Figure 9. Relationships between Picture Naming skills and each emotion category type in English (A, C, and E) and in Cantonese (B, D, F).



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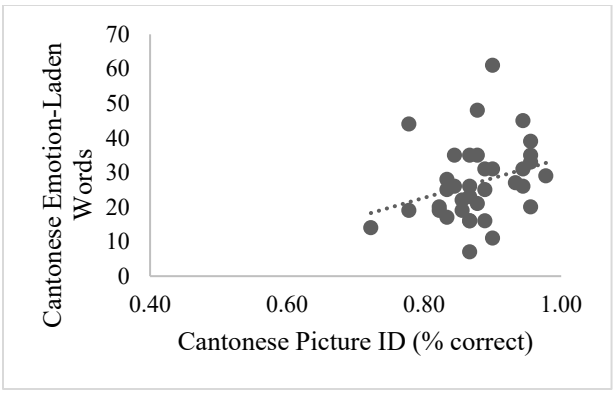

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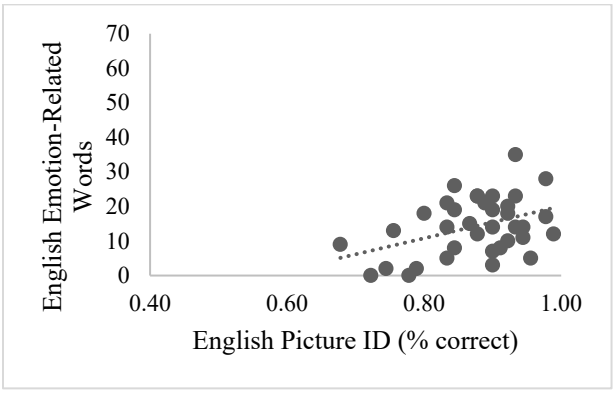

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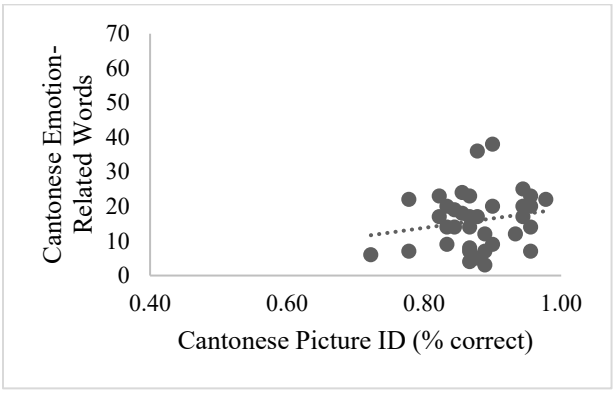

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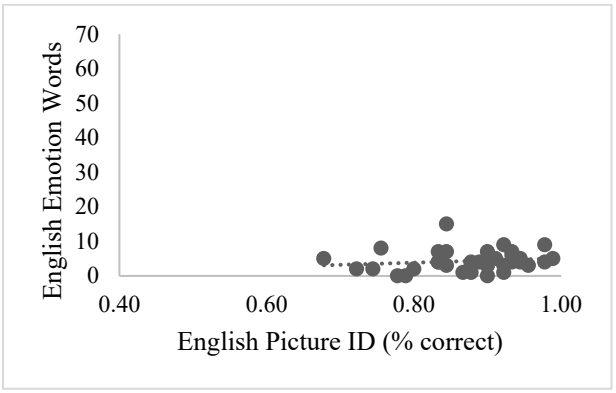

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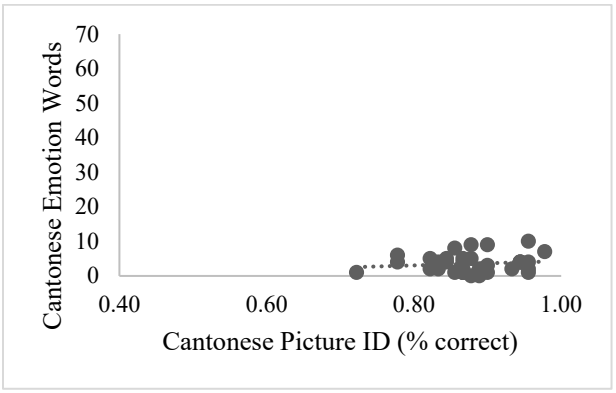

F.

Figure 10. Relationships between Picture Identification skills and each emotion category type in English (A, C, and E) and in Cantonese (B, D, F).

Language Factors as Predictors of Emotion Language Skills

In the regression models examining emotion language comprehension, the dependent variables were ERV in English and in Cantonese (see Table 13). The following independent variables in English or Cantonese were included in each model: Picture Identification, Picture Naming, and MLU-Words or MLU-Morphemes. The model with ERV in English was statistically significant $F(3, 32) = 4.57$, $p < 0.01$, $r^2 = .30$. Picture Naming in English showed a positive slope, $\beta = .39$ ($p < .05$), indicating that as Picture Naming skills increased, ERV also increased (see *Figure 11*). The model with ERV in Cantonese was not statistically significant, $F(3, 32) = .92$, $p > .05$, $r^2 = .08$.

Table 13. Results of the enter regression analysis for ERV in English (L2) and Cantonese (L1) for typically developing children.

	β	*SE*	*t*	$F(3, 32)$	R^2
Emotion Recognition Vignettes (English)					
MLU - Morphemes	.00	.01	.50	4.57**	.30
Picture Identification	-.19	.22	-.85		
Picture Naming	.39	.18	2.13*		
Emotion Recognition Vignettes (Cantonese)					
MLU - Words	.03	.02	1.48	.92	.08
Picture Identification	.18	.29	.62		
Picture Naming	-.14	-.17	-.88		

*$p < 0.05$, **$p < 0.01$

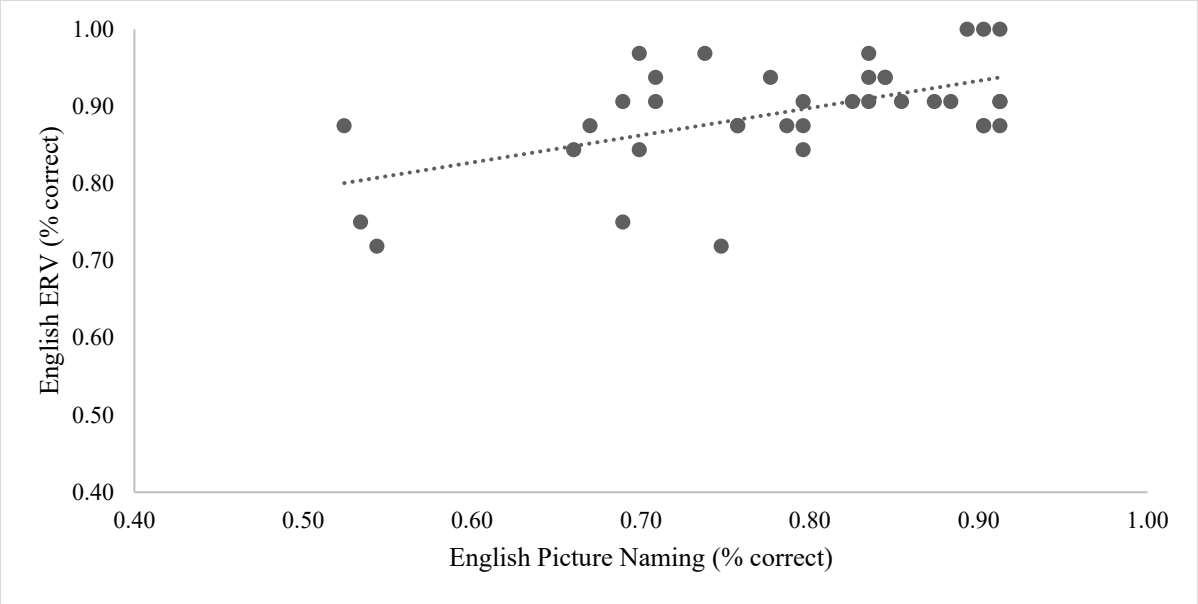

Figure 11. Percent accuracy of English Emotion Recognition Vignettes (ERV) as a function of English Picture Naming skills.

Discussion

Study 1 examined the emotion language skills in typically developing dual language learners who were exposed to Cantonese (L1) at home since birth and started to learn English (L2) in school. We administered several emotion language measures to examine emotion comprehension and production skills in Cantonese and English. The emotion comprehension measures included the ACES and ERV tasks. The emotion production measures included a Cantonese and English story retell task that elicited emotion words, and then we identified different categories of emotion words in each language following a coding procedure (i.e., Ng et al., 2019; Pavlenko, 2008). For the language measures, children's vocabulary skills were measured using a bilingual receptive and expressive vocabulary test (i.e., Kan et al., 2020) and their grammar skills were measured using language sample analyses from the story retell task.

Three main findings emerged from the analyses. First, bilingual children's emotion comprehension skills and language skills are both higher in English than in Cantonese. Second,

English language skills are linked with emotion comprehension skills in both Cantonese and English. Third, English expressive vocabulary skills predict bilingual children's emotion comprehension skills in English. Interestingly, Cantonese language skills were not linked with emotion language skills, which may be due to a regression of home language skills as children get older and are exposed to more English at school. Our findings suggest that emotion language skills in each language may vary along with the child's dual language skills and suggests further research examining emotion language development over time as language proficiency changes.

Emotion Language and Language Skills in Cantonese and English

Our first research question sought to understand whether there were differences in emotion language and language skills between L1 and L2 in sequential bilingual children who have been exposed to Cantonese at home since birth and began learning English at school. Results showed that children's grammar and expressive vocabulary skills were stronger in English than in Cantonese, but receptive vocabulary skills were similar across languages. As shown in Huang and Kan (2021), chronological age is related to English language exposure at school, and since the children in our study are 5 years old and have been in school for an average of 13 months, it is likely that their English language skills are growing due to consistent English exposure in school.

In addition to stronger English language skills, children's emotion language comprehension skills were significantly higher in English than in Cantonese. A possible explanation is that the ERV task may have required high language comprehension demands because children must listen to a short story and then identify how the character feels. Although we tried to reduce the language and working memory demands by including pictures so that children can reference them while listening to the story, the task may still require sufficient

language skills to understand the story. Therefore, it is possible that high English language skills may have supported their emotion comprehension in English too (see also the discussion about emotion and language relationships below).

However, the ACES task required less language comprehension demands because children simply identified the facial expressions based on the provided choices. Therefore, we would expect that children's performance would be similar across languages, yet our findings showed that children still performed higher in English than in Cantonese. Identifying and labeling pictures is similar to the testing culture and activities seen in mainstream American classroom settings, and so children may be more familiar with these testing procedures when presented in English than in their home language. Another possible explanation is that there may be a mismatch between the faces that children see in the task and the home language that children used to respond. The faces in the facial expressions task included more westernized faces (e.g., Black, White) than Asian faces, which may potentially confound children's testing performance. Children may be more accurate when they are responding in English and seeing westernized faces, than when they are responding in Cantonese. Indeed, previous literature has shown cultural variability in emotion recognition skills such that people are more accurate in recognizing emotions and facial expressions when they are expressed by members of their own cultural group (e.g., Elfenbein & Ambady, 2002; Segal, et al., 2019). Future studies should include faces representing different racial and ethnic backgrounds for more inclusivity as well as more accuracy when examining emotion recognition skills in bilingual bicultural children.

In emotion production skills, there were no significant differences between Cantonese and English emotion-laden, emotion-related, and emotion words. Since language production is harder than comprehension, it is possible that children's emotion production skills were similarly

low across languages. Indeed, in the children's language samples we see that out of the average total number of words (TNW) produced, the total emotion-laden, emotion-related, and emotion words produced was only 19% in English and 25.60% in Cantonese. Alternatively, these findings may also suggest that at this time in development, children's emotion vocabulary skills are similarly distributed across languages, but that may change as they get older, and their language proficiency varies. These findings should be interpreted with caution because this is a small sample size, and we collected the data at a single time point. Another limitation is that we only used one task to measure children's emotion language production skills and in a limited context. Future studies should examine emotion language production skills in different language areas (e.g., sentence production, asking questions, conversations), and across different settings (e.g., school, community) with different social partners (e.g., peers, siblings) (see also Limitations).

Relationships between Emotion Language and Language Skills

Another question in this study is whether there are relationships between bilingual children's emotion language skills and language skills in L1 and L2. We found that children's picture naming and grammar skills in English, but not in Cantonese, were correlated with emotion comprehension skills in both languages. Our findings align with Sun and colleagues' (2018) study who also showed a positive relationship between language proficiency skills and social-emotional behavioral skills in simultaneous bilingual children. However, we studied sequential bilingual children who were exposed to Cantonese as their home language and learned English as a second language later in school. This distinction is important because sequential bilingual children's proficiency skills in each language vary over time, which may influence their emotion language skills too. The children in our study were getting consistent English language exposure at school and navigating social situations with different people (peers, teachers) and

across different settings (lunch time, recess, circle time, etc.), and so they have many opportunities at school to develop their emotion language skills in English, possibly more opportunities than at home in Cantonese. Out findings showed that as bilingual children's English language skills grow, so do their emotion comprehension skills. Our next section below discusses further which English language factors may support emotion comprehension skills.

It is interesting that English language skills were also related to emotion comprehension skills in Cantonese, which may suggest possible language transfer between English and Cantonese. Indeed, we found evidence of a correlation between emotion comprehension skills in English and in Cantonese ($r = 0.52$, $p < 0.01$). Previous research has shown transfer of English language skills to Chinese in other language areas including vocabulary (see Yang et al., 2017) and morphology (e.g., Huang & Kan, 2021; Nicoladis et al., 2020), and so it is possible that there may be language transfer in emotion language skills too. Although examining language transfer was not the focus of this study, it directs future studies to explore this question further using additional language and emotion measures in each language.

Cantonese language skills, however, were not related to emotion comprehension skills in either language, possibly because L1 development in the context of a dominant L2 environment may result in the home language plateauing or regressing overtime (e.g., Paradis, 2011; Wei & Lee, 2001). It is important to pay attention to other factors in the home environment, beyond language skills, that may influence children's emotion comprehension skills. For example, previous studies have demonstrated that parents' emotion talk and sociocultural experiences may influence bilingual bicultural children's emotion language development too (Huang and Kan, 2021). Future studies should examine other factors in the child's home language environment,

including family members' emotion talk and language input, to understand the role of the home language in emotion language comprehension.

In another measure of emotion comprehension skills, children's performance on ACES task in both languages was not correlated with any of the English language measures. One possible explanation is that children's average accuracy on the ACES task was already high (83% in Cantonese and 91% in English), and so it is likely that the task was too easy, and children may have reached ceiling effects. Another possible explanation is that the ACES task itself may be a more accurate measure of non-verbal, rather than verbal, emotion language skills since it requires children to identify different facial expressions that represent emotions. Previous work has shown how non-verbal emotion language skills such as vocal patterns (intonation, stress), eye gaze, and facial expressions contribute to emotion language comprehension and social competence too (e.g., Sauter et al., 2012; Tonks et al., 2007). Future studies could implement a wider range of verbal and nonverbal emotion language measures to examine how each may be differentially related to children's dual language skills.

We were also interested in whether emotion production skills were related to language skills in both or either language. We found evidence that children's picture naming and identification skills in English were correlated with their production of emotion-laden and emotion-related words in English only. It is possible that emotion-laden words (e.g., mean, ugly) and emotion-related words (e.g., crying, yelling) are similar to the words in the bilingual vocabulary test. For example, words like "crying" or "hugging" presented in the vocabulary tests are also categorized as emotion-laden words that children may have used in the story retell task. However, emotion words that directly refer to affective states, such as "happy" or "sad", are not included in the vocabulary tests used in this study, which may explain the lack of correlation

between emotion words and their vocabulary skills. Furthermore, emotion words have been considered a distinct category of words that are processed and represented differently in the mental lexicon (i.e., Altarriba & Bauer, 2004; Altarriba et al., 1999). This lack of correlation between emotion words and vocabulary words suggests the need to explicitly test emotion vocabulary skills in children.

Vocabulary Skills are Linked to Emotion Language Skills

Our third research question sought to identify which language factors predicted emotion comprehension skills in bilingual children. Dual language proficiency skills influence social-emotional and behavioral skills in bilingual children (e.g., Sun et al., 2018), and so it can be expected that children with greater vocabulary proficiency and grammar skills, are likely to have stronger emotion language comprehension skills too. However, in this study MLU-Morphemes in English was not a significant predictor of emotion comprehension skills in English. Although MLU has been considered an accurate measure of grammatical development for English-speaking children (Miller & Chapman, 1981), especially around age 5, it may not be a sensitive enough measure of the grammar skills involved in emotion language. Previous studies have examined how parents explain emotions can influence children's emotion understanding (e.g., Aznar & Tenenbaum, 2013; Cervantes & Callahan, 1998). Emotion explanations include statements that provide causal information about emotions ("She is unhappy because there is a mean and ugly witch in her house"), high-level Wh- questions that ask about emotions ("Why is Kiki sad?"), or consecutive events that are related but not linked with a causal conjunction ("Kiki is scared. The witch was under the stairs") (i.e., Bloom & Capatides, 1987). It is likely that emotion language comprehension may require more complex and sophisticated grammar skills—skills that 5-year-old children may not yet have mastered at this stage in language development.

We found evidence that children's English expressive vocabulary skills significantly predicted their emotion comprehension skills in English. These results are consistent with the numerous studies documenting the links between children's general language skills and emotion comprehension skills in both monolinguals (e.g., Conte et al., 2019; Eisenberg et al., 2005) and bilinguals (e.g., Sun, 2019; Sun et al., 2018). However, less is understood about emotion-specific vocabulary words and its role in the development of children's emotion understanding. Previous studies have emphasized that emotion-specific vocabulary, rather than general vocabulary, contribute to emotion comprehension (Ornaghi & Grazzani, 2013; Streubel et a., 2020). A limitation in this study is that our vocabulary test included a combination of general or neutral vocabulary words and different types of emotion words, and so the links between vocabulary and emotion comprehension skills may be unclear. For example, test items like "hugging" and "crying" are also categorized as emotion-related words. Future studies should examine more closely different types of vocabulary, including emotion-specific (e.g., crying, happy) and general vocabulary (e.g., orange), to understand how they are differentially linked to emotion language comprehension.

Another possible explanation is that children's growing vocabulary knowledge may support them in understanding emotions in a sentence context. The Semantic Bootstrapping theory proposes that as children acquire words, they use this semantic information to cue them to the meaning of a sentence (Pinker, 1984). Accordingly, children can understand a sentence about emotions by first learning its semantic elements that are related to emotions or evoke emotions and then building upon, or bootstrapping from, that knowledge. For example, in the test item, "Susie had a nightmare. She was dreaming about a monster chasing her," knowing the vocabulary words "nightmare", "monster", and "chasing" may provide enough contextual and

semantic cues to understand that the character feels scared. These words are also categorized as emotion-related or emotion-laden words, which may cue them to understand the emotional state of the character in that sentence. Indeed, Beckwidth (2014) proposed that children learn emotion words by bootstrapping the meaning of two or more words. Our findings may suggest that knowing more vocabulary words can support stronger emotion language comprehension.

CHAPTER III

III. STUDY 2 – BILINGUAL CHILDREN AT-RISK FOR A LANGUAGE IMPAIRMENT: A CASE STUDY

The purpose of Study 2 was to examine the emotion language skills and the language skills in Cantonese (L1) and English (L2) sequential bilingual children who may be at risk for a language impairment (LI). In particular, we explored the patterns in emotion language skills and language skills between L1 and L2. We used a parent questionnaire to gather more holistic information about children's demographic information (e.g., family members, parent education, etc.), language background and exposure, and emotion language experiences in the home to analyze and interpret patterns among emotion language and language skills in bilingual children at risk for a language impairment.

Another important question in Study 2 is whether children at risk for a language impairment have lower emotion language skills compared to their typically developing peers. Since previous research showed that greater bilingual vocabulary skills in both languages is positively related to better social-emotional behavioral skills (Sun et al., 2018), the opposite explanation would suggest that children who have low language skills in one or both languages would also have low emotion language skills. Therefore, in our study we expect that children at risk for a LI may also have low emotion language skills in one or both languages. However, a

previous study by Ren and colleagues (2016) examining Mandarin-English sequential bilingual preschool children found that even children with low English proficiency skills remained high in their emotion regulation skills in the classroom setting, suggesting that emotion competency skills could serve as a potential advantage in those with low English language skills. Therefore, it is possible that there may not be differences in emotion language skills between study groups (children at risk for LI vs. TD children).

Study 2 has three research questions:

1) What are the emotion language skills and the language skills in Cantonese (L1) and English (L2) in children at risk for language impairment?
2) Are there differences in emotion language skills between children at risk for language impairment and their typically developing peers?
3) What are the patterns in emotion language skills among the children at risk for language impairment?

Method

Participants

A total of three sequential bilingual children who speak Cantonese as a home language (L1) and then learned English as a second language (L2) were identified as being at-risk for a LI and qualified for Study 2. Currently, there are no standardized measures available or agreed upon best practice for identification of Cantonese-English bilingual children at-risk for a language impairment in the United States. Therefore, based on previous work (i.e., Kan et al., 2021; Restrepo & Gutierrez- Clellen, 2001), this study followed a series of requirements by meeting at least 4 out of the 5 criteria below to ensure that the children demonstrated a risk for LI (see Table 14):

1) Parental Concerns: Parents reported whether they had concerns about their child's speech and language skills on the questionnaire. Parents from minority backgrounds may not feel comfortable reporting concerns about their child on a formal document. Feeling uncomfortable reporting on a formal document or to "experts" is not uncommon for minorities. Rather, parents may feel more comfortable communicating with cultural liaisons, and so we accepted if parents orally reported to the cultural liaison that they have concerns about their child's speech and/or language skills.
2) No Developmental Disorders: We confirmed that children had low language skills in the absence of other diagnosed developmental disorders. Conventional criteria (see Leonard, 1998) are used to exclude children with language impairments secondary to other types of developmental disorders.
3) Low Vocabulary Scores: We identified the vocabulary mean and standard deviation of all the participants. We identified those whose receptive and expressive vocabulary scores were at least 1 SD below the mean in Cantonese and/or English. See Table 15 for a summary of the mean, standard deviation, and cut off scores for each vocabulary task in each language.
4) Low Grammar Scores: We identified the mean length utterance (MLU) mean and standard deviation of all the participants. We identified those whose MLU performance was 1 SD below the mean in the Cantonese and/or English language samples. See Table 15 for a summary of the mean, standard deviation, and cut off scores for the MLU in each language.
5) Clinical judgement: We observed children's testing performance in both languages, including attention, response rate, impulsivity, and behavior, to gather convergent information about whether they may be at risk for a LI.

Table 14. Inclusion criteria for participants with low language skills in STUDY 2.

	Child A	Child B	Child C
Parental Concerns		X	X
No Developmental Disorders	X	X	X
Low Cantonese Vocabulary Scores	X	X	X
Low English Vocabulary Scores	X		X
Low Cantonese Grammar Scores	X		X
Low English Grammar Scores	X		X
Clinical Judgment	X	X	X

Table 15. Summary of the mean, standard deviation, and cut off scores from the vocabulary and mean length utterance measures in Cantonese and English in Study 2.

	Mean	*SD*	Cutoff
Cantonese			
Picture Naming	0.62	0.13	< 0.49
Picture Identification	0.86	0.09	< 0.77
MLU – Words (Cantonese)	3.52	0.92	< 2.6
English			
Picture Naming	0.77	0.12	< 0.65
Picture Identification	0.87	0.08	< 0.79
MLU – Morphemes (English)	4.90	1.68	< 3.22

Procedures

Study 2 followed the same procedures and administered the same tests and measures as in Study 1. Each child participated in the Cantonese and English tasks on two different days with about a week interval. The children in Study 2 required more time and breaks to complete the tasks. Each testing session lasted about 75-100 minutes, depending on the child's behavior and attention span. See Table 16 for a summary of the children's testing procedures with extended time and additional breaks. The procedures for 1) data scoring, 2) coding emotion terms, and 3) language sample analysis were the same as those in Study 1.

Table 16. Summary of children's testing procedures in Study 2.

	Task	**Time to Complete**
English	Picture Naming Task	15-20 minutes
	Assessment of Children's Emotion Skills	10-15 minutes
	Break (if needed)	
	Emotion-Elicited Story Retell Task	15-20 minutes
	Break (if needed)	
	Emotion Recognition Vignettes	15-20 minutes
	Break (if needed)	
	Picture Identification Task	20-25 minutes
	Task	**Time to Complete**
Cantonese	Picture Naming Task	15-20 minutes
	Assessment of Children's Emotion Skills	10-15 minutes
	Break (if needed)	
	Emotion-Elicited Story Retell Task	15-20 minutes
	Break (if needed)	
	Emotion Recognition Vignettes	15-20 minutes
	Break (if needed)	
	Picture Identification Task	20-25 minutes

Data Analysis

To address our first research question, we reported each child's performance on the emotion and language measures in Cantonese and English. Measures of emotion language

comprehension included the ACES and ERV tasks, and the measures of emotion language production included the frequency of emotion words, emotion-related words, and emotion-laden words. Measures of dual language skills included MLU from the storytelling task, and picture naming and picture identification vocabulary skills in each language.

We addressed the second research question in two steps. First, I conducted a one sample t-test for each child with low language skills to examine whether each child's mean emotion and language skills were significantly different from the larger mean in typically developing children. I report a summary of the one-sample analyses and the corresponding tables below for each child. Second, each child who was identified at risk for a language impairment (Child A, B, and C) was matched as closely as possible with a typically developing child (Child X, Y, and Z) based on their demographic background information for a descriptive comparison. Henceforth, the typically developing matched peer will be labeled as TD-Matched Child X, Y, or Z. Children were matched on their age, home state, home language, whether they were born in the United States, time spent in school, family members living in the home, and amount of language exposure from each family member. I also reported a comparison table of dual language and emotion language skills between each child at risk for a language impairment and their typically developing matched peer.

For the third research question, we used data from the parent questionnaire and provided a description of each child's demographic information, language background, and emotion language experiences in the home environment. Additionally, we observed children's testing performance in each language to gather information about behaviors in children at risk for LI.

Video Coding Procedures for Clinical Observations

The Cantonese and English video recordings for the 3 children were used to clinically observe each child's behaviors during the testing session. The mean length of the video recordings was 60 minutes (Range = 57 – 64 minutes) for the Cantonese videos and 62 minutes (Range = 57-67 minutes) for the English videos. We analyzed both the Cantonese and English video recordings using our coding scheme. Following a sampling method from previous studies (e.g., Kan et al., 2020; Wood et al., 2016), we sampled the first minute of the child's behavior for every 5-minute segment of the video recording. On average there were 11 one-minute segments for the Cantonese and English videos.

Additionally, we were interested in observing how children behave during transition periods. A "transition period" is defined as the point between ending a task and starting a new task. We sampled the first 1 minute of the child's behaviors after each transition period for each task. There was a total of 5 transition periods: 1) Picture Naming task and ACES task, 2) ACES task and listening to the Witch story, 3) Listening to the Witch story and story retell task, 4) story retell task and ERV task, 5) ERV task and Picture Identification task.

Result

CHILD A

Child Background and Emotion and Language Measures

1. **Demographic information and home language environment.**

Child A is a 5;0-year-old female who was born in the U.S. and lives in California with her mother, father, grandparents, and older and younger siblings. Child A's parent reported that both the mother's and father's highest education attained was secondary school (elementary or middle school). The mother's job was not reported, but the father works in service industry. Child A has attended school for 16 months. Languages spoken in the home include Cantonese,

Toisan, and Hakka, but Cantonese is the dominant language used by all family members. Parents did not report any concerns with speech, language, learning, or development. Child A's mother, father, grandfather, and younger sibling use 100% Cantonese at home. Her grandmother uses 50% Cantonese, and her older sibling uses 40% Cantonese (see Figure 12). Parents reported that Child A engages in all the storytelling activities and is exposed to 100% Cantonese during storytelling, reading stories, and watching T.V. activities (see Figure 13).

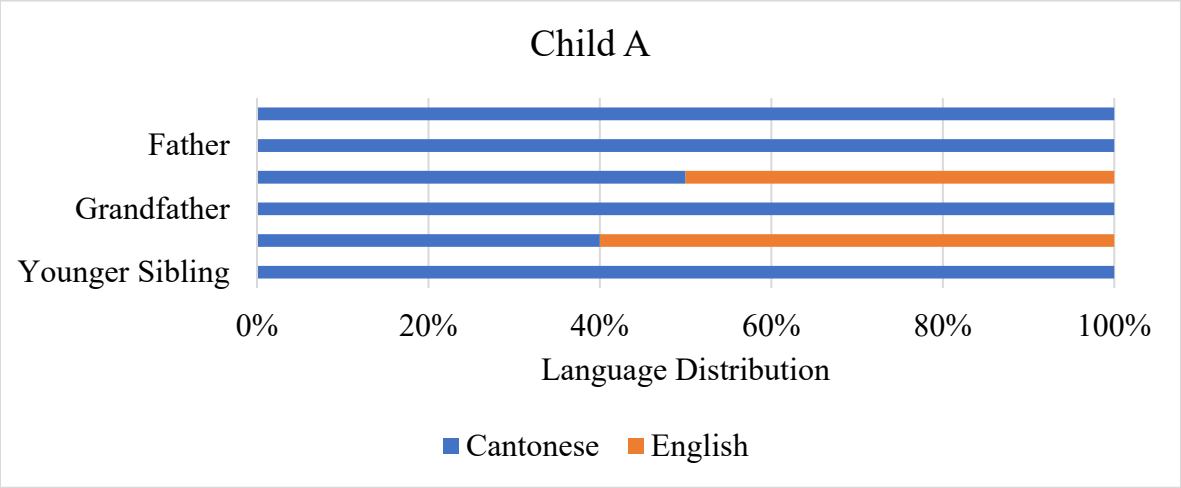

Figure 12. Cantonese and English language distribution across family members for Child A.

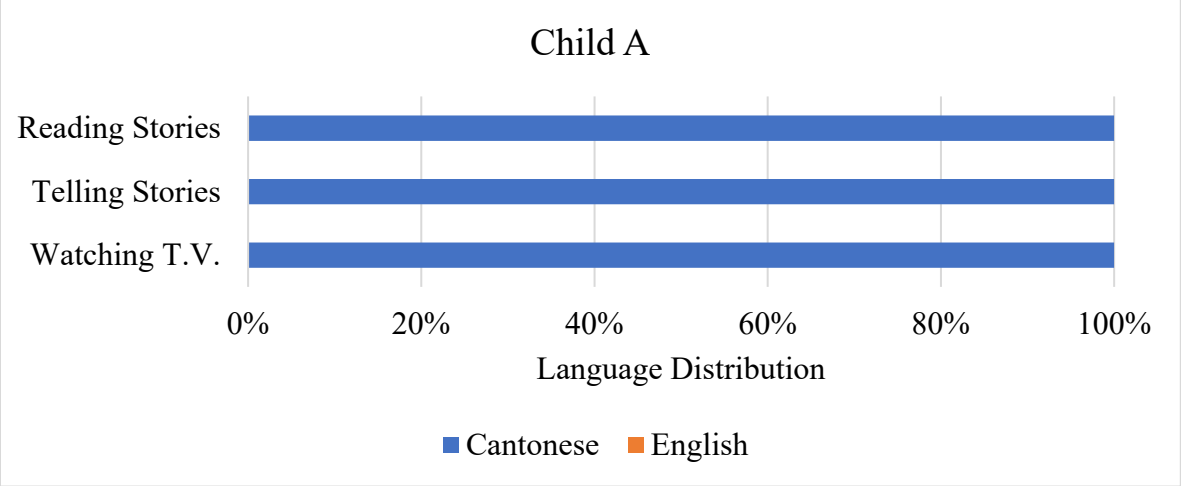

Figure 13. Cantonese and English language distribution across home activities for Child A.

2. Dual language skills.

See Table 17 and Figure 14 below for a summary of Child A's vocabulary and grammar skills in Cantonese and in English. Child A's language performance for MLU was higher in Cantonese MLU-Words (2.29) than in English MLU-Morphemes (1.60). Additionally, Child A has a higher type token ratio (TTR) in the Cantonese language sample (62.50%) than in the English one (52.78%). Performance on the picture identification task in each language was similar, with a slightly higher score in Cantonese (67.78%) than in English (63.33%). Child A's picture naming skills were higher in English (57.28%) than in Cantonese (30.10%). A's picture naming skills were higher in English (57.28%) than in Cantonese (30.10%).

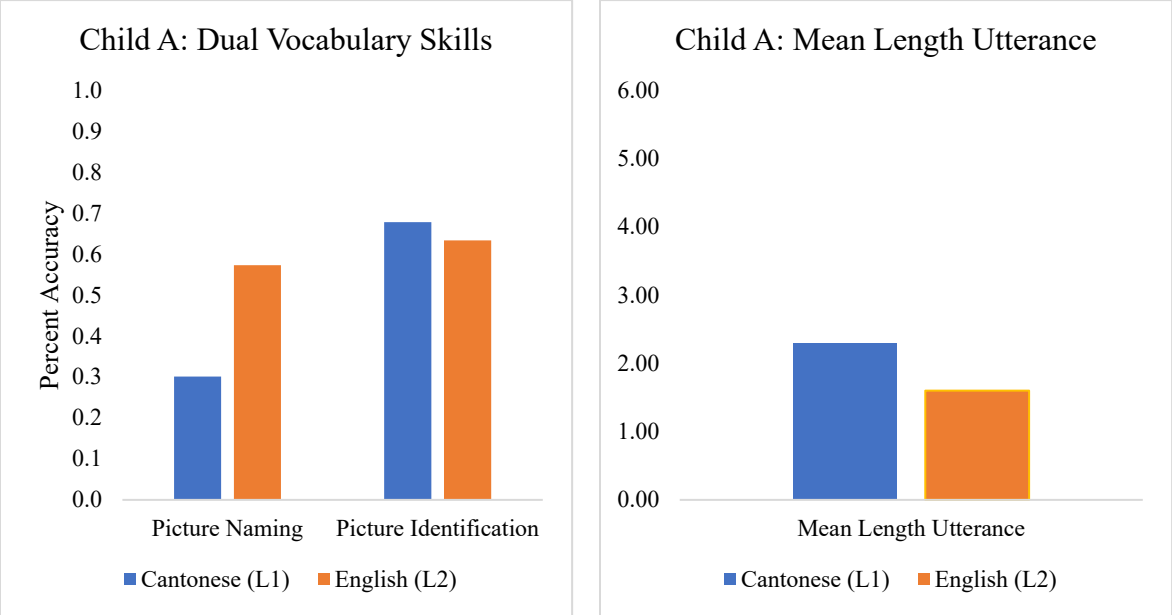

Figure 14. Comparison of vocabulary skills (left) and grammar skills (right) between Cantonese and English for Child A.

Table 17. Summary of the Cantonese and English language skills from the bilingual vocabulary measures and the storytelling task in Child A.

	Cantonese (L1)	English (L2)
Picture Naming (%)	30.10	57.28
Picture Identification (%)	67.78	63.33
MLU – Words	2.29	--
MLU – Morphemes	--	1.60
Total Utterances	38	46
Type Token Ratio (%)	62.50	52.78

Note: MLU = Mean Length Utterance

3. Dual emotion language skills.

See Table 18 and Figure 15 below for a summary of Child A's emotion language skills in Cantonese and in English. Child A performed better on the recognizing facial expressions task in English (68.75%) than in Cantonese (43.75%). However, for the ERV task, Child A performed higher in Cantonese (68.75%) than in English (40.63%). Child A used similar number of words in English and in Cantonese for each emotion category.

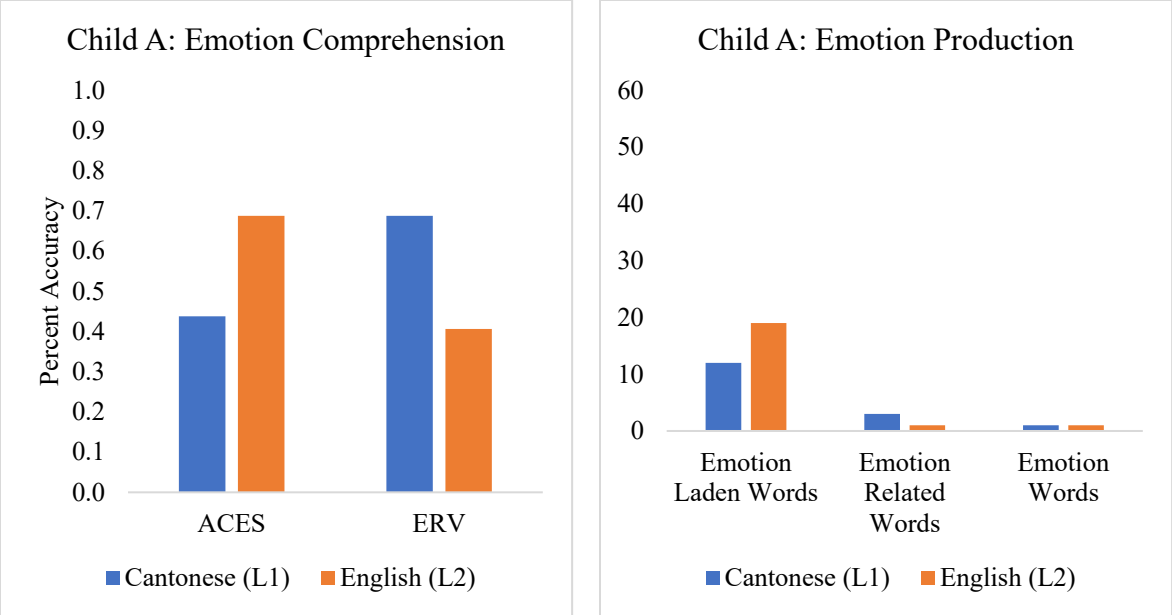

Figure 15. Comparison of emotion comprehension skills (left) and emotion production skills (right) between Cantonese and English for Child A.

Table 18. Summary of Child A's dual emotion language measures in Cantonese and English.

		Cantonese (L1)	English (L2)
Emotion Comprehension	Assessment of Children's Emotion Skills (%)	43.75	68.75
	Emotion Recognition Vignettes (%)	68.75	40.63
Emotion Production	Emotion Words	1	1
	Emotion-Related Words	3	1
	Emotion-Laden Words	12	19

Comparison between the Child at Risk for a Language Impairment and their Typically Developing Peers

1. **One-Sample T-Test**

Child A's vocabulary and grammar measures in Cantonese and English were significantly lower than typically developing children's mean scores (see Table 19 below). Child A's emotion comprehension and production measures in Cantonese and English were also significantly lower than typically developing children's mean scores (see Table 20 below).

Table 19. Comparisons between Child A and their typically developing peers on Cantonese and English language measures from a one sample t-test.

	Child A	Typically Developing	t	Cohen's d
Cantonese (L1)				
Picture Naming (%)	30.10	63.86 (10.71)	18.91***	3.15
Picture Identification (%)	67.78	87.75 (5.67)	21.11***	3.52
MLU – Words	2.29	3.60 (0.88)	9***	1.50
English (L2)				
Picture Naming (%)	57.28	77.91 (10.80)	11.47***	1.91
Picture Identification (%)	63.33	87.38 (7.48)	19.29***	3.22
MLU – Morphemes	1.60	5.34 (1.72)	13.03***	2.17

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

Table 20. Comparisons between Child A and their typically developing peers on Cantonese and English emotion language measures from a one sample t-test.

	Child A	Typically Developing Peers	t	Cohen's d
Cantonese (L1)				
Assessment of Children's Emotion Skills (%)	43.75	82.99 (14.53)	16.20***	2.7
Emotion Recognition Vignettes (%)	68.75	86.02 (8.91)	11.62***	1.94
Emotion-Laden Words	12	27.08 (11.17)	8.10***	1.35
Emotion Words	1	3.53 (2.62)	5.78***	.96
Emotion-Related Words	3	15.92 (8.28)	9.37***	1.56
English (L2)				
Assessment of Children's Emotion Skills (%)	68.75	91.15 (7.67)	17.51***	2.92
Emotion Recognition Vignettes (%)	40.63	88.89 (6.82)	42.43***	7.07
Emotion-Laden Words	19	26.22 (10.86)	3.99***	.67
Emotion Words	1	4.31 (3.03)	6.54***	1.09
Emotion-Related Words	1	14.22 (8.40)	9.44***	1.57

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

2. Typically Developing Matched Peer

Matching Criteria- Child A and TD-matched Child X are both 5;0 years old who were born in the U.S., live in the state of California, and speak Cantonese as their home language. They spent similar amount of time in school; Child A spent 16 months in school while Child X spent 17 months. Both children live with their mother, father, younger sibling, grandmother, and grandfather. Child A also lives with an older sibling who uses 40% Cantonese at home. Overall, Child A and X are similar in their demographic background and amount of exposure to each language. See Table 21 below for a summary of their demographic background.

Table 21. Summary of matching criteria between Child A (at-risk for LI) and Child X (TD matched peer) based on their demographic information.

	Child A	**TD Matched-Child X**
Age (months)	60	60
California State? (Yes/No)	Yes	Yes
Cantonese as home language? (Yes/No)	Yes	Yes
USA born? (Yes/No)	Yes	Yes
Time spent in school (months)	16	17
Cantonese Exposure		
Mother	100%	80%
Father	100%	80%
Older Sibling	40%	--
Younger Sibling	100%	20%
Grandmother	50%	100%
Grandfather	100%	100%

Child A and TD-matched Child X Emotion and Language Skills- Even though both children have similar demographic and language background, TD-matched Child X performed higher than Child A on all language measures in Cantonese and English. For the language measures, Child X has higher MLU, picture identification, and picture naming scores in both Cantonese and English compared to Child A (see Table 22). For the emotion language measures, Child X performed consistently higher than Child A across all emotion language measures,

except for the ERV task in Cantonese (see Table 23). For the ERV, Child X performed higher than Child A in English, but performed the same as Child A in Cantonese. For the emotion categories, Child X used more emotion-laden, emotion-related, and emotion words compared to Child A in both Cantonese and English.

Table 22. Comparison of Child A and their TD-matched Child X dual language skills from the vocabulary and storytelling task.

	Child A	TD-Matched Child X
Cantonese		
Picture Naming (%)	30.10	72.82
Picture Identification (%)	67.78	82.22
MLU – Words	2.29	4.71
English		
Picture Naming (%)	57.28	74.76
Picture Identification (%)	63.33	75.56
MLU – Morphemes	1.60	5.24

Table 23. Comparison of Child A and their TD-matched Child X emotion language skills in Cantonese and English.

	Child A	TD-Matched X
Cantonese		
Assessment of Children's Emotion Skills (%)	43.75	87.50
Emotion Recognition Vignettes (%)	68.75	68.75
Emotion-Laden Words	12	19
Emotion Words	1	5
Emotion-Related Words	3	17
English		
Assessment of Children's Emotion Skills (%)	68.75	93.75
Emotion Recognition Vignettes (%)	40.63	71.88
Emotion-Laden Words	19	25
Emotion Words	1	8
Emotion-Related Words	1	13

Patterns in Emotion Language Experiences and Behaviors

1. **Emotion language experiences at home**

Child A- Child A's parent reported that both the parent and the child prefer to use Cantonese when talking about emotions. Parents reported discussing Sad, Happy, and Surprised feelings 1-2 times in the past two weeks, and they did not discuss or have the opportunity to

discuss Angry, Scared/Worried, and Guilty feelings. Parent reported using a total of 5 different emotion words with their child: 高興 (gouhing, joyful), 唔開心 (mhoisam, not happy/sad), 嬲 (nau, mad), 怕醜 (paacau, shy), 驚 (geng, scared). Parent reported that their child uses a total of 5 different emotion words with them: 快樂 (faailok, happy), 難過 (naangwo, sad/sorrow), 沮喪 (zeoisong, frustrated), 怕醜 (paacau, shy), 擔心 (daamsam, worried).

TD-Matched Child X- Child X's parent reported that both the parent and the child prefer to use Cantonese when talking about emotions. Parents reported that in the past two weeks, they discussed Sad and Happy feelings 3-4 times, and Angry, Scared/Worried, and Surprised feelings 5 times or more. Parents reported not discussing or did not have the opportunity to discuss Guilty feelings in the past two weeks. Parent reported using a total of 9 different emotion words with their child: **開心** (hoisam, happy), **快樂** (faailok, happy), **幸福** (hangfuk, blessing), **傷心** (soengsam, broken hearted), **慘** (caam, miserable), **嬲** (nau, mad), **羞家** (saugaa, disgrace to the family), **怕醜** (paacau, shy), and **驚** (geng, scared). Parents reported that their child uses a total of 5 different emotion words with them: **開心** (hoisam, happy), **唔開心** (mhoisam, not happy/sad), **嬲** (nau, mad), **怕醜** (paacau, shy), and **驚** (geng, scared).

2. Behavioral Observations in Child A

Child A's behavior was similar across English and Cantonese testing. Child A benefitted from having her mom sit with her to redirect her attention to the task at hand, prompt her to scan all the pictures, or repeat the question. In both English and Cantonese testing, Child A showed impulsivity when she responded before the examiner finished asking the question or providing all the answer choices. For example, Child A interrupted the examiner 3 times before the examiner finished asking the question. Child A appeared restless, asking "are we finished yet?",

turning the video and audio on and off, swiveling in her chair, jumping on the couch, and leaning into and away from the camera. She benefitted from taking 2 two-minute body breaks in which we turned the camera off and she got out of her seat and moved her body. Following the break, she was sitting quietly, listening to the examiner, scanning the screen, and consistently responding to the examiner. Near the end of the testing, Child A was getting increasingly restless and shouted the answers. For the Picture Naming task, Child A often responded in English when she did not know the word in Cantonese.

Summary of Child A

Child A performed better on the ERV task in Cantonese than in English, possibly because this task requires more language comprehension. This is consistent with Child A's higher MLU in Cantonese than in English, suggesting that Child A's language skills are stronger in Cantonese than in English. It is also likely that Child A is using contextual cues from the short story to identify the character's emotions in this task. Child A's performance on ACES task was lower in Cantonese compared to in English. This may be explained by the parents reporting that they talk about emotions only 1-2 times or not at all in the past 2 weeks. It is also likely that Child A may be more comfortable labeling emotions in English since this activity is similar to activities done in the classroom.

We further examined Child A's responses on each item on the ACES task in Cantonese. Although Child A did not accurately label the facial expression, Child A's incorrect answers were often within the same negative valence (e.g., sad instead of angry). Moreover, Child A's responses were broadly labeled as either happy or sad. Child A often labeled negative valence emotions as sad rather than distinguishing between angry, scared, and sad. This may suggest that

Child A may not have the emotional differentiation in Cantonese yet to distinguish between different among negative valence emotions.

CHILD B

Child Background and Emotion and Language Measures

1. **Demographic information and home language environment.**

Child B is a 5;0-year-old female who was born in the U.S. and lives in California with her mother, father, grandparents, and older sibling. Child B's parent reported that both the mother's and father's highest education attained was secondary school (elementary or middle school). The mother works in the service industry and the father works as a professional or administrator. Child B has attended school for 40 months. Languages spoken in the home included Cantonese, English, Toisan, and Mandarin, but Cantonese is the dominant language used by all family members. Parents reported concerns with language and learning. Child B's mother, father, and grandparents use 100% Cantonese at home. Child B's older sibling used 60% Cantonese (see *Figure 16*). Parents reported that Child B is engaged in storytelling and watching t.v. activities, but not in reading stories, and is exposed to 80% Cantonese (see *Figure 17*).

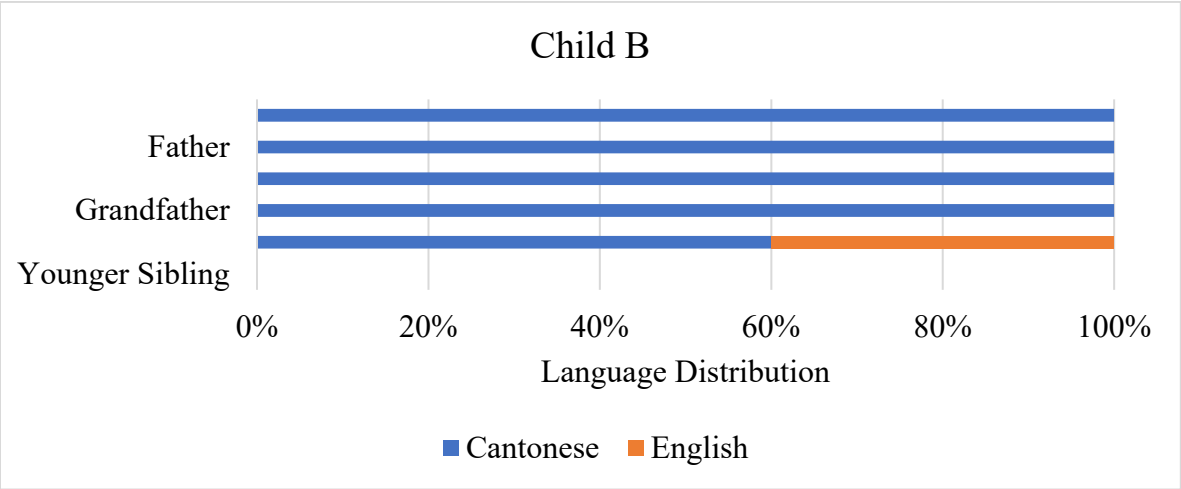

Figure 16. Cantonese and English language distribution across family members for Child B.

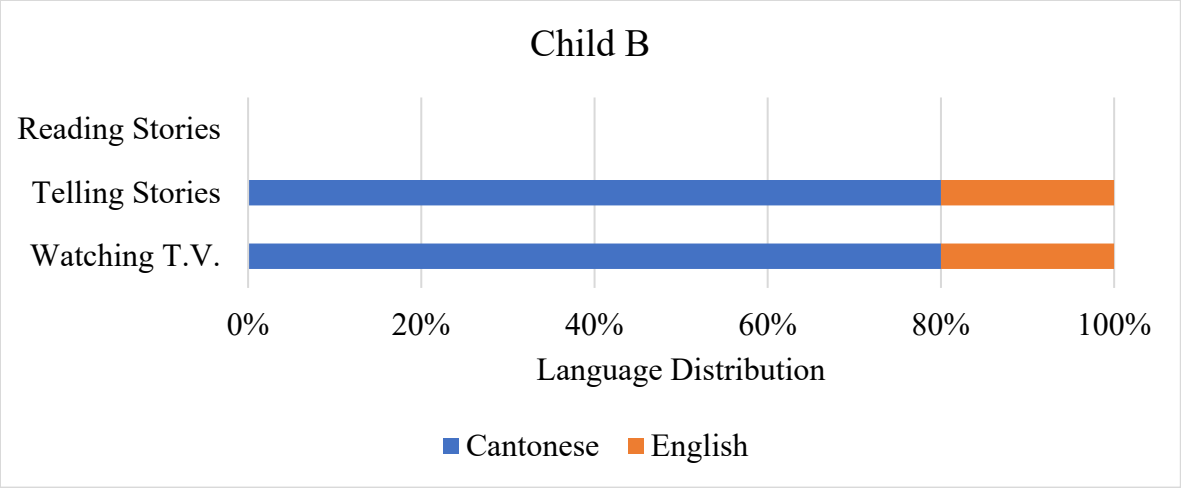

Figure 17. Cantonese and English language distribution across home activities for Child B.

2. Dual language skills.

See Table 24 and Figure 18 below for a summary of Child B's vocabulary and grammar skills in Cantonese and in English. Child B's language performance for MLU was lower in Cantonese MLU-Words (3.57) than in English MLU-Morphemes (5.87). Additionally, although Child B produced fewer utterances in Cantonese (73) compared to English (132), Child B has a higher type token ratio in the Cantonese language sample (40.95%) than in English (23.91%). Performance on the Cantonese picture identification (50%) and picture naming (38.83%) was lower than on the English picture identification (86.67%) and picture naming (81.55%). These scores may suggest that Child B's English language skills are growing faster than their Cantonese language skills.

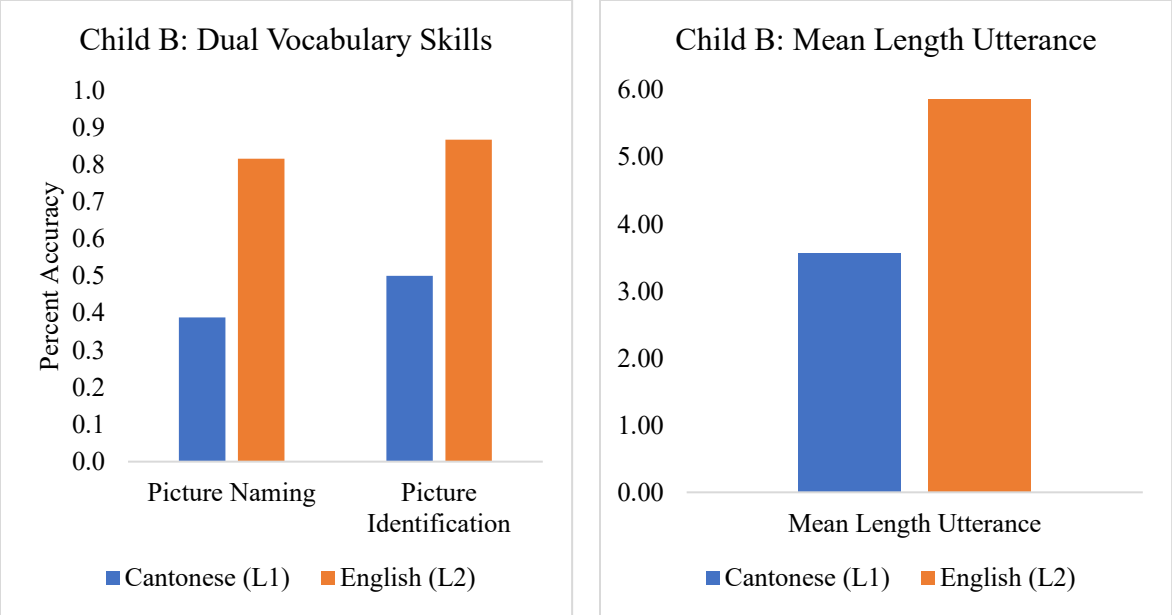

Figure 18. Comparison of vocabulary skills (left) and grammar skills (right) between Cantonese and English for Child B.

Table 24. Summary of Cantonese and English language skills from the bilingual vocabulary measures and the storytelling task in Child B.

	Cantonese (L1)	English (L2)
Picture Naming (%)	38.83	81.55
Picture Identification (%)	50	86.67
MLU – Words	3.57	--
MLU – Morphemes	--	5.87
Total Utterances	73	132
Type Token Ratio (%)	40.95	23.91

Note: MLU = Mean Length Utterance

3. Dual emotion language skills.

See Table 25 and Figure 19 below for a summary of Child B's emotion language skills in Cantonese and in English. Child B performed the same on ACES task in English and in Cantonese (100%). However, for the ERV task, Child B performed higher in English (78.13%) than in Cantonese (65.63%). For each emotion category, Child B used more emotion laden (55), emotion-related (23), and emotion words (15) in English than in Cantonese. In Cantonese, Child B produced a total of 32 emotion-laden words, 6 emotion words, and 9 emotion-related words. These results are consistent with Child B's higher English grammar and vocabulary skills.

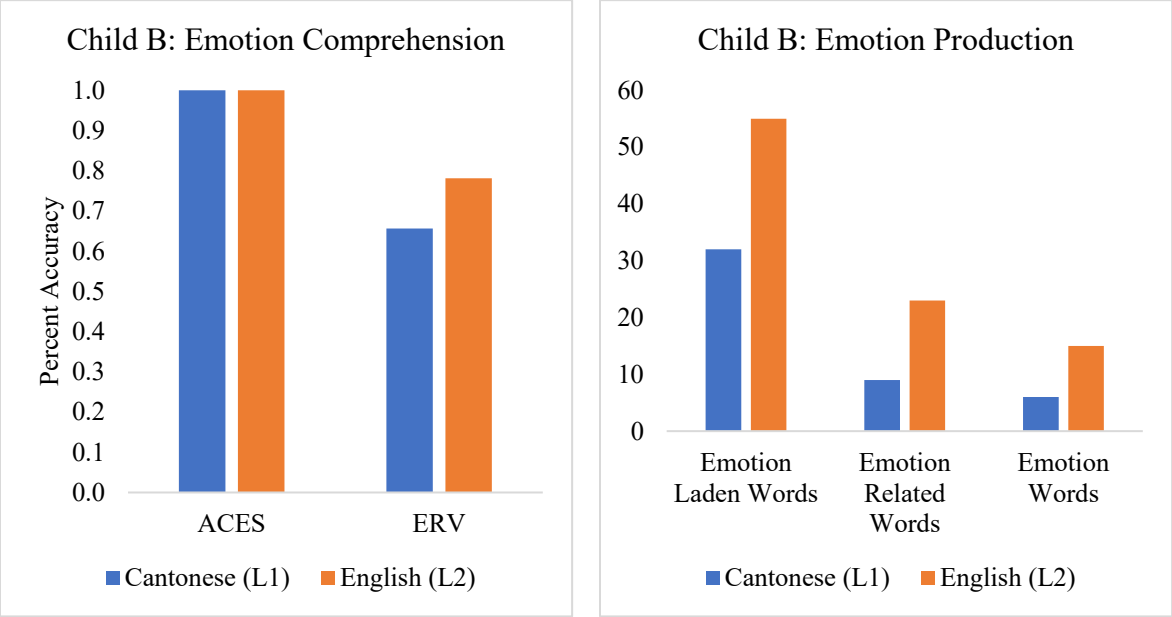

Figure 19. Comparison of emotion comprehension skills (left) and emotion production skills (right) between Cantonese and English for Child B.

Table 25. Summary of Child B's dual emotion language measures in Cantonese and English.

		Cantonese (L1)	English (L2)
Emotion Comprehension	Assessment of Children's Emotion Skills (%)	100	100
	Emotion Recognition Vignettes (%)	65.63	78.13
Emotion Production	Emotion Words	6	15
	Emotion-Related Words	9	23
	Emotion-Laden Words	32	55

Comparison between the Child at Risk for a Language Impairment and their Typically Developing Peers

1. **One-Sample T-Test**

For the Cantonese language measures, Child B's Cantonese vocabulary measures were lower than typically developing children's mean scores. Cantonese grammar skills, as measured by MLU-Words, were not significantly different from the sample mean. For the English language measures, Child B's picture naming skills and grammar skills (MLU-Morphemes) were significantly higher than the larger sample mean. English picture identification skills were not significantly different from the sample mean. See Table 26 below. Child B's emotion language measures were mixed. Child B performed significantly higher than their typically developing peers on the ACES task and produced more emotion words, emotion-laden words, and emotion-related words compared. However, Child B performed significantly lower on the ERV compared to their typically developing peers. See Table 27 below.

Table 26. Comparisons between Child B and their typically developing peers on Cantonese and English language measures from a one sample t-test.

	Child B	Typically Developing	t	Cohen's d
Cantonese (L1)				
Picture Naming (%)	38.83	63.86 (10.71)	14.02***	2.34
Picture Identification (%)	50	87.75 (5.67)	39.91***	6.65
MLU – Words	3.57	3.60 (0.88)	.23	.04
English (L2)				
Picture Naming (%)	81.55	77.91 (10.80)	-2.02*	-.34
Picture Identification (%)	86.67	87.38 (7.48)	.57	.09
MLU – Morphemes	5.87	5.34 (1.72)	-1.85*	-.31

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

Table 27. Comparisons between Child B and their typically developing peers on Cantonese and English emotion language measures from a one sample t-test.

	Child B	Typically Developing Peers	t	Cohen's d
Cantonese (L1)				
Assessment of Children's Emotion Skills (%)	100	82.99 (14.53)	-7.03***	-1.17
Emotion Recognition Vignettes (%)	65.63	86.02 (8.91)	13.72**	2.29
Emotion-Laden Words	32	27.08 (11.17)	-2.64**	-.44
Emotion Words	6	3.53 (2.62)	-5.65***	-.94
Emotion-Related Words	9	15.92 (8.28)	5.02***	.84
English (L2)				
Assessment of Children's Emotion Skills (%)	100	91.15 (7.67)	-6.92***	-1.15
Emotion Recognition Vignettes (%)	78.13	88.89 (6.82)	9.46***	1.57
Emotion-Laden Words	55	26.22 (10.86)	-15.90***	-2.65
Emotion Words	15	4.31 (3.03)	-21.17***	-3.53
Emotion-Related Words	23	14.22 (8.40)	-6.27***	-1.04

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

2. **Typically Developing Matched Peer**

Matching Criteria- Child B is 5;0 years old and TD-matched Child Y is 5;1 years old. They were both born in the U.S., live in California states, and speak Cantonese as their home language. Child B spent more time in school (40 months) than Child Y (26 months). Both children live with their mother, father, older sibling, grandmother, and grandfather. The major difference between the children's language background is the amount of time they spent in school which represents the amount of time they have been formally exposed to English. See Table 28 below for a summary of their demographic background.

Table 28. Summary of matching criteria between Child B (at-risk for LI) and Child Y (TD matched peer) based on their demographic information.

	Child B	**TD Matched-Child Y**
Age (months)	60	61
California State? (Yes/No)	Yes	Yes
Cantonese as home language? (Yes/No)	Yes	Yes
USA born? (Yes/No)	Yes	Yes
Time spent in school (months)	40	26
Cantonese Exposure		
Mother	100%	80%
Father	100%	80%
Older Sibling	60%	80%
Younger Sibling	--	--
Grandmother	100%	100%
Grandfather	100%	100%

Child B and TD-Matched Child Y Emotion and Language Skills- In Cantonese, TD-matched Child Y performed higher on picture identification (88.89%) and picture naming skills (61.17%) than Child B. Child B also had higher Cantonese MLU-Words (3.57) than Child Y (2.60). However, in English, Child Y was higher in English MLU-Morphemes (8.11) than Child B (5.87). Child Y performed only slightly higher on picture identification (90%) and picture naming skills (83.50%) than Child B. Even though Child Y has had less formal English exposure

compared to Child B, Child Y performed equally as well as Child B on the English vocabulary measures, while still maintaining high Cantonese vocabulary scores. See Table 29.

The patterns for emotion language skills are more complex (see Table 30). For the ACES task, Child Y's performance in the in Cantonese (68.75%) and English (87.50%) was lower than that of Child B's. Child B scored 100% accuracy on this task in both languages. For the ERV, Child Y performed higher than Child B in English (93.75%) and in Cantonese (96.88%). It is likely because the ERV task require higher language demands compared to the ACES task. Interestingly, for the emotion categories, Child B used more emotion-laden, emotion-related, and emotion words compared to Child Y in both Cantonese and English.

Table 29. Comparison of Child B and their TD-matched Child Y dual language skills from the vocabulary and storytelling task.

	Child B	TD-Matched-Child Y
Cantonese		
Picture Naming (%)	38.83	61.17
Picture Identification (%)	50	88.89
MLU – Words	3.57	2.60
English		
Picture Naming (%)	81.55	83.50
Picture Identification (%)	83.50	90
MLU – Morphemes	5.87	8.11

Table 30. Comparison of Child B and their TD-matched Child Y emotion language skills in Cantonese and English.

	Child B	TD-Matched Child Y
Cantonese		
Assessment of Children's Emotion Skills (%)	100	68.75
Emotion Recognition Vignettes (%)	65.63	96.88
Emotion-Laden Words	32	25
Emotion Words	6	2
Emotion-Related Words	9	7
English		
Assessment of Children's Emotion Skills (%)	100	87.50
Emotion Recognition Vignettes (%)	78.13	93.75
Emotion-Laden Words	55	14
Emotion Words	15	0
Emotion-Related Words	23	3

Patterns in Emotion Language Experiences and Behavioral Observations

1. **Emotion language experiences at home**

Child B- Child B's parent reported that both the parent and the child prefer to use Cantonese when talking about emotions. Parents reported discussing Sad, Happy, and Angry feelings 1-2 times in the past two weeks. Parents reported not discussing or did not have the

opportunity to discuss Scared/Worried, Surprised, and Guilty feelings in the past two weeks. Parents reported using a total of 7 different emotion words with their child: 開心 (hoisam, happy), 快樂 (faailok, happy), 傷心 (soengsam, sad), 唔開心 (mhoisam, not happy/sad), 激氣 (gikhei, angry), 羞家 (saugaa, disgrace), 擔心 (daamsam, worried). Parents reported that their child uses a total of 5 different emotion words with them: 開心 (hoisam, happy), 唔開心 (mhoisam, sad), 激死人 (gikseijan, irritated), 無面 (moumin, no face), 得人驚 (dakjangeng, frighten).

TD-Matched Child Y- Child Y's parent reported that both the parent and the child prefer to use Cantonese when talking about emotions. Parents reported that in the past two weeks, they discussed Sad, Happy, Angry, and Surprised feelings 3-4 times, Scared/Worried feelings 5 times or more, and Guilty feelings 1-2 times. Parents reported using a total of 10 different emotion words with their child: 開心 (hoisam, happy), **高興** (gouhing, joyful), **平靜** (pingzing, peaceful), 傷心 (soengsam, sad), **難過** (naangwo, sad/sorrow), **唔開心** (mhoisam, not happy/sad), **憤怒** (fannou, angry), **失望** (satmong, disappointed), **驚** (geng, scared), and **嚇死** (haaksei, scared to death). Parents reported that their child uses a total of 6 emotions words with them: 開心 (hoisam, happy), **難過** (naangwo, sad/sorrow), **嬲** (nau, mad), **失望** (satmong, disappointed), **怕醜** (paacau, shy), and **驚** (geng, scared).

2. Behavioral Observations in Child B

For the English testing, Child B was attentive and responding to the examiner's prompt at the beginning. However, as the testing continued Child B appeared less focused. For example, she often changed her answer when the examiner repeated the question. She benefitted greatly from a 2-minute break. Following the break, she listened attentively to the examiner's story and

retold the story independently with minimal prompting. Although mom expressed concerns with Child B's language skills during the testing, her story retell was long and she used a range of vocabulary and emotion words—similar to that of typically developing children. For the second half of the testing, she was spinning in her chair and benefitted from another 2-minute break.

For the Cantonese testing, Child B responded in English when she did not know the vocabulary word in Cantonese. There was a brief Internet connection issue and the examiner logged off of Zoom, but Child B transitioned well and was easily redirected back to the testing. Near the second half of testing, Child B appeared restless, rocking side to side in her chair, fidgeting with the computer screen, and turning the camera on and off. During the ACES task, she often responded with "angry-scared," and when prompted to pick one, she answered correctly. During the story retell, Child B occasionally codeswitched vocabulary and emotion words. For example, Child B said "m-happy" when she meant "not happy", possibly because "mhoisum" translated to "not happy" in Cantonese.

Summary of Child B

Overall, Child B's emotion comprehension and productions skills were higher in English than in Cantonese. These findings align with Child B's performance on the language measures, which may show that language skills are growing stronger in English than in Cantonese. Although Child B's emotion language and language skills were higher in English than in Cantonese, Child B still performed higher than their typically developing peers in both Cantonese and English across all emotion measures, except for the ERV task. It is possible that this task requires greater language demands than the other tasks. Indeed, Child's B Cantonese receptive and expressive vocabulary skills were also significantly lower than their typically developing peers.

CHILD C

Child Background and Emotion and Language Measures

1. Demographic information and home language environment.

Child C is a 5;5-year-old male who was born in the United States and lives in California with his mother, father, and older sibling. Child C's parents reported that both the mother's and father's highest education attained was high school/GED degree/technical school. The father's job was not reported, but the mother works as a professional or administrator. Child C has attended school for 28 months. Languages spoken in the home include Cantonese and Mandarin, but Cantonese is the dominant language used by all family members. Parents reported concerns with language. Child C's mother uses 60% Cantonese and father uses 80% Cantonese at home. Child C's older sibling uses 40% Cantonese at home (see Figure 20). Parents reported that Child C engages in all the storytelling activities and is exposed to 80% Cantonese during storytelling, 60% during reading stories, and 40% during watching T.V. activities (see *Figure 21*).

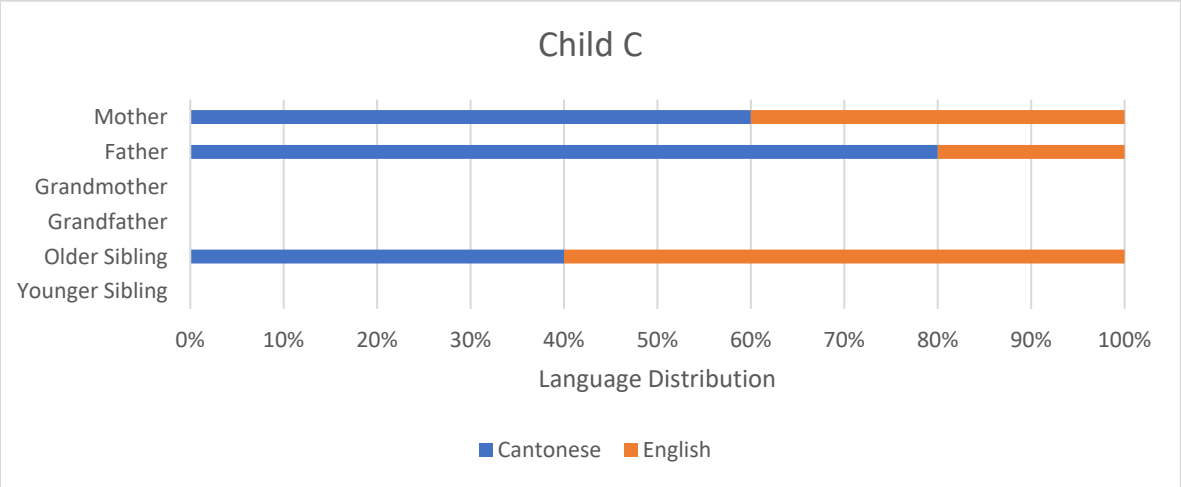

Figure 20. Cantonese and English language distribution across family members for Child C.

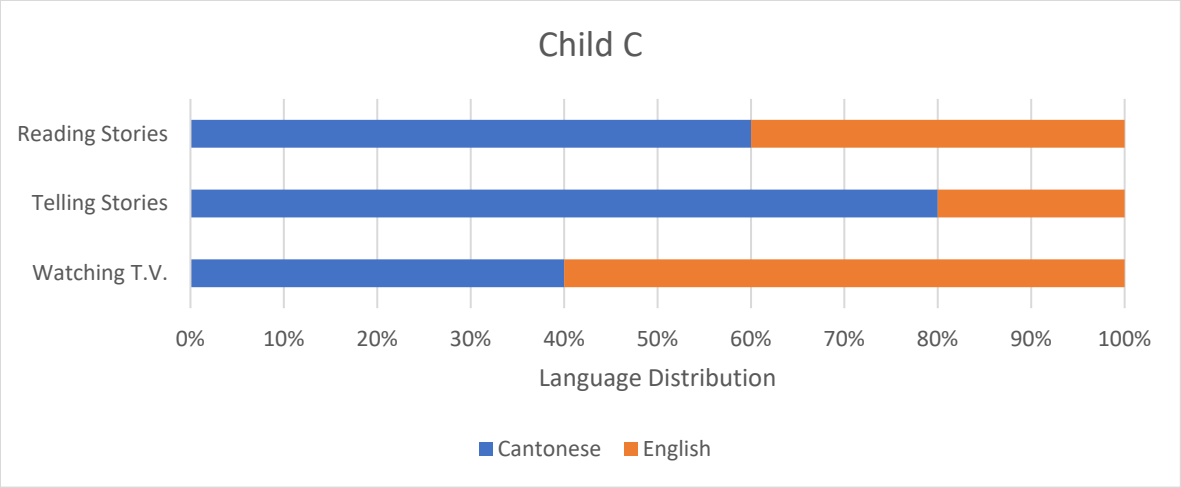

Figure 21. Cantonese and English language distribution across home activities for Child C.

2. Dual language skills.

See Table 31 and *Figure 22* below for a summary of Child C's vocabulary and grammar skills in Cantonese and in English. Child C's language performance for MLU was slightly higher in English MLU-Morphemes (2.79) than in Cantonese MLU-Words (1.65). Although Child C produced similar number of utterances in Cantonese (33) and in English (34), Child C had a higher type toke ratio in Cantonese (79.41%) than in English (44.23%). Performance on the picture identification task in each language was similar, with a slightly higher score in English (80%) than in Cantonese (73.33%). Performance on the picture naming task in each language was similar, with a slightly higher score in English (49.51%) than in Cantonese (42.72%). Overall, Cantonese and English language skills are similar across languages.

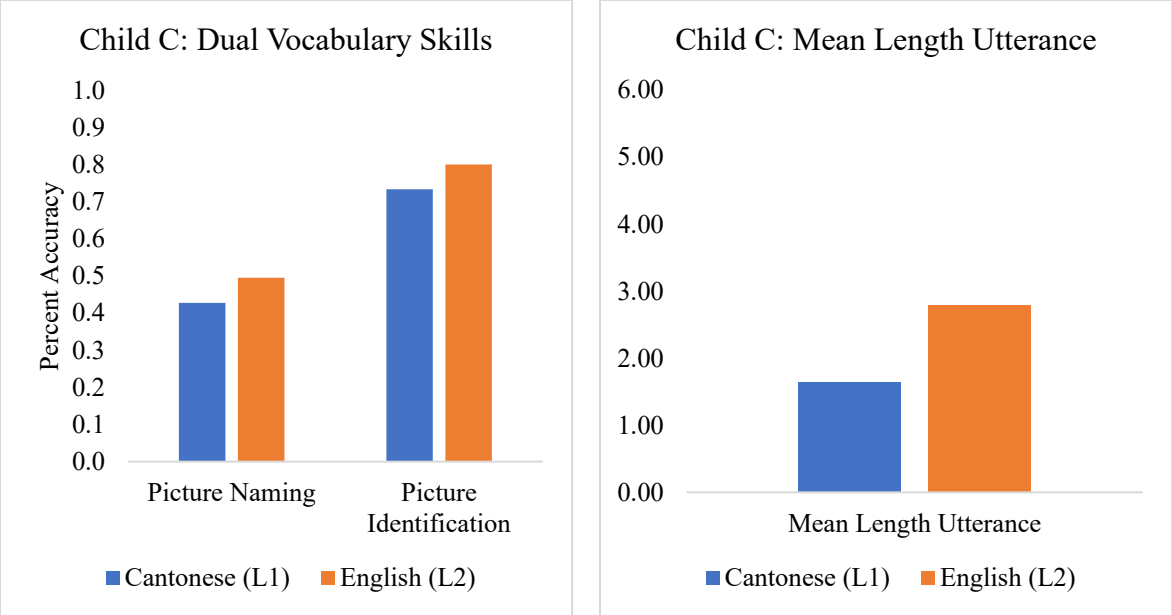

Figure 22. Comparison of vocabulary skills (left) and grammar skills (right) between Cantonese and English for Child C.

Table 31. Summary of Cantonese and English language skills from the bilingual vocabulary measures and the storytelling task in Child C.

	Cantonese (L1)	English (L2)
Picture Naming (%)	42.72	49.51
Picture Identification (%)	73.33	80
MLU – Words	1.65	--
MLU – Morphemes	--	2.79
Total Utterances	33	34
Type Token Ratio (%)	79.41	44.23

Note: MLU = Mean Length Utterance

3. **Dual emotion language skills.**

See Table 32 and *Figure 23* below for a summary of Child C's emotion language skills in Cantonese and in English. Child C performed better on the ACES task in English (93.75%) than in Cantonese (81.25%). For the ERV task, Child C also performed better in English (96.88%) than in Cantonese (90.63%). Child C used similar number of words in English and Cantonese for each emotion category.

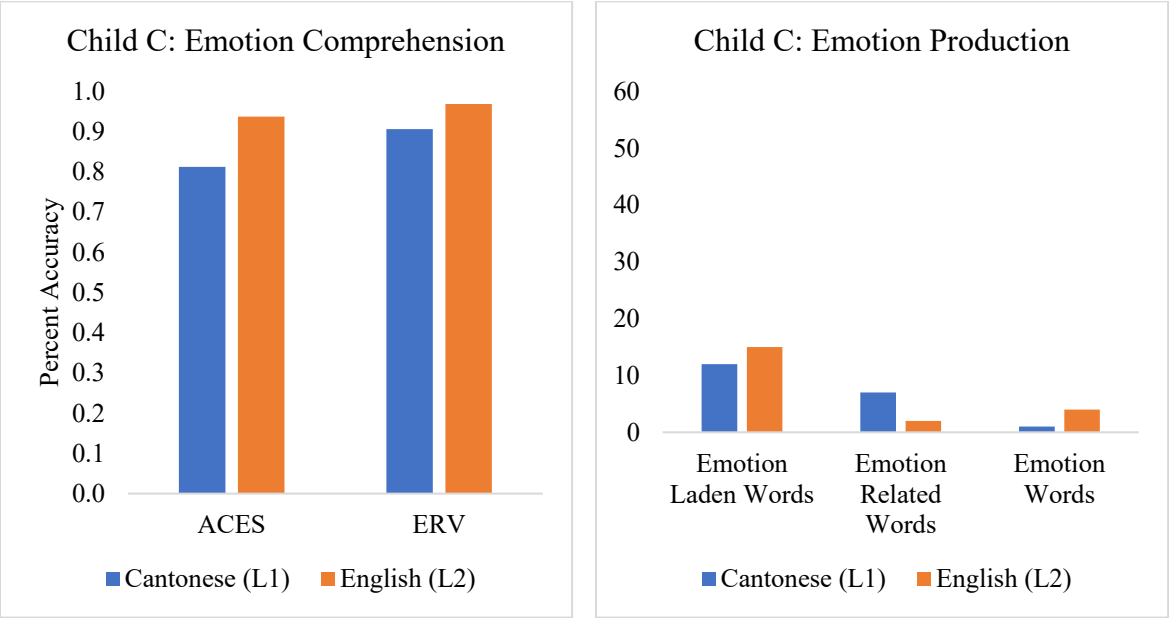

Figure 23. Comparison of emotion comprehension skills (left) and emotion production skills (right) between Cantonese and English for Child C.

Table 32. Summary of Child C's dual emotion language measures in Cantonese and English.

		Cantonese (L1)	English (L2)
Emotion Comprehension	Assessment of Children's Emotion Skills (%)	81.25	93.75
	Emotion Recognition Vignettes (%)	90.63	96.88
Emotion Production	Emotion Words	1	4
	Emotion-Related Words	7	2
	Emotion-Laden Words	12	15

Comparison between the Child at Risk for a Language Impairment and their Typically Developing Peers

1. **One-Sample T-Test**

For language measures, Child C's vocabulary and grammar measures in Cantonese and English were lower than typically developing children's mean scores (see Table 33 below). For the emotion language measures, Child C's performance on the emotion comprehension and production measures were mixed (see Table 34). Child C performed significantly higher than their typically developing peers in Cantonese and in English on the ERV task. However, Child C produced significantly less emotion words, emotion-laden words, and emotion-related words in both languages compared to their typically developing peers. The only exception was emotion word production in English in which there were no significant differences between Child C and their typically developing peers. There were also no significant differences between Child C and their typically developing peers in the ACES task in Cantonese and in English.

Table 33. Comparisons between Child C and their typically developing peers on Cantonese and English language measures from a one sample t-test.

	Child C	Typically Developing	t	Cohen's d
Cantonese (L1)				
Picture Naming (%)	42.72	63.86 (10.71)	11.84***	1.97
Picture Identification (%)	73.33	87.75 (5.67)	15.24***	2.54
MLU – Words	1.65	3.60 (0.88)	13.39***	2.23
English (L2)				
Picture Naming (%)	49.51	77.91 (10.80)	15.78***	2.63
Picture Identification (%)	80	87.38 (7.48)	5.92***	.99
MLU – Morphemes	2.79	5.34 (1.72)	8.88***	1.48

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

Table 34. Comparisons between Child C and their typically developing peers on Cantonese and English emotion language measures from a one sample t-test.

	Child C	Typically Developing Peers	t	Cohen's d
Cantonese (L1)				
Assessment of Children's Emotion Skills (%)	81.25	82.99 (14.53)	.72	.12
Emotion Recognition Vignettes (%)	90.63	86.02 (8.91)	-3.1**	-.52
Emotion-Laden Words	12	27.08 (11.17)	8.10***	1.35
Emotion Words	1	3.53 (2.62)	5.78***	.96
Emotion-Related Words	7	15.92 (8.28)	6.47***	1.08
English (L2)				
Assessment of Children's Emotion Skills (%)	93.75	91.15 (7.67)	-.003	-.001
Emotion Recognition Vignettes (%)	96.88	88.89 (6.82)	-7.03***	-1.17
Emotion-Laden Words	15	26.22 (10.86)	6.20***	1.03
Emotion Words	4	4.31 (3.03)	.61	.10
Emotion-Related Words	2	14.22 (8.40)	8.73***	1.45

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

2. Typically Developing Matched Peer

Matching Criteria- Child C is 5;5 years old and Child Z is 5;0 years old. They were both born in the U.S., live in California states, and speak Cantonese as their home language. Child C spent 4 more months in school (28 months) than Child Z (24 months). Both children live with their mother, father, and older sibling. The major difference is that Child C is 5 months older and also spent 4 more months in school than Child Z. See Table 35 below for a summary of their demographic background.

Table 35. Summary of matching criteria between Child C (at-risk for LI) and Child Z (TD matched peer) based on their demographic information.

	Child C	**TD Matched-Child Z**
Age (months)	65	60
California State? (Yes/No)	Yes	Yes
Cantonese as home language? (Yes/No)	Yes	Yes
USA born? (Yes/No)	Yes	Yes
Time spent in school (months)	28	24
Cantonese Exposure		
Mother	60%	100%
Father	80%	80%
Older Sibling	40%	80%
Younger Sibling	--	--
Grandmother	--	--
Grandfather	--	--

Child B and TD-Matched Child Y Emotion and Language Skills- TD-matched Child Z performed higher on Cantonese MLU-Words (2.45) and English MLU-Morphemes (3.46). Child Z performed higher on English picture naming (66.99%) than Child C. Child Z performed only slightly higher than Child C in picture identification in English and Cantonese, and picture naming in Cantonese. Even though Child C is older and has had more English exposure than

Child Z, Child C's vocabulary and grammar skills in English and Cantonese are not higher than Child Z's. See Table 36 below.

Interestingly, Child Z's performance in the recognizing facial expressions task in Cantonese (75%) and English (87.50%) was lower than that of Child C's. Similarly, for the ERV task Child Z performed lower than Child C in Cantonese (84.38%) and English (87.50%). For the emotion categories in Cantonese, Child Z used slightly more words compared to Child C. However, in English Child C and Z used similar number of words for each emotion category (see Table 37). Overall, although Child C's language skills were lower than Child Z's, Child C's emotion language skills were higher than Child Z's.

Table 36. Comparison of Child C and their TD-matched Child Z dual language skills from the vocabulary and storytelling task.

	Child C	TD-Matched-Child Z
Cantonese		
Picture Naming (%)	42.72	50.49
Picture Identification (%)	73.33	77.78
MLU – Words	1.65	2.45
English		
Picture Naming (%)	49.51	66.99
Picture Identification (%)	80	83.33
MLU – Morphemes	2.79	3.46

Table 37. Comparison of Child C and their TD-matched Child Z emotion language skills in Cantonese and English.

	Child C	TD-Matched Child Z
Cantonese		
Assessment of Children's Emotion Skills (%)	81.25	75
Emotion Recognition Vignettes (%)	90.63	84.38
Emotion-Laden Words	12	19
Emotion Words	1	6
Emotion-Related Words	7	7
English		
Assessment of Children's Emotion Skills (%)	93.75	87.50
Emotion Recognition Vignettes (%)	96.88	87.50
Emotion-Laden Words	15	11
Emotion Words	4	4
Emotion-Related Words	2	5

Patterns in Emotion Language Experiences and Behavioral Observations

1. **Emotion language experiences at home**

Child C- Child C's parents reported that both the parent and the child prefer to use Cantonese when talking about emotions. Parents reported discussing Sad, Angry, Surprised, and Guilty feelings 1-2 times in the past two weeks and Happy and Scared/Worried feelings 3-4

times in the past two weeks. Parents reported using a total of 6 different emotion words with their child: 開心 (hoisam, happy), 傷心 (soengsam, sad), 唔開心 (mhoisam, not happy/sad), 羞家 (saugaa, disgrace), 怕醜 (paacau, shy), and 擔心 (daamsam, worried). Parents reported that their child uses a total of 5 different emotion words with them: 開心 (hoisam, happy), 幸福 (hangfuk, blessing), 傷心 (soengsam, sad), 唔開心 (mhoisam, not happy/sad), and 驚 (geng, scared).

TD-matched Child Z- Child Z's parent reported that both the parent and the child prefer to use Toisanese when talking about emotions. Parents reported that in the past two weeks, they discussed Sad, Angry, and Guilty feelings 1-2 times, Happy, Scared/Worried feelings 3-4 times, and Surprised feelings 5 times or more. Parents reported using a total of 12 different emotion words with their child: 開心 (hoisam, happy), 快樂 (faailok, happy), **興奮** (hingfan, excited), 傷心 (soengsam, sad), 難過 (naangwo, sad/sorrow), 唔開心 (mhoisam, not happy/sad), 憤怒 (fannou, angry), **激氣** (gikhei, angry air), 害怕 (hoipaa, scared), 擔心 (daamsam, worried), 得人驚 (dakjangeng, frightened human), and 嚇死 (haaksei, scared to death). Parents reported that their child uses a total of 7 different emotion words with them: 傷心 (soengsam, sad), 難過 (naangwo, sad/sorrow), 唔開心 (mhoisam, not happy/sad), **激氣** (gikhei, angry air), 激死人 (gikseijan, irritated/annoyed), 害怕 (hoipaa, scared), and 得人驚 (dakjangeng, frightened human).

2. Behavioral Observations in Child C

Child C's behavior was similar across English and Cantonese testing. Child C appeared shy, holding onto his mom, looking away at the examiner, and talking minimally. For both the English and Cantonese testing, the examiner chatted with Child C briefly in Cantonese to get him

more comfortable and ease him into testing. Child C had a delayed response for all the tasks. When he did not respond after a few second, his mom or the examiner would repeat the question or prompt him to respond with "I don't know" if he did not know the answer. Child C did not appear restless, but occasionally would put on his costume mask on or look at mom when he did not know the answer. Child C took 2 short breaks to break up the testing and increase his comfort level, rather than to help with restlessness. For the ACES task in English and Cantonese, he consistently labeled the emotion and produced the facial expression. For example, he said "angry" and furrowed his eyebrows and pursed his lips. During the story retell task, Child C was slow to formulate sentences and produced 1- to 2-word phrases, but the phrases often included emotion words. Child C's mom shared with the examiner that he had a language delay in preschool, but then he caught up with the language milestones later.

Summary of Child C

Overall, Child C performance for the emotion language and the language tasks were similar across Cantonese and English. Child C produced similar number of emotions words, emotion-related words, and emotion-laden words in English and in Cantonese, suggesting that their emotion vocabulary may be similarly distributed across languages. When comparing Child C with their typically developing peers, we see that Child C's performance was significantly lower than their typically developing peers across all the language measures. However, we see a different pattern in their emotion language measures. Child C produced significantly less emotion laden, emotion words, and emotion-related words compared to their typically developing peers, but their emotion comprehension skills were similar to or even higher than their typically developing peers. This may suggest that although they produce few emotion words in both languages, they understand emotion language in both languages.

Discussion

The primary question in Study 2 examined the dual emotion language skills and language skills in sequential Cantonese-English bilingual children at risk for a language impairment (LI). We were also interested in identifying patterns in emotion language skills in children with LI that set them apart from their typically developing peers. In addition to analyzing the emotion and language measures used in Study 1, we also analyzed data collected from the Chinese parent questionnaire. The Chinese parent questionnaire included information on the child's home language environment, language input from family members, and parents' socialization of emotions.

We analyzed three bilingual children who were identified as being at risk for a language impairment based on our inclusion criteria (e.g., Retrepo & Gutierrez- Clellen, 2001). We conducted a one sample t-test to examine whether each child's mean emotion and language skills were significantly different from the larger mean in typically developing children. Next, we matched each bilingual child with low language skills with a typically developing child based on their demographic information to explore different patterns in their emotion language skills.

Dual Emotion Language and Language Skills

Language plays a critical role in emotion language learning and development such that greater language skills may support emotion language skills (e.g., Monopoli & Kingston, 2012; Sun et al., 2018). Previous studies have shown difficulties in emotion understanding and expression in monolingual children with language impairment (e.g., Nelson et al., 2011; Spackman, 2006). Therefore, it can be expected that bilingual children who have low language skills in one or both languages may also have low emotion language skills in those languages. Our findings showed mixed results. For emotion comprehension skills, findings showed that

children who had higher language skills in one language also had higher emotion comprehension skills in that language. Additionally, children whose language skills were distributed across languages (e.g., high vocabulary skills in L2, but high grammar skills in L1) also showed distributed emotion comprehension skills across languages.

For emotion production skills, children's use of emotion words, emotion-related, and emotion-laden words were similarly low in both languages, which may suggest that their emotion vocabulary skills are distributed across languages. This is consistent with previous bilingual studies showing distributed vocabulary skills across languages (Gross et al., 2014; Oller et al., 2007). Alternatively, it may also suggest that emotion production skills are difficult for children at this age and so children may have few emotion vocabulary skills in both languages. However, Child B produced significantly more emotion words, emotion-related words, and emotion-laden words in L2 than in L1. A likely explanation is that Child B's grammar and vocabulary skills were also higher in English than in Cantonese, and so Child B's high emotion production skills may indicate Child B's rapid growth of English language skills.

Findings from Study 2 may suggest that emotion language skills in bilingual children at risk for a language impairment may vary along with their language skills, such that those who have high language skills in one language may also have high emotion language skills in that language, while those whose language skills were distributed across languages may also show distributed emotion language skills. It is important to note that we only analyzed 3 children, and so our findings are only preliminary, but they point to further research examining the relationship between emotion language skills and dual language skills in bilingual children at risk for LI.

Differences in Emotion Language Skills and Language Skills in Children at Risk for LI and their Typically Developing Peers

Another question was whether there were significant differences in dual language and emotion language skills between children at risk for a language impairment and their typically developing peers. Results from each child's one sample t-test for the language and emotion language measures compared to typically developing peers showed mixed patterns. These findings may reveal different possible outcomes in bilingual children's dual emotion language profile.

Findings from Child A showed that they had significantly lower vocabulary and grammar skills and emotion comprehension and production skills in both Cantonese and English compared to their typically developing peers. Previous studies suggest that children who have both low language skills and low emotion language skills carry the "double risk" and may have greater social difficulties and fewer opportunities for successful peer interactions (Nelson et al., 2011). In simultaneous bilinguals, greater bilingual vocabulary skills in both languages are positively related to better social-emotional behavioral skills (Sun et al., 2018), and so the opposite explanation may suggest that bilingual children who have low language skills in one or both languages may also have low emotion language skills. In our study which examines sequential bilingual children, one possible outcome in the dual emotion language profile is that bilingual children at risk for LI who have low language skills in both languages are likely to also have low emotion language skills in both languages.

Findings from Child B showed significantly lower receptive and expressive vocabulary skills in Cantonese, but higher expressive vocabulary and grammar skills in English when compared to their typically developing peers, suggesting distributed language skills. Results from the emotion language measures showed that for both languages they produced significantly more emotion words in each emotion category and were better at recognizing facial expressions

compared to their typically developing peers. It is important to note that the ACES task and the emotion-elicited story retell task offered children more visual and facial cues and contextual information than the other tasks. The ACES task requires children to identify different facial expressions that represent emotions, and so it may be a more accurate measure of non-verbal emotion language skills. Additionally, children may be relying on the facial cues and visual information in the wordless picture book when producing emotion words, emotion-laden words, or emotion-related words. Previous studies investigating emotion recognition from facial cues in typically developing children and children with language disorder show mixed results (e.g., Bahn et al., 2021). Some studies showed that children with language disorder had greater difficulty in recognizing emotion cues from facial expressions compared to typically developing children (e.g., Griffiths et al., 2020), while other studies found no significant differences in accuracy of identifying facial expressions between typically developing children and children with language disorder (e.g., Czaplewska & Sterczynski, 2015). This may suggest that children with language disorder may still understand facial expressions of emotions similarly to their typically developing peers. Therefore, a second possible outcome in the dual emotion language profile is that bilingual children who have low language skills may benefit from nonverbal cues such as visual and facial cues to support their emotion language skills. These findings are preliminary and future studies should further examine nonverbal emotion language skills in bilingual children at risk for LI.

Child C had lower vocabulary and grammar skills in Cantonese and English compared to their typically developing peers. However, Child C's emotion language measures showed higher emotion listening skills but lower emotion production skills in both Cantonese and English compared to their typically developing peers. Although a child may not be able to produce an

emotion word, the child may still be able to learn and understand the emotion concept (Streubel al., 2020). Indeed, normative data on children's emotion comprehension and production development showed that children understand many more emotion words than they can express (i.e., Ridgeway et al., 1985). Furthermore, children with low language skills may express their emotions in other ways besides using words, including nonverbal language like facial expressions, intonation changes, or body language. For example, observations from the storytelling task showed that Child C used different facial expressions when describing the character's emotions (e.g., furrowing eyebrows to indicate angry or raising eyebrows to indicate scared), even though Child C did not produce a long story or use a lot of emotion words. A third possible outcome in the dual emotion language profile is that bilingual children with low language skills in both languages may still understand emotion language even if they cannot express their emotions yet. Future studies should look further at differences between emotion comprehension and emotion production skills in bilingual children at risk for LI.

Emotion Talk in Parents of Children at Risk for Language Impairment

Parents' socialization of emotions plays an important role in children's emotion language development (e.g., Huang & Kan, 2021). Parents' beliefs about the value of emotions, emotion labeling and teaching behaviors, and conversations with their child about emotions contribute greatly to children's emotional development (Castro et al., 2015; Lozada et al., 2016; Mazzone et al., 2017). Previous studies have shown that parents of children with LI have qualitatively different language input, including lower response rate and fewer turn-taking behaviors, when compared to parents of their typically developing peers, (e.g., Vigil et al., 2005). In this study, it can be expected that parents of children with LI may also talk less frequently about emotion words. One of the patterns we found from the parent questionnaire showed that parents of

typically developing children talk about emotion words (i.e., Happy, Sad, Angry, Scared/Worried, Guilt, Surprised) with greater frequency than parents of children at risk for LI. Specifically, parents of typically developing children often reported talking about emotions 3-4 times or 5 times or more in the past two weeks, while parents of children at risk for LI reported talking about emotions with their child about 3-4 times, 1-2 times, or not at all. These preliminary findings may suggest that parents of children at risk for LI may talk less about emotions in the home language compared to parents of TD children.

Interestingly, Child C's parents reported talking about emotions at a frequency similar to the parents of their typically developing matched peer (Child Z). One possible explanation for this similarity is that both Child C and TD-Matched Child Z's parents have low maternal and paternal education levels. Unlike the other TD-Matched children's parents who have a bachelor's or an associate's degrees, Child C and TD-Matched Child Z's parents both have similar secondary or high school education levels. Lower parental education level is typically considered an index of socioeconomic challenges (e.g., Hollingshead, 1975), which has been associated with greater parental emotion challenges and lower executive functioning skills in children (Finch and Obradović, 2017). It is likely that parents with low education may be experiencing other intersectional stressors including financial stress, parental work overload, or lack of social support, which may make them less available to engage in conversations with their child about emotions, guide their child's emotion management, or label emotions.

Another pattern we found was that parents of children at risk for LI used fewer emotions words with their child compared to parents of typically developing kids. Specifically, parents of typically developing children reported using about 9-12 different emotion words with their child, while parents of children at risk for language impairment reported using only 5-7 different

emotions words. A possible explanation is that parents of typically developing children may have greater emotion differentiation than parents of children at risk for LI. Emotion differentiation refers to the ability to perceive and distinguish a full range of emotions and label these emotions using discreet words to describe different levels of intensity (e.g., Barrett, 2004; 2006). It is possible that parents of children at risk for LI may have low emotional differentiation, or a limited range of words to describe emotions, and so they may use the same words to describe a few emotional states with their child.

However, when we examine the children's emotion vocabulary words, we see that the children at risk for LI and their typically developing matched peers are using similar number of emotions words at home. Both groups of children are producing about 5-7 emotion words. A likely explanation is that at this early stage in development (~5 years old), children are probably not producing a high number of varied emotion vocabulary. According to our emotion production measures in Study 1, even typically developing children were only producing an average of 3.53 Cantonese and 4.31 English emotion words during the storytelling task. Furthermore, although there is normed data on the comprehension and production of these English equivalent emotion words in monolingual English-speaking children (i.e., Baron-Cohen et al., 2010; Ridgeway et al., 1985) and monolingual Chinese-speaking children (i.e., Li & Yu, 2015), we do not know the development of emotion words in children who learn both Cantonese and English. More research examining the emotion words that bilingual bicultural children are exposed to in the home may contribute to our understanding of emotion language development in this population.

Behavioral Profiles in Children at Risk for a Language Impairment

It is well documented that children with language impairment have enduring problems with communication, may also be at increased risk for emotional and behavioral problems which may impact their ability to access and navigate social situations (e.g., see review in Yew & O'Kearney, 2013). In Study 2, we observed the children's behaviors during testing in each language to examine whether they exhibited behavioral problems. We were interested in gaining a better understanding of their behavioral profile and exploring to what extent it may impact their emotion regulation skills during social situations. Consistent with the literature on children with LI (Aro et al., 2012; Fujiki et al., 2002), our children at risk for LI also exhibited behavioral problems including short attention span, impulsivity, and hyperactivity, and they did so in both Cantonese and English language testing.

In our study, all three children at risk for LI benefitted from having their mom sit next to them for the duration of testing to help redirect their attention and prompt them to respond to the examiner. Additionally, while all the typically developing children had 1 scheduled break for each day of testing or no breaks at all, children at risk for LI had 2 scheduled breaks along with brief unscheduled breaks (e.g., blow nose, drink water, go to the bathroom). Children at risk for LI also showed impulsivity when answering before the examiner finished asking the question or presenting all the item choices. For example, one of the children responded incorrectly twice before hearing all the choices, and after the examiner indicated with hand gestures to stop and listen the child changed her response to the correct answer choice. The children also showed more hyperactive behaviors than their typically developing peers, including jumping on the couch, twisting in their chair, rocking back and forth, and fidgeting with the computer camera. They benefitted from guided movement breaks with the examiner during their scheduled break time to help calm their bodies (e.g., deep breathing, jumping jacks, dancing). It is important to

note that the children exhibited these behavioral problems in both languages, which may also be related to difficulties in both Cantonese and English.

Another behavioral profile we observed in children at risk for LI was a slower response rate throughout testing and in both languages. The examiner often repeated the questions 3 to 4 times, and when the child did not respond the parent prompted the child to respond with "I don't know". After multiple prompts, additional waiting time, and no response, the examiner moved on to the next test item. According to the Generalized Slowing Hypothesis (Kail, 1994), children with language impairment may have slower processing speed and therefore respond more slowly on a range of linguistic and nonlinguistic tasks compared to their typically developing peers. Additionally, research examining bilingual children also showed that slower response speed is a reliable and sensitive indicator of a risk for language impairment (Kan et al., 2021). It is well documented that children with language problems may be at risk for social difficulties in peer interactions (e.g., Fujiki, et al., 2002; Spackman et al., 2006), and so it is likely that a slow response rate could further impact their emotion regulation, comprehension, and expression in various social situations. Bilingual children with language difficulties in one or both languages may have difficulties labeling emotions or be slow to label their feelings or others' feelings, which could negatively impact the social exchange. Kassam and Mendes (2013) showed that labeling feelings can help solidify the emotion and reduce its intensity, especially for negative emotions such as angry, scared, or sad. Since peer interactions tend to move quickly, children at risk for language impairment who may be slow to label their feelings may have difficulty keeping up with conversations and feel increased frustration.

To some extent, these behavioral problems may reflect communication difficulties in children with LI because limited language skills or restricted lexicon can delay their response

rate and impact their ability to label emotions. Language development contributes to the development of emotion regulation because it equips the child with the ability to express their wants and needs with words rather than with behaviors (Schmitt et al., 2014). It is also possible that behavioral problems as a function of a language impairment may influence other domains of development, specifically exacerbating emotion regulation difficulties and negatively impacting children's ability to access or navigate ambiguous social situations (e.g., St Clair et al., 2019). For example, children with short attention span may miss subtle body language or facial cues that indicate emotions, and children who are hyperactive and/or impulsive may have difficulty maintaining a conversation with their peers. Our findings are only preliminary, but they suggest further research examining bilingual children's behavioral and emotion regulation skills in each language to understand how they impact emotion language skills.

CHAPTER IV

IV. COMBINED DISCUSSION

The current research aims to understand emotion language skills in sequential Cantonese-English bilingual children, by exploring the use of emotion language measures in both languages. Two studies examined two populations of bilingual children. Study 1 examined emotion language skills in typically developing bilingual children and Study 2 examined bilingual children at risk for a language impairment. This sample of children was relatively homogenous. All parents reported that Cantonese was the dominant language used at home. Accordingly, we can assume that children were first exposed to emotions in Cantonese (L1) at home and then learned emotions in English (L2) at school. Findings from Study 1 and Study 2 highlight the importance of examining bilingual children's emotion and language skills in both languages.

Emotion Language Skills in Typically Developing Cantonese-English Bilingual Children

In the absence of measures that examine emotion language skills in bilingual children, Study 1 implemented several tasks to explore emotion comprehension and production skills in Cantonese-English bilingual children in both L1 and L2. In Study 1, we assessed the emotion language and language skills in L1 and L2 and examined which language factors predicted emotion language skills in typically developing bilingual children. For the emotion language measures, we administered a facial recognition task (ACES) and the ERV task to assess emotion comprehension skills, and coded different categories of emotions words in children's language samples from a story retell task to assess emotion production skills. For language measures, we measured children's vocabulary skills and grammar skills in each language. Results showed that, children's emotion comprehension skills and language skills are higher in English than in Cantonese, suggesting growth in English language skills. Results also showed that English picture naming skills predicted emotion comprehension skills in English only, while Cantonese language skills were not linked to any of the emotion language skills.

Our findings in Study 1 were consistent with the literature on varying language proficiency in dual language development over time. Bilingual children's rate of development is sensitive to the amount and frequency of exposure and the quality of input in each language (Paradis, 2011; Paradis & Jia, 2016). In sequential bilingual children, L1 development in the context of a dominant L2 environment may cause some competition between the two languages, such that L1 may undergo delay, stagnation, and then attrition, while L2 grows stronger with greater and more consistent language input (e.g., Wei & Lee, 2001). Our findings showed that emotion language comprehension skills were greater in English than in Cantonese, possibly because by age 5 children have growing English language experience, while their home language

skills may begin to weaken and regress. With growing English language skills, our study also found evidence that English expressive vocabulary skills predicted English emotion comprehension skills in bilingual children. Numerous studies have documented the links between children's language skills and emotion comprehension skills in both monolingual (e.g., Conte et al., 2019; Eisenberg et al., 2005) and bilingual (e.g., Sun, 2019; Sun et al., 2018) children. According to the Semantic Bootstrapping theory (Pinker, 1984), children acquire words by using semantic information to cue them on the meaning of a sentence, and so children can understand emotions in a sentence context by first learning its semantic elements and then bootstrapping from that knowledge (e.g., Beckwidth, 2014). Future studies are needed to examine longitudinally the relationship between language and emotions as children's language proficiency skills change over time (see Limitations and Future Directions).

Findings from Study 1 have clinical and educational implications in supporting bilingual children's emotion language development in both languages at home and in school. Although our results did not show links between Cantonese language skills and Cantonese emotion language skills, it does not mean that the home language is not important in children's emotion language development. Rather, our study points to the need for further research examining other aspects of the home environment that may contribute to children's emotion language development (e.g., other family members, language use across different home activities, etc.). Parents should continue using the home language with their child while they are learning English in school to expose them to emotion language in the home language, and thereby increasing their child's opportunities to communicate emotions in more social contexts and maintain positive social-emotional well-being. Findings from this study will also have implications in developing a

culturally responsive social-emotional curriculum or a parent training emotion program to promote bilingual children's emotion language learning and development in school and at home.

Emotion Language Skills in Bilingual Children at Risk for Language Impairment

In Study 2, we identified 3 bilingual children who may be at risk for a language impairment (LI) and examined how their emotion language skills compared to those of typically developing children. Since there are no standardized measures available or agreed upon best practice for identification of Cantonese-English bilingual children at risk for LI, we followed a series of requirements based on previous studies (i.e., Kan et al., 2021; Restrepo & Gutierrez-Clellen, 2001). We used the same emotion language and language measures for bilingual children at risk for LI as we did for the typically developing children. We also matched each child at risk for LI as closely as possible with a typically developing peer based on their demographic information. Results revealed different possible outcomes in the dual emotion language profile for bilingual children at risk for LI. Additionally, results from the parent questionnaire and behavioral observations showed different patterns between children at risk for LI and TD children.

Findings from Study 2 revealed three possible dual emotion language profiles in bilingual children at risk for LI. First, children at risk for LI who have low language skills in both languages may likely have low emotion language skills in both languages. Consistent with previous studies about the "double risk" in children with LI (Nelson et al., 2011), it is possible that bilingual children with low language skills in both languages may also have low emotion language skills too. Second, bilingual children who have low language skills may benefit from nonverbal cues such as visual and facial cues to support their emotion language skills. Indeed, some studies have found no significant differences between typically developing children and

children with language disorder in the accuracy of identifying facial expressions (e.g., Czaplewska & Sterczynski, 2015). Third, bilingual children with low language skills in both languages may still understand emotion language even if they cannot express their emotions yet. Studies on monolingual children's emotion language development showed that children understand many more emotion words before they can verbally express them (e.g., Ridgeway et al., 1985; Streubel al., 2020).

These possible dual emotion language profiles may have implications for identifying clinical and educational strategies to support bilingual children at risk for LI. Since bilingual children's language proficiency in each language varies over time, it is important that parents continue to support the home language, while children learn English at school, in order to expose children to more emotion words in both languages. Clinicians and teachers working with bilingual children at risk for LI incorporate multisensory activities and draw on nonverbal cues when teaching emotion words to children. This may include using facial expressions (e.g., using a scared face for scared), changing voice intonations (e.g., a loud and deep voice for angry), or using body language (e.g., slumping the head and shoulders down for sadness) to indicate and emphasize emotions. Additionally, since children may understand emotions more than they can express in words, adults working with children are encouraged to label the child's emotions to help scaffold their emotion production.

Findings from Study 2 also revealed different patterns in parents' emotion talk and children's behaviors between typically developing children and those at risk for LI. Parents' socialization of emotions, including emotion labeling, value of emotions, and conversations with the child about emotions, contribute to children's emotion language development (e.g., Castro et al., 2015; Lozada et al., 2016; Mazzone et al., 2017). Findings from the parent questionnaire

showed that parents of typically developing children talk about emotion words (i.e., Happy, Sad, Angry, Scared/Worried, Guilt, Surprised) with greater frequency than parents of children at risk for LI. In addition, parents of children at risk for LI used fewer emotions words with their child compared to parents of typically developing kids. These findings are consistent with the literature regarding parent language input in children with LI (e.g., Vigil et al., 2005). When observing their behaviors during testing, children at risk for LI exhibited short attention span, impulsivity, hyperactivity, and slow response rate, and they did so in both Cantonese and English language testing. Our observations are consistent with the literature about behaviors typically observed in children at risk for LI (e.g., Aro et al., 2012; Fujiki et al., 2002).

Clinical implications may include developing a parent home training program to scaffold parents on how to use emotion language with their bilingual children in the home environment. It is important to involve Chinese American immigrant parents in developing this training program to ensure that it is culturally-linguistically appropriate. Additionally, since behavioral problems are common in children with LI, clinical and education implications may include managing children's behavior through emotion regulation strategies. For example, if this child is getting frustrated, teach the child to use breathing techniques and then labeling the emotion (e.g., Laurent & Prizant, 2005). Findings from this study are only preliminary but lay a foundation for future research to examine emotion language development in bilingual children.

Limitations & Future Directions

This research provides useful information about emotion language skills in bilingual children growing up learning two languages and in two cultural contexts, and lays the foundations for further research examining emotions in typically developing children and children at risk for LI. Nevertheless, since this research is a starting point there are several

limitations to be noted. First, our research used only a few measures to examine emotion language comprehension and production in bilingual children (i.e., story retell task, ACES, ERV). More measures are needed to examine other areas of emotion language including verbal and nonverbal language skills. Future studies should examine more verbal language skills including how children explain emotions and ask questions related to emotions (Aznar & Tenebaum, 2013; Huang & Kan, 2021), and other language levels beyond the word level including sentence and discourse level. Future studies should also examine body language, intonation patterns, and facial expressions to understand bilingual children's nonverbal emotion language skills in each language.

A second limitation is that our findings only represent children's emotion comprehension and production language skills and vocabulary and grammar skills at a single point in development at 5 years old. Sequential bilingual children's proficiency skills in each language may vary over time (e.g., Paradis, 2011; Paradis & Jia, 2016), and so it would be important to examine whether these relationships between emotion and language skills hold as children get older and as their dual language skills change. Alternatively, it would also be interesting to examine these relationships when children are younger and have had greater Cantonese language exposure at home than English exposure at school. Future studies could examine emotion and language skills at different developmental points such as when children begin preschool and are first exposed to English, and later in development when they have been in school for a longer period.

A third limitation is that we only examined emotion language skills in the home environment and from parents' perspective. Children learn emotion language across multiple social settings and with different people. Future studies should look at different social settings

(e.g., school, community) and interactions with different social partners (e.g., peers, siblings). Additionally, since many of the children in our study live with their grandparents or additional family members, future studies could have other family members complete the questionnaire to see if they talk about emotions differently with the child compared to the parents. Teachers could also complete the questionnaire to examine how they talk about emotions in English in the school setting.

A fourth limitation is that we only coded emotion words, emotion-related words, and emotion-laden words. It would be interesting to code other types of words that the children used in the story retell task to get a better sense of their emotional state, thinking style, or personality. The Linguistic Inquiry and Word Count (LIWC) software program codes and analyzes different categories of words in a language sample to provide insight on the individual's psychological state (Pennebaker et al., 2015). For example, some of the categories of words that LIWC codes include words that have a positive or negative tone, social words, or moral words. LIWC program references dictionaries in multiple languages, including Chinese. Future studies should conduct further analysis on children's language samples in both languages to code different words used, beyond emotion categories words, to obtain a better understanding of children's psychological state. The LIWC program benefits from longer texts for more accurate measures, and so future studies would need to collect longer language samples from children in each language.

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REFERENCES

Altarriba, J., & Baur, L. M. (2004). The distinctiveness of emotion concepts: a comparison between emotion, abstract, and concrete words. *American Journal of Psychology, 117*(3), 389-410.

Altarriba, J., Bauer, L. M., & Benvenuto, C. (1999). Concreteness, context availability, and imageability ratings and word associations for abstract, concrete, and emotion words. *Behavior Research Methods, Instruments, & Computers*, *31*(4), 578–602. https://doi.org/10.3758/BF03200738

Aro T., Eklund K., Nurmi J.-E., & Poikkeus A.-M. (2012). Early Language and Behavioral Regulation Skills as Predictors of Social Outcomes. *Journal of Speech, Language, and Hearing Research*, *55*(2), 395–408. https://doi.org/10.1044/1092-4388(2011/10-0245)

Aznar, A. and Tenebaum, H., (2013). Spanish parents' emotion talk and their children's understanding of emotion. *Frontiers in Psychology, 4*(670), 1-11.

Bahn, D., Vesker, M., Schwarzer, G., & Kauschke, C. (2021). A Multimodal Comparison of Emotion Categorization Abilities in Children with Developmental Language Disorder. *Journal of Speech, Language, and Hearing Research*, *64*(3), 993–1007. https://doi.org/10.1044/2020_JSLHR-20-00413

Baker, M. and Páez, M. (2018). The Language of the Classroom: Dual Language Learners in Head Start, Public Pre-K, and Private Preschool Programs. Washington, DC: Migration Policy Institute.

Barrett, L. F. (2004). Feelings or Words? Understanding the content in self-report ratings of experiences emotion. *Journal of Personality and Social Psychology, 87*(2), 266-281.

Barrett, L. F. (2006). Solving the emotion paradox: Categorization and the experience of

emotion. *Personality and Social Psychology Review, 10*(1), 20-46.

Baron-Cohen, S., Golan, O., Wheelwright, S., Granader, Y., & Hill, J. (2010). Emotion Word Comprehension from 4 to 16 Years Old: A Developmental Survey. *Frontiers in Evolutionary Neuroscience*, *2*. https://doi.org/10.3389/fnevo.2010.00109

Beckwidth, R.T. (1991). The language of emotion, the emotinsm and nominalist bootstrapping. In Frye, D. and Moore, C., Ch*ildren's theories of mind: Mental states and social understanding.* Lawrence Erlbaum Associates, Inc., 77-95.

Bedford, O. A. (2004). The Individual Experience of Guilt and Shame in Chinese Culture. *Culture & Psychology*, *10*(1), 29–52. https://doi.org/10.1177/1354067X04040929

Bedore, L. M. and Peña, E. D. (2008). Assessment of bilingual children for identification of language impairment: Current findings and implications for practice. *International Journal of Bilingual Education and Bilingualism, 11*(1), 1-29.

Bialystok, E., Luk, G., Peets, K. F., Yang, S. (2010). Receptive vocabulary differences in monolingual and bilingual children. *Bilingualism: Language and Cognition, 13*(4), 525-531.

Bierman, K. L., Domitrovich, C. E., Nix, R. L., Gest, S. D., Welsh, J. A., Greenberg, M. T., Blair, C., Nelson, K. E., Gill, S. (2008). Promoting academic and Social-Emotional School Readiness: The Head Start REDI Program. *Child Development, 79*(6), 1802-1817.

Bloom, L. (1998). Language Development and Emotional Expression. *Pediatrics*, *102*(5), 1272–1277.

Bloom, L. and Capatides, J. B. (1987). Expression of affect and the emergence of language. *Child Development, 58*(6), 15-13-1522.

Bloom, P., & Markson, L. (1998). Capacities underlying word learning. *Trends in Cognitive Sciences*, *2*(2), 67–73. https://doi.org/10.1016/S1364-6613(98)01121-8

Blau, R., & Klein, P. S. (2010). Elicited emotions and cognitive functioning in preschool children. *Early Child Development and Care*, *180*(8), 1041–1052. https://doi.org/10.1080/03004430802674316

Bond, M. H., & Lai, T.-M. (1986). Embarrassment and code-switching into a second language. *The Journal of Social Psychology,* 126*(2), 179-186.*

Bretherton, I., & Beeghly, M. (1982). Talking about internal states: The acquisition of an explicit theory of mind. *Developmental Psychology*, *18*(6), 906–921. https://doi.org/10.1037/0012-1649.18.6.906

Castro, V. L., Halberstadt, A. G., Lozada, F. T., & Craig, A. B. (2015). Parents' Emotion-Related Beliefs, Behaviors, and Skills Predict Children's Recognition of Emotion. *Infant and Child Development*, *24*(1), 1–22. https://doi.org/10.1002/icd.1868

Cervantes, C. A. and Callahan, M. A. (1998) Labels and explanations in mother-child emotion talk: age and gender differentiation. *Developmental Psychology, 34*(1), 88-98.

Chang, L., Schwartz, D., Dodge, K. A., & McBride-Chang, C. (2003). Harsh Parenting in Relation to Child Emotion Regulation and Aggression. *Journal of Family Psychology*, *17*(4), 598–606. https://doi.org/10.1037/0893-3200.17.4.598

Cheung, H. (1998). The application of MLU in Chinese. J*ournal of Speech-Language-Hearing Association of the Republic of China, 13*, 36-48

Cheung, S., Kan, P. F., Winicour, E., Yang, J. (2018). Effects of home language input on the vocabulary knowledge of sequential bilingual children. *Bilingualism: Language and Cognition, 22*(5), 986-1004.

Coan, J. A., & Allen, J. J. B. (Eds.). (2007). *Series in affective science. Handbook of emotion elicitation and assessment.* Oxford University Press.

Commins, N. L. (1989). Language and Affect: Bilingual students at Home and at School. *Language Arts, 66*(1), 29-43.

Conte, E., Ornaghi, V., Grazzani, I, Pepe, A., and Cavioni, V. (2019) Emotion Knowledge, Theory of Mind, and Language in Young Children: Testing a Comprehensive Conceptual Model. *Frontiers Psychology, 10*(2144). doi: 10.3389/fpsyg.2019.02144

Czaplewska, E., & Sterczynski, R. (2015). The recognition of non-verbal messages expressing emotion by children with SLI aged 4 to 7. *Acta Neuropsychologica*, *13*, 1–10. https://doi.org/10.5604/17307503.1148328

Denham, S. A., Blair, K. A., DeMulder, E., Levitas, J., Sawyer, K., Auerbach–Major, S., & Queenan, P. (2003). Preschool Emotional Competence: Pathway to Social Competence? *Child Development*, *74*(1), 238–256. https://doi.org/10.1111/1467-8624.00533

Denham, S. A., Bassett, H. H., Way, E., Mincic, M., Zinsser, K., & Graling, K. (2012). Preschoolers' emotion knowledge: Self-regulatory foundations, and predictions of early school success. *Cognition and Emotion*, *26*(4), 667–679. https://doi.org/10.1080/02699931.2011.602049

Dunn, J., Brown, J., & Beardsall, L. (1991). F*am*ily talk about feeling states and children's later understanding of others' emotions*. Developmental Psychology, 27*(3), 448-455.

Eisenberg, N., Sadovsky, A., & Spinrad, T. L. (2005). Associations of emotion-related regulation with language skills, emotion knowledge, and academic outcomes. *New Directions for Child and Adolescent Development*, *2005*(109), 109–118. https://doi.org/10.1002/cd.143

Elfenbein, H.A. and Ambady, N. (2002). When familiarity breeds accuracy: Cultural exposure and facial emotion recognition. *Journal of Personality and Social Psychology, 85*(2), 276-290.

Finch, J. E., & Obradović, J. (2017). Unique effects of socioeconomic and emotional parental challenges on children's executive functions. *Journal of Applied Developmental Psychology*, *52*, 126–137. https://doi.org/10.1016/j.appdev.2017.07.004

Fivush, R. & Wang, Q. (2005). Emotion talk in mother-child conversations of the shared past: the effects of culture, gender, and event valence. *Journal of Cognition and Development, 6*(4), 489-506. https://doi.org/10.1207/s15327647jcd0604_3

Flores, C. (2015). Losing a language in childhood: a longitudinal case study on language attrition. *Journal of Child Language, 42*(3), 562-590.

Fujiki M., Brinton B., & Clarke D. (2002). Emotion Regulation in Children With Specific Language Impairment. *Language, Speech, and Hearing Services in Schools*, *33*(2), 102–111. https://doi.org/10.1044/0161-1461(2002/008)

Fung, H. (1999). Becoming a moral child: The socialization of shame among young Chinese children. *American Anthropological Association*, *27*(2), 180-209.

Genesee, F., & Nicoladis, E. (2006). Bilingual acquisition. In E. Hoff & M. Shatz (eds.), Handbook of Language Development, Oxford, Eng.: Blackwell.

Goodman, J. C., Dale, P. S., & Li, P. (2008). Does frequency count? Parental input and the acquisition of vocabulary. *Journal of Child Language*, *35*(3), 515-531.

Griffiths, S., Goh, S. K. Y., & Norbury, C. F. (2020). Early language competence, but not general cognitive ability, predicts children's recognition of emotion from facial and vocal cues. *PeerJ*, *8*, e9118. https://doi.org/10.7717/peerj.9118

Grosjean, F. (1989). Neurolinguists, beware! The bilingual is not two monolinguals in one person. *Brain and Language*, *36*(1), 3–15.

Gross, A., & Ballif, B. (1991). Children's understanding of emotion from facial expressions and situations: A review. *Developmental Review*, *11*(4), 368–398. https://doi.org/10.1016/0273-2297(91)90019-K

Gross, M., Buac, M., & Kaushanskaya, M. (2014). Conceptual Scoring of Receptive and Expressive Vocabulary Measures in Simultaneous and Sequential Bilingual Children. *American Journal of Speech-Language Pathology*, *23*(4), 574. https://doi.org/10.1044/2014_AJSLP-13-0026

Gutierrez-Clellen, V. F., & Kreiter, J. (2003). Understanding child bilingual acquisition using parent and teacher reports. *Applied Psycholinguistics, 24*(2), 267-288. doi:10.1017/s0142716403000158

Harris, P. L., de Rosnay, M., & Pons, F. (2005). Language and Children's Understanding of Mental States. *Current Directions in Psychological Science*, *14*(2), 69–73. https://doi.org/10.1111/j.0963-7214.2005.00337.x

Heath, S. B. (1982). What No Bedtime story Means: Narrative Skills at Home and school. *Language in society, 11*(1), 49-76.

Hernández, M. M., Eisenberg, N., Valiente, C., VanSchyndel, S. K., Spinrad, T. L., Silva, K. M., Berger, R. H., Diaz, A., Terrell, N., Thompson, M. S., & Southworth, J. (2016). Emotional Expression in School Context, Social Relationships, and Academic Adjustment in Kindergarten. *Emotion*, *16*(4), 553–566. https://doi.org/10.1037/emo0000147

Hoff, E. (2005). *Language Development.* Wadsworth Thomson Learning.

Hollingshead, A. A. (1975). Four-factor index of social status. Unpublished manuscript, Yale University, New Haven, CT.

Huang, S. (2016). Cultural Competence in Bilingual Social Communication Assessment: A Case Study. *SIG 14 Perspectives on Cultural and Linguistic Diversity,* Vol. 1, 29-41. doi: 10.1044/persp1.SIG14.29

Huang, S. & Kan, P.F. (2021). Cross-linguistic Transfer between Aspect in Cantonese and Past Tense in English in Cantonese-English bilingual Preschool Children*. International Journal of Speech-Language Pathology.*

Huang, S. & Kan, P. F. (2021). Chinese American Immigrant Parents' Socialization of Emotions in Bilingual Bicultural Children. *Frontiers in Psychology. Special Issue: The Role of Experience in Children's Language Development: A Cultural Perspective. 12*(642417), 1-14.

Humphrey, N., Kalambouka, A., Wigelsworth, M., Lendrum, A., Deighton, J., & Wolpert, M. (2011). Measures of Social and Emotional Skills for Children and Young People: A Systematic Review. *Educational and Psychological Measurement*, *71*(4), 617–637. https://doi.org/10.1177/0013164410382896

Kail, R. (1994). A Method for Studying the Generalized Slowing Hypothesis in Children with Specific Language Impairment. *Journal of Speech, Language, and Hearing Research*, *37*(2), 418–421. https://doi.org/10.1044/jshr.3702.418

Kan, P. F., Miller, A., & Still, S. (2021). Identifying Bilingual Children at Risk for Language Impairment: The Implication of Children's Response Speed in Narrative Contexts. *Children*, *8*(2), 62. https://doi.org/10.3390/children8020062

Kan, P.F., Huang, S., Winicour, E., Yang, J. (2020). Vocabulary Growth: Dual Language Learners at Risk for Language Impairment. *American Journal of Speech-Language Pathology, 29*(3), 1178-1195.

Karmiloff-Smith, A. (1992). Beyond Modularity: a Developmental Perspective on Cognitive Science. Cambridge, Mass: MIT Press.

Kassam, K. S., & Mendes, W. B. (2013). The Effects of Measuring Emotion: Physiological Reactions to Emotional Situations Depend on whether Someone Is Asking. *PLOS ONE*, *8*(6), e64959. https://doi.org/10.1371/journal.pone.0064959

Keltner, D. and Haidt, J. (1999). Social Functions of Emotions at Four Levels of Anlaysis. *Cognition and Emotion, 13*(5), 505-521.

Kohnert, K. (2010). Bilingual children with primary language impairment: Issues, evidence and implications for clinical actions. *Journal of Communication Disorders, 43*(1), 456-473.

LaBounty, J., Wellman, H. M., Olson, S., Lagattuta, K., & Liu, D. (2008). Mothers' *and* Fathers' Use of Internal State Talk with their Young Children. *Social Development*, *17*(4), 757–775. https://doi.org/10.1111/j.1467-9507.2007.00450.x

Laurent, A.C. and Prizant, B.M. (2005). Emotional regulation: A critical developmental capacity underlying social communicative competence. *Perspectives on School-Based Issues, 6*(3), 9-14.

Leonard, L. B. (1998). *Language, speech, and communication. Children with specific language impairment.* The MIT Press.

Lim, N. (2016). Cultural differences in emotion: Differences in emotional arousal level between the East and the West. *Integrative Medicine Research*, *5*(2), 105–109. https://doi.org/10.1016/j.imr.2016.03.004

Li, Y., Yu, D. (2015). Development of emotion word comprehension in Chinese children from 2 to 13 years old: Relationships with valence and empathy. *PLoS ONE, 10*(12), 1-18.

Lin, J. and Yao, Y. (2016). Encoding emotion in Chinese: a database of Chinese emotion words with information of emotion type, intensity, and valence. *Lingua Sinica, 2*(6).

Lindsay, G., & Dockrell, J. E. (2012). Longitudinal patterns of behavioral, emotional, and social difficulties and self-concepts in adolescents with a history of specific language impairment. *Language, Speech, & Hearing Services in Schools*, *43*, 445-460.

Lozada, F.T., Halberstadt, A.G., Craig, A.B., Dennis, P.A., Dunsmore, J.C. (2016). Parents' belief about children's emotions and parents' emotion-related conversations with their children. *Journal of Child Family Studies, 25*(1), 1525-1538.

Martins, E. C., Osório, A., Veríssimo, M., & Martins, C. (2016). Emotion understanding in preschool children: The role of executive functions. *International Journal of Behavioral Development*, *40*(1), 1–10. https://doi.org/10.1177/0165025414556096

Mazzone, S., Roskam, I., Mikolajczak, M., & Nader-Grosbois, N. (2017). Do Parents Talk about Emotions with Their Children? The Questionnaire of Parent-Child Conversations about Emotions (QPCCE). *Psychology*, *8*(1), 987–1007. https://doi.org/10.4236/psych.2017.87065

Mesquita, B., & Boiger, M. (2014). Emotions in Context: A Sociodynamic Model of Emotions. *Emotion Review*, *6*(4), 298–302. https://doi.org/10.1177/1754073914534480

Mesquita, B., Boiger, M., & De Leersnyder, J. (2016). The cultural construction of emotions. *Current Opinion in Psychology*, *8*, 31–36. https://doi.org/10.1016/j.copsyc.2015.09.015

Miller, J. F. & Chapman, R. S. (1981). The relation between age and mean lengths of utterance in morphemes. *Journal of Speech and Hearing Research, 24*(2), 154-161. doi:10.1044/jshr.2402.154

Miller, J. & Iglesias, A. (2020). Systematic Analysis of Language Transcripts (SALT), Research Version 2020 [Computer Software].

Monopoli, W. J., & Kingston, S. (2012). The relationships among language ability, emotion regulation and social competence in second-grade students. *International Journal of Behavioral Development*, *36*(5), 398–405. https://doi.org/10.1177/0165025412446394

Nelson, K. E., Welsh, J. A., Trup, E. M. V., & Greenberg, M. T. (2011). Language delays of impoverished preschool children in relation to early academic and emotion recognition skills. *First Language*, *31*(2), 164–194. https://doi.org/10.1177/0142723710391887

Ng, B. C., Cui, C., & Cavallaro, F. (2019). The annotated lexicon of chinese emotion words. *WORD*, *65*(2), 73–92. https://doi.org/10.1080/00437956.2019.1599543

Nicoladis, E., Yang, Y., and Jiang, Z. (2020). Why jumped is so difficult: tense/aspect marking in Mandarin-English bilingual children. *Journal of Child Language,* 1-11. doi:10.1017/S0305000920000082

Nunes, T. (2004). Domain-General and Domain-Specific processes in cognitive development. *Human Development, 47*(6), 370-375.

Oller, D. K., Pearson, B. Z., & Cobo-lewis, A. B. (2007). Profile effects in early bilingual language and literacy. *Applied Psycholinguistics*, *28*(2), 191–230.

Ornaghi, V., & Grazzani, I. (2013). The relationship between emotional-state language and emotion understanding: A study with school age-children. *Cognition & Emotion*, *27*, 356–366. https://doi.org/10.1080/02699931.2012.711745

Paradis, J. (2011). Individual differences in child English second language acquisition: Comparing child-internal and child-external factors. Linguistic Approaches to Bilingualism, 1(3), 213–237. doi:10.1075/lab.1.3.01par

Paradis, J., & Jia, R. (2016). Bilingual children's long-term outcomes in English as a second language: Language environment factors shape individual differences in catching up with monolinguals. *Developmental Science*, *20*. https://doi.org/10.1111/desc.12433

Pavlenko, A. (2008). Emotion and emotion-laden words in the bilingual lexicon. *Bilingualism Language and Cognition, 11*(2), 147-164.

Pearson, B. Z. (2007). Social factors in childhood bilingualism in the United States. *Applied Psycholinguistics*, *28*(3), 399-410. doi:10.1017/s014271640707021x

Pennebaker, J.W., Booth, R.J., Boyd, R.L., & Francis, M.E. (2015). Linguistic Inquiry and Word Count: LIWC2015. Austin, TX: Pennebaker Conglomerates (www.LIWC.net).

Pinker, S. (1984) Language Learnability and Language Development, Harvard University Press, Cambridge, MA.

Pons. F., Harris, P.L., de Rosnay, M. (2004). Emotion comprehension between 3 and 11 years: Developmental periods and hierarchical organization. *European Journal of Developmental Psychology, 1*(2), 127-152.

Ren, Y., Wyver, S., Rattanasone, N. X., & Demuth, K. (2016). Social Competence and Language Skills in Mandarin–English Bilingual Preschoolers: The Moderation Effect of Emotion Regulation. *Early Education and Development*, *27*(3), 303–317. https://doi.org/10.1080/10409289.2015.1066639

Ren, Y., Rattanasone, N. X., Demuth, K., Andronos, F., & Wyver, S. (2018). Relationships between proficiency with grammatical morphemes and emotion regulation: A study of

Mandarin–English preschoolers. *Early Child Development and Care*, *188*(8), 1055–1062. https://doi.org/10.1080/03004430.2016.1245189

Restrepo, M.A. and Gutierrez-Clellen, V.F. (2001). Article use in Spanish-speaking children with Specific Language Impairment. *Journal of Child Language, 28*(1). 433-452.

Ribordy, S. C., Camras, L. A., Stefani, R., & Spaccarelli, S. (1988). Vignettes for Emotion Recognition Research and Affective Therapy With Children. *Journal of Clinical Child Psychology*, *17*(4), 322–325. https://doi.org/10.1207/s15374424jccp1704_4

Ridgeway, D., Waters, E., & Kuczaj, S. A. (1985). Acquisition of emotion-descriptive language: Receptive and productive vocabulary norms for ages 18 months to 6 years. *Developmental Psychology*, *21*(5), 901–908. http://dx.doi.org.colorado.idm.oclc.org/10.1037/0012-1649.21.5.901

Saffran, J. R., & Thiessen, E. D. (2007). Domain-general learning capacities. In E. Hoff & M. Shatz (Eds.), Blackwell handbook of language development (pp. 68–86). Blackwell Publishing.

Sauter, D.A., Panattoni, C., Happé, F. (2013). Children's recognition of emotions from vocal cues. *British Journal of Developmental Psychology, 31*(1), 97-113.

Schmitt, M.B., Justice, L.M., O'Connell, A. (2014). Vocabulary gain among children with language disorders: Contributions of children's behavior regulation and emotionally supportive environments. American Journal of Speech-Language pathology, 23*(1)*, 373-384.

Schultz, D., Izard, C. E., and Bear, G. (2004). Children’s emotion processing: relations to emotionality and aggression. *Development and Psychopathology, 16*(2004), 371-387.

Segal, S.C., Reyes, B.N., Gobin, K.C., Moulson, M.C. (2019). Children's recognition of emotion expressed by own-race versus other race faces. *Journal of Experimental Child Psychology, 182*(1), 102-113.

Shields, A., & Cicchetti, D. (1997). Emotion Regulation Among School-Age Children: The Development and Validation of a New Criterion Q-Sort Scale. *Developmental Psychology, 33*(6), 906-916.

Shiro, M., Hoff, E., Ribot, K.M. (2020). Cultural differences in the content of child talk: evaluative lexis of English monolingual and Spanish-English bilingual 30-month-olds. *Journal of Child Language, 47*(1)*,* 844-869.

Smith, M. There's a witch under the stairs. New York: Lothrap, Lee and Shepard Books, 1991.

Sourn-Bissaoui, S. L., & Hooge-Lespagnol, F. (2006). Maternal Discourse, Children's Language, and Development of Theory of Mind. *Psychology of Language and Communication, 10*(1), 5-19.

Spackman, M. P., Fujiki, M., & Brinton, B. (2006). Understanding emotions in context: The effects of language impairment on children's ability to infer emotional reactions. *International Journal of Language & Communication Disorders*, *41*(2), 173–188. https://doi.org/10.1080/13682820500224091

St Clair Michelle C., Forrest Claire L., Yew Shaun Goh Kok, & Gibson Jenny L. (2019). Early Risk Factors and Emotional Difficulties in Children at Risk of Developmental Language Disorder: A Population Cohort Study. *Journal of Speech, Language, and Hearing Research*, *62*(8), 2750–2771. https://doi.org/10.1044/2018_JSLHR-L-18-0061

Streubel, B., Gunzenhauser, C., Grosse, G., & Saalbach, H. (2020). Emotion-specific vocabulary and its contribution to emotion understanding in 4- to 9-year-old children. *Journal of Experimental Child Psychology*, *193*(1), 1-20. https://doi.org/10.1016/j.jecp.2019.104790

Sun, H. (2019). Home Environment, Bilingual Preschooler's Receptive Mother Tongue Language Outcomes, and Social-Emotional and Behavioral Skills: One Stone for Two Birds? *Frontiers in Psychology*, *10*(1640), 1-13. https://doi.org/10.3389/fpsyg.2019.01640

Sun, H., Yussof, N. T. B., Habib Mohamed, M. B. B., Rahim, A. B., Bull, R., Cheung, M. W. L., & Cheong, S. A. (2018). Bilingual language experience and children's social-emotional and behavioral skills: A cross-sectional study of Singapore preschoolers. *International Journal of Bilingual Education and Bilingualism*, 1–16. https://doi.org/10.1080/13670050.2018.1461802

Tao, A., Zhou, Q., Lau, N., Liu, H. (2013). Chinese American immigrant mother's discussion of emotion with children: Relations to cultural orientations. *Journal of Cross-Cultural Psychology, 44*(3), 478-501.

Taumoepeau, M., & Ruffman, T. (2008). Stepping Stones to Others' Minds: Maternal Talk Relates to Child Mental State Language and Emotion Understanding at 15, 24, and 33 Months. *Child Development*, *79*(2), 284–302.

Thordarrdottir, E., Rothenberg, A., Rivard, M-E., and Naves, R. (2006). Bilingual assessment: Can overall proficiency be estimated from separate measurement of two languages? *Journal of Multilingual, 4*(1), 1-21.

Tonks, J., Williams, W.W., Frampton, I., Yaes, P., Slater, A. (2007). Assessing emotion recognition in 9–15-years olds: Preliminary analysis of abilities in reading emotion from faces, voices and eyes. *Brain Injury*, *21*(6), 623-629. DOI:10.1080/02699050701426865

Tsai, J. L. (2007). Ideal Affect. *Perspectives on Psychological Science, 2*(3), 242-259.

van Kleef, G. A., Cheshin, A., Fisher, A. H. and Schneider, I. K. (2016). Editorial: the Social Nature of Emotions. *Frontiers Psychology, 7*(896), 1-5.

Vigil, D.C., Hodges, J., Klee, T. (2005). Quantity and quality of parental language input to late-talking toddlers during play. *Child Language Teaching and Therapy, 21*(2), 107-122.

Wege, B. V., Sánchez González, M. L., Friedlmeier, W., Mihalca, L. M., Goodrich, E., & Corapci, F. (2014). Emotion displays in media: A comparison between American, Romanian, and Turkish children's storybooks. *Frontiers in Psychology*, *5*(600), 1-12. https://doi.org/10.3389/fpsyg.2014.00600

Wei, L., & Lee, S. (2001). L1 Development in an L2 Environment: The Use of Cantonese Classifiers and Quantifiers by Young British-born Chinese in Tyneside. *International Journal of Bilingual Education and Bilingualism*, *4*(6), 359–382. https://doi.org/10.1080/13670050108667738

Widen, S.C. and Russell, J. A. (2003). A closer look at preschoolers' freely produced labels for facial expressions. *Developmental Psychology, 39*(1), 114-128.

Widen, S.C. and Russell, J. A. (2008). Children acquire emotion categories gradually. *Cognitive Development, 23*(1), 291-312.

Wang, Q. (2003). Emotion situation knowledge in American and Chinese preschool children and adults. *Cognition & Emotion, 17*(5), 725-746. https://doi.org/10.1080/02699930302285

Wang, Q., and Leichtman, M.D. (2000). Same beginnings, different stories: A comparison of American and Chinese Children's narratives. *Child Development, 71*(5), 1329-1346.

Wang, Q., Leichtman, M. D., & Davies, K. I. (2000). Sharing memories and telling stories: American and Chinese mothers and their 3-year-olds. *Memory*, *8*(3), 159–177. https://doi.org/10.1080/096582100387588

Wong, Y. and Tsai, J. (2007). Cultural Models of Shame and Guilt. In Tracy, J. L., Robins, R. W., and Tangney, J. P. (First Edition), The Self-Conscious Emotions: Theory and Research (pp. 209-223). New York City, New York: Guildford Press

Wood, C., Diehm, E. A., & Callender, M. F. (2016). An investigation of language environment analysis measures for Spanish–English bilingual preschoolers from migrant low-socioeconomic-status backgrounds. *Language, Speech, and Hearing Services in Schools, 47*(2), 123–134. https://doi.org/10.1044/2015_LSHSS-14-0115

Wu, C., Zhang, J., Yuan, Z. (2021). Exploring Affective Priming Effect of Emotion-LabelWords and Emotion-LadenWords: An Event-Related Potential Study. *Brain Sciences*. *11*(553). https:// doi.org/10.3390/brainsci11050553

Xu, Y., & Zhang, Z. (2008). Distinguishing Proactive and Reactive Aggression in Chinese Children. *Journal of Abnormal Child Psychology*, *36*(4), 539–552. https://doi.org/10.1007/s10802-007-9198-0

Yang, M., Cooc, N., Sheng, L. (2017). An investigation of cross-linguistic transfer between Chiense and English: a meta-analysis. *Asian-Pacific Journal of Second andForeign Language Education. 2*(15), 1-21.

Yew, S. G. K., & O'Kearney, R. (2013). Emotional and behavioural outcomes later in childhood and adolescence for children with specific language impairments: Meta-analyses of

controlled prospective studies. *Journal of Child Psychology and Psychiatry*, *54*(5), 516–524. https://doi.org/10.1111/jcpp.12009

Zhang, J., Wu, C., Meng, Y. and Yuan, Z., (2017). Different Neural Correlates of Emotion-Label Words and Emotion-Laden Words: An ERP Study. *Frontiers in Human Neuroscience*. *11*(455). doi: 10.3389/fnhum.2017.00455

Appendix 1. Information on recruitment strategies and research team management.

According to IRB standards, this study population is considered a vulnerable population because they are children, and their families have limited English proficiency. Moreover, since the data collection took place during COVID-19, the principal investigator took extra care in recruiting, obtaining informed consent, and implementing the study tasks. The recruitment strategies and research team management approaches are discussed below.

Family Recruitment Manager

I hired a family recruitment manager in San Francisco to actively recruit Chinese families. The family recruitment manager is a native Cantonese-speaker and knows the families in San Francisco. She is a trusted member of the community and is knowledgeable of the community's culture. The family recruitment manager has worked with the Child Language Laboratory as a research assistant for many years. I have also worked with her on my independent projects and am familiar with her work and communication style. Her responsibilities involved advertising the study in her WeChat groups. She was also hired as a research assistant to conduct testing.

Cultural Liaisons

I also hired the laboratory manager for the Child Language Learning Laboratory to help me with managing the data collection for my dissertation. The laboratory manager has been working with CLLL and the families in San Francisco for the past 12 years. She is a trusted member of the community and is knowledgeable about conducting research with this community. The laboratory manager was responsible for administrative paperwork and coordinating the data collection. When hiring Cantonese-speaking research assistants to implement the Chinese tests, I first consulted with Boston's Chinatown community leader and

cultural liaison. She is a highly respected and trusted member of the community and knows many children and their families. The community leader helped to narrow down my search for a Cantonese-speaking RAs based on their qualifications. I hired two research assistants who live in Boston's Chinatown, are native speakers of Cantonese, and majoring in Psychology.

Community Engagement

When I was a speech-language pathologist in Boston, I also served as a guest writer for the SAMPAN newspaper, which is the only Chinese-English bilingual newspaper in the New England area. Since I was recruiting Chinese families in Boston's Chinatown, it was important to me to re-establish my relationship with the community. Therefore, I published another article about emotion development in bilingual children. The newspaper article served dual purposes: 1) to disseminate knowledge about the importance of emotions in bilingual children and 2) to recruit interested families to participate in my study. I also purchased advertisement space in the SAMPAN newspaper to recruit families, and the funds were a donation to support the newspaper. I also connected with my former colleague and Boston's Chinatown's cultural liaison to help with recruitment. The cultural liaison is a highly respected and trusted member of the community and among Chinese families. She helped advertise the study by posting the study flyer to her WeChat groups, which reached many families. Since the entire study took place virtually, I had greater access to Chinese communities in different states and reach more families who otherwise would not have participated due to scheduling or transportation issues.

Research Assistant Training

Since online testing was a new platform for all the research assistants, including the principal investigator, training sessions focused on preparing the RAs for technical challenges and working with children online. I have done telehealth practice and am knowledgeable about

managing children's behavior online. Research assistants participated in a 8-hour long training session split up on different days. First, research assistants had 3 one-hour training sessions with the principal investigator to orient to Zoom, its functions, and the tests used in this study. Second, research assistants were expected to spend 2 hours practicing with each other, so they are comfortable with the Zoom format and functions in an ideal situation with adults. Next, each research assistant spent 1 hour piloting the entire testing procedures with a young child so they could practice behavioral management skills in a virtual setting. Finally, after piloting the procedures with a child, the principal investigator met with each research assistant for 1 hour and provided feedback on ways to improve their testing approach and style (e.g., slow down your rate of speech or pause to chat with the child).

Returning Forms and Sending Gift Cards

In this study's population, many parents do not have email addresses or do not have sufficient digital literacy to access and complete documents on the computer. Therefore, we mailed a manila envelope package to parents that contained the following documents: parent consent form, parent questionnaire, and return envelopes and stamps. Parents were asked to complete the forms and use the return materials to mail the documents back to the principal investigator. After the study was complete, parents received their book and gift card by mail. For parents who preferred email, they received their consent forms, and parent questionnaire, and gift-card by email.

Appendix 2. Sample of the questionnaire about language distribution among family members living in the home in English (top) and Chinese (bottom).

What percentage of each language do the following members **at home** speak to your child **per week**? Please add any additional members in the household to the blank boxes.

Mother	**Father**
□ 100% Cantonese/Toisan □ 80% Cantonese/Toisan; 20% English □ 60% Cantonese/Toisan; 40% English □ 50% Cantonese/Toisan; 50% English □ 40% Cantonese/Toisan; 60% English □ 20% Cantonese/Toisan; 80% English □ 100% English □ Other language: _____%; _____% □ If **Mother** speaks Toisan at home, what percent of Toisan and Cantonese is spoken? Toisan_____%; Cantonese_____% □ N/A	□ 100% Cantonese/Toisan □ 80% Cantonese/Toisan; 20% English □ 60% Cantonese/Toisan; 40% English □ 50% Cantonese/Toisan; 50% English □ 40% Cantonese/Toisan; 60% English □ 20% Cantonese/Toisan; 80% English □ 100% English □ Other language: _____%; _____% □ If **Father** speaks Toisan at home, what percent of Toisan and Cantonese is spoken? Toisan_____%; Cantonese_____% □ N/A
Older Sibling	**Younger Sibling**
□ 100% Cantonese/Toisan □ 80% Cantonese/Toisan; 20% English □ 60% Cantonese/Toisan; 40% English □ 50% Cantonese/Toisan; 50% English □ 40% Cantonese/Toisan; 60% English □ 20% Cantonese/Toisan; 80% English □ 100% English □ Other language: _____%; _____% □ If **Older sibling** speaks Toisan at home, what percent of Toisan and Cantonese is spoken? Toisan_____%; Cantonese_____% □ N/A □ Member does not live at home	□ 100% Cantonese/Toisan □ 80% Cantonese/Toisan; 20% English □ 60% Cantonese/Toisan; 40% English □ 50% Cantonese/Toisan; 50% English □ 40% Cantonese/Toisan; 60% English □ 20% Cantonese/Toisan; 80% English □ 100% English □ Other language: _____%; _____% □ If **Younger sibling** speaks Toisan at home, what percent of Toisan and Cantonese is spoken? Toisan_____%; Cantonese_____% □ N/A □ Member does not live at home

請填寫家庭成員**每週在家**使用的各語言的比例。若該家庭成員目前不住在家中，請選擇"**目前不住在家中**"。如有缺漏成員，請於空白欄位填寫該位家中成員。

母親	**父親**
□ 100% 廣東話/臺山話 □ 80% 廣東話/臺山話; 20% 英文 □ 60% 廣東話/臺山話; 40% 英文 □ 50% 廣東話/臺山話; 50% 英文 □ 40% 廣東話/臺山話; 60% 英文 □ 20% 廣東話/臺山話; 80% 英文 □ 100% 英文 □ 其他語言: _____%; _____% 如果**母親**在家說臺山話，請問他使用臺 山話跟廣東話的比例分別是多少？ 臺山話 ____% 廣東話 ____% □不適用 □目前不住在家中	□ 100% 廣東話/臺山話 □ 80% 廣東話/臺山話; 20% 英文 □ 60% 廣東話/臺山話; 40% 英文 □ 50% 廣東話/臺山話; 50% 英文 □ 40% 廣東話/臺山話; 60% 英文 □ 20% 廣東話/臺山話; 80% 英文 □ 100% 英文 □ 其他語言: _____%; _____% 如果**父親**在家說臺山話，請問他使用臺山話跟廣東話的比例分別是多少？ 臺山話 ____% 廣東話 ____% □不適用 □目前不住在家中
兄/姐	**弟/妹**
□ 100% 廣東話/臺山話 □ 80% 廣東話/臺山話; 20% 英文 □ 60% 廣東話/臺山話; 40% 英文 □ 50% 廣東話/臺山話; 50% 英文 □ 40% 廣東話/臺山話; 60% 英文 □ 20% 廣東話/臺山話; 80% 英文 □ 100% 英文 □ 其他語言: _____%; _____% □ 如果兄/姐在家說臺山話，請問他使用臺山話跟廣東話的比例分別是多少？ 臺山話 ____% 廣東話 ____% □不適用 □目前不住在家中	□ 100% 廣東話/臺山話 □ 80% 廣東話/臺山話; 20% 英文 □ 60% 廣東話/臺山話; 40% 英文 □ 50% 廣東話/臺山話; 50% 英文 □ 40% 廣東話/臺山話; 60% 英文 □ 20% 廣東話/臺山話; 80% 英文 □ 100% 英文 □ 其他語言: _____%; _____% □ 如果 弟/妹 在家說臺山話，請問他使用臺山話跟廣東話的比例分別是多少？ 臺山話 ____% 廣東話 ____% □不適用 □目前不住在家中

Appendix 3. Sample of the questionnaire about language distribution among storytelling activities in the home in English (top) and Chinese (bottom).

What percentage of each language is your child exposed to during the following activities **per week**?

Activity	Hours spent per week	Percentage of each language exposed
Reading stories out loud to your child (with books, newspapers, etc.)	□ 0-5 hours per week □ 6-10 □ 11-15 □ 16-20 □ 21-25 □ 26+ □ This activity is not done at home	□ 100% Cantonese/Toisan □ 80% Cantonese/Toisan; 20% English □ 60% Cantonese/Toisan; 40% English □ 50% Cantonese/Toisan; 50% English □ 40% Cantonese/Toisan; 60% English □ 20% Cantonese/Toisan; 80% English □ 100% English □ Other language: _____%; _____%
Telling stories out loud to your child (without books or newspapers, etc.)	□ 0-5 hours per week □ 6-10 □ 11-15 □ 16-20 □ 21-25 □ 26+ □ This activity is not done at home	□ 100% Cantonese/Toisan □ 80% Cantonese/Toisan; 20% English □ 60% Cantonese/Toisan; 40% English □ 50% Cantonese/Toisan; 50% English □ 40% Cantonese/Toisan; 60% English □ 20% Cantonese/Toisan; 80% English □ 100% English □ Other language: _____%; _____%
Watching t.v. shows or movies	□ 0-5 hours per week □ 6-10 □ 11-15 □ 16-20 □ 21-25 □ 26+ □ This activity is not done at home	□ 100% Cantonese/Toisan □ 80% Cantonese/Toisan; 20% English □ 60% Cantonese/Toisan; 40% English □ 50% Cantonese/Toisan; 50% English □ 40% Cantonese/Toisan; 60% English □ 20% Cantonese/Toisan; 80% English □ 100% English □ Other language: _____%; _____%

請填寫**每週**進行下述活動時，您對您孩子使用各語言的比例。

活動項目	**每週**耗時	語言環境之各語言百分比
讀報紙或故事書等文章給您的孩子聽時（書，報紙，等等）	每週幾小時 □ 0-5 □ 6-10 □ 11-15 □ 16-20 □ 21-25 □ 26+ □ 在家中沒有進行這項活動	讀這些文章時，您對您的孩子使用語言的比例分別是多少？ □ 100% 廣東話/臺山話 □ 80% 廣東話/臺山話; 20% 英文 □ 60% 廣東話/臺山話; 40% 英文 □ 50% 廣東話/臺山話; 50% 英文 □ 40% 廣東話/臺山話; 60% 英文 □ 20% 廣東話/臺山話; 80% 英文 □ 100% 英文 □ 其他語言: _____% _____%
說故事給您的孩子聽時 (沒有故事書或報紙等)	每週幾小時 □ 0-5 □ 6-10 □ 11-15 □ 16-20 □ 21-25 □ 26+ □ 在家中沒有進行這項活動	說故事時，您對您的孩子使用語言的比例分別是多少？ □ 100% 廣東話/臺山話 □ 80% 廣東話/臺山話; 20% 英文 □ 60% 廣東話/臺山話; 40% 英文 □ 50% 廣東話/臺山話; 50% 英文 □ 40% 廣東話/臺山話; 60% 英文 □ 20% 廣東話/臺山話; 80% 英文 □ 100% 英文 □ 其他語言: _____% _____%
與孩子一同收看電視節目或電影時	每週幾小時 □ 0-5 □ 6-10 □ 11-15 □ 16-20 □ 21-25 □ 26+ □ 在家中沒有進行這項活動	收看電視時，您對您的孩子使用語言的比例分別是多少？ □ 100% 廣東話/臺山話 □ 80% 廣東話/臺山話; 20% 英文 □ 60% 廣東話/臺山話; 40% 英文 □ 50% 廣東話/臺山話; 50% 英文 □ 40% 廣東話/臺山話; 60% 英文 □ 20% 廣東話/臺山話; 80% 英文 □ 100% 英文 □ 其他語言: _____% _____%

Appendix 4. Sample of the questionnaire about how frequently parents talk about each emotion in English (top) and Chinese (bottom).

Which language do **YOU** feel more comfortable using when discussing feelings with your child? (check one)

☐ Cantonese ☐ English ☐ Toisonese ☐ Other: _____

Which language does **YOUR CHILD** feel more comfortable using when discussing his/her feelings with you? (check one)

☐ Cantonese ☐ English ☐ Toisonese ☐ Other: _____

Please mark how many times you have experienced this kind of situation with your child in the **last two weeks**:

	0x	1-2x	3-4x	5x or more	N/A
• When my child asked me questions about someone being **sad**, we talked about why that person was sad.	☐	☐	☐	☐	☐
• When my child asked me questions about someone being **happy**, we talked about why that person was happy.	☐	☐	☐	☐	☐
• When my child asked me questions about someone being **angry**, we talked about why that person was angry.	☐	☐	☐	☐	☐
• When my child asked me questions about someone being **scared/worried**, we talked about why that person was scared/worried.	☐	☐	☐	☐	☐
• When my child asked me questions about someone being **surprised**, we talked about why that person was surprised.	☐	☐	☐	☐	☐
• When my child asked me questions about someone being **guilty/ashamed**, we talked about why that person was guilty/ashamed.	☐	☐	☐	☐	☐

當您和您的孩子討論情緒，以下哪種語言**您**使用地最自然？（請選擇一個答案）

□ 廣東話 □ 英文 □ 臺山話 □ 其他: _____

當您的孩子和您討論情緒，以下哪種語言**他 / 她**使用地最自然？（請選擇一個答案）

□ 廣東話 □ 英文 □ 臺山話 □ 其他: _____

在過去的兩周內，請問您和您的孩子經歷過多少次以下這些情況？(每種情況請選擇一個答案)

	0 次	**1-2 次**	**3-4 次**	**5 次或 更多**	**不適用**
• 當我的孩子問我某人為甚麼傷心，我們討論了那人傷心的原因。	□	□	□	□	□
• 當我的孩子問我某人為甚麼開心，我們討論了那人開心的原因。	□	□	□	□	□
• 當我的孩子問我某人為甚麼憤怒，我們討論了那人憤怒的原因。	□	□	□	□	□
• 當我的孩子問我某人為甚麼害怕／不安，我們 討論了那人害怕／不安的原因。	□	□	□	□	□
• 當我的孩子問我某人為甚麼驚訝，我們討論了那人驚訝的原因。	□	□	□	□	□
• 當我的孩子問我某人為甚麼內疚／慚愧，我們討論了那人內疚／慚愧的原因。	□	□	□	□	□

Appendix 5. Sample of the emotion vocabulary checklist from the parent questionnaire in English (top) and Chinese (bottom).

What words do **YOU** use when talking to your child about feelings? Check all that apply.

Happy	**Sad**	**Angry**
□ Happy	□ Sad	□ Angry
□ Joyful	□ Upset	□ Furious
□ Excited	□ Unhappy	□ Frustrated
□ Cheerful	□ Gloomy	□ Annoyed
□ Proud	□ Depressed	□ Jealous
□ Surprised	□ Hopeless	□ Mad
□ Peaceful	□ Helpless	□ Bothered
□ Pleased	□ Miserable	□ Grumpy
Other: _____	Other: _____	Other: _____

□ **Guilt / Shame**	**Scared / Worried**
□ Guilty	□ Scared
□ Ashamed	□ Worried
□ Embarrassed	□ Afraid
□ Disappointed	□ Nervous
□ Shy	□ Panic
□ Disgraceful	□ Fearful
□ Regretful	□ Shocked
□ Humiliated	□ Frightened
Other: _____	Other: _____

當您和您的孩子談論情緒，您使用以下哪些詞彙？（多選）

開心	傷心	憤怒
□ 開心	□ 傷心	□ 憤怒
□ 高興	□ 難過	□ 嬲
□ 快樂	□ 難受	□ 火滾
□ 幸福	□ 唔開心	□ 穀氣
□ 興奮	□ 灰心	□ 激氣
□ 激動	□ 洩氣	□ 激死人
□ 自豪	□ 絕望	□ 沮喪
□ 平靜	□ 閉翳	□ 煩
□ 驚訝	□ 無助	□ 妒忌
Other: _____	□ 慘	Other: _____
	□ 淒涼	
	Other: _____	

內疚/ 羞恥	害怕 / 擔心
□ 內疚	□ 害怕
□ 羞恥	□ 擔心
□ 慚愧	□ 驚
□ 無面	□ 得人驚
□ 羞家	□ 嚇死
□ 尷尬	□ 揗揗震
□ 失望	□ 驚青
□ 掃興	□ 囉囉攣
□ 怕醜	□ 緊張
□ 後悔	□ 不安
	□ 震驚
Other: _____	□ 心虛
	Other: _____

Appendix 6. Validation data for the ACES facial expression subtest (Schultz, public unpublished data).

The table below presents the average ratings for each picture from the ACES facial expression subtest from two college validation studies. College students rated how happy, surprised, angry, sad, scared, and disgusted each child appears to feel on a scale from 0 ("not at all") to 5 ("very much"). Numbers in bold represent the "correct" answer for the question when given the options of "happy," "sad," "mad," and "scared." If no number is in bold in a given row, that means that that item is purposefully ambiguous, mostly eliciting a mixture of "sad" and "mad" response

	211 UMBC College Students (2004-2005)						104 UMBC College Students (2008-2009)						Total (315 UMBC College Students except for items 3, 6, 9, and 18)					
ACES	Happy	Surprised	Angry	Sad	Scared	Disgusted	Happy	Surprised	Angry	Sad	Scared	Disgusted	Happy	Surprised	Angry	Sad	Scared	Disgusted
1	0.11	0.18	**3.32**	0.33	0.16	1.27	0.02	0.07	**4.05**	0.56	0.25	1.33	0.08	0.14	**3.56**	0.41	0.19	1.29
2	**1.94**	0.59	0.08	0.16	0.56	0.06	**2.34**	0.61	0.12	0.14	0.54	0.07	**2.07**	0.60	0.09	0.15	0.55	0.06
3							1.20	0.37	2.22	0.35	0.17	0.76	1.20	0.37	2.22	0.35	0.17	0.76
4	0.16	0.17	0.25	**2.65**	0.22	0.70	0.03	0.20	0.46	**3.01**	0.30	0.68	0.12	0.18	0.32	**2.77**	0.25	0.69
5	0.10	1.16	0.15	0.16	**2.95**	0.56	0.05	2.19	0.33	0.19	**3.13**	0.29	0.08	1.50	0.21	0.17	**3.01**	0.47
6							0.06	0.18	2.97	1.29	0.24	1.65	0.06	0.18	2.97	1.29	0.24	1.65
7	0.05	0.14	1.55	2.64	0.82	0.38	0.17	0.18	2.41	3.60	0.69	0.64	0.09	0.15	1.83	2.96	0.78	0.47
8	**3.75**	0.32	0.03	0.00	0.01	0.01	**3.94**	0.10	0.04	0.04	0.03	0.03	**3.81**	0.25	0.03	0.01	0.02	0.02
9	0.06	0.04	0.28	**3.93**	0.21	0.10	0.03	0.04	0.77	**4.27**	0.37	0.32	0.05	0.04	0.44	**4.04**	0.26	0.17
10	0.08	0.91	0.03	0.15	**2.03**	0.49							0.08	0.91	0.03	0.15	**2.03**	0.49
11	0.05	0.06	**3.51**	0.08	0.06	1.48	0.25	0.09	**3.42**	0.31	0.11	1.79	0.12	0.07	**3.48**	0.16	0.08	1.58
12	0.05	0.07	1.69	2.51	1.33	0.14	0.01	0.10	2.04	3.01	0.82	0.39	0.04	0.08	1.80	2.68	1.16	0.22
13	0.03	0.09	0.67	3.23	0.26	0.62	0.05	0.11	0.92	2.58	0.56	0.82	0.04	0.10	0.75	3.02	0.36	0.69
14	0.06	0.02	0.17	**3.75**	0.09	0.16	0.11	0.11	0.29	**3.55**	0.27	0.11	0.08	0.05	0.21	**3.69**	0.15	0.14
15	0.02	0.03	0.29	1.80	0.36	0.75	0.04	0.06	0.76	2.16	0.53	1.24	0.03	0.04	0.44	1.92	0.42	0.91
16	0.02	0.07	1.46	3.29	0.04	0.39	0.02	0.01	2.40	2.71	0.12	0.64	0.02	0.05	1.77	3.10	0.07	0.47
17	**2.19**	0.45	0.00	0.37	0.06	0.09	**1.78**	0.21	0.15	0.88	0.27	0.20	**2.06**	0.37	0.05	0.54	0.13	0.13
18							0.00	0.10	3.71	1.08	0.19	1.92	0.00	0.10	3.71	1.08	0.19	1.92
19	0.00	0.03	**3.57**	0.12	0.03	1.11	0.01	0.12	**3.79**	0.86	0.39	1.53	0.00	0.06	**3.64**	0.36	0.15	1.25
20	0.24	0.96	0.13	0.26	**2.19**	0.73	0.43	2.54	0.13	0.30	**3.01**	0.45	0.30	1.48	0.13	0.27	**2.46**	0.64
21	0.02	0.02	1.12	3.67	0.07	0.27	0.03	0.04	1.47	3.68	0.27	0.43	0.02	0.03	1.24	3.67	0.13	0.32
22	0.00	0.05	**4.17**	0.20	0.10	0.70	0.07	0.09	**4.40**	0.64	0.10	1.07	0.02	0.06	**4.25**	0.34	0.10	0.82
23	0.08	0.03	0.28	**3.20**	0.02	0.09	0.06	0.01	0.31	**2.99**	0.16	0.33	0.07	0.02	0.29	**3.13**	0.07	0.17
24	0.08	2.04	0.00	0.04	**2.76**	0.15	0.14	3.52	0.03	0.07	**3.24**	0.16	0.10	2.53	0.01	0.05	**2.92**	0.15
25	**3.06**	0.15	0.01	0.05	0.04	0.10	**3.34**	0.24	0.05	0.13	0.09	0.07	**3.15**	0.18	0.02	0.08	0.06	0.09
26	0.11	0.02	2.84	2.58	0.05	0.51	0.05	0.05	3.23	2.95	0.23	0.71	0.09	0.03	2.97	2.70	0.11	0.58

Appendix 7. Sample images from the original Emotion Recognition Vignettes (Ribordy et al., 1988).

Table 1. *Emotion Recognition Vignettes*

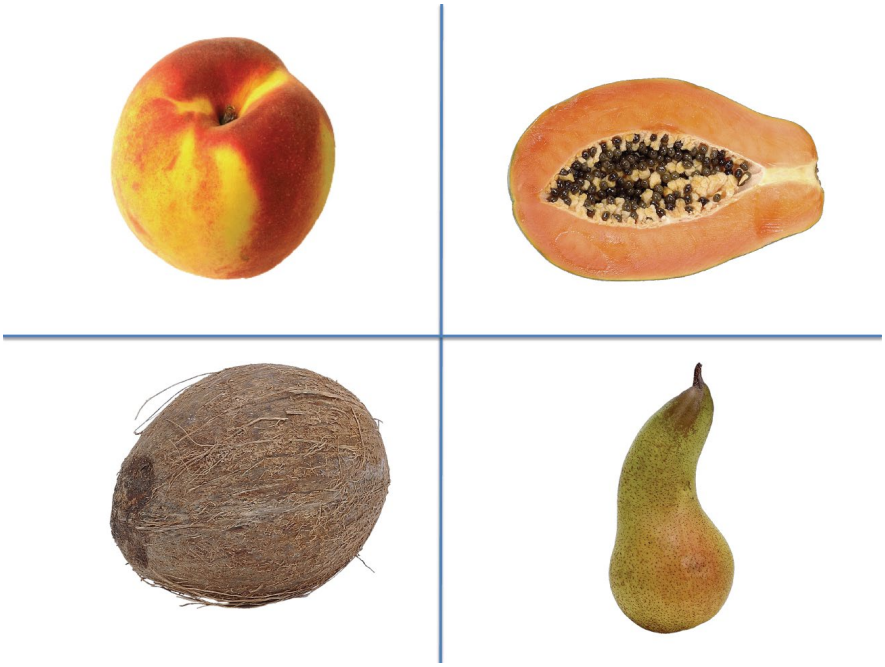
Vignette	Percentage of Correct Judgments
Happy	
1. Johnny/Susie wanted his/her friends to come over to play. So he/she asked them, and they came to play with him/her at his/her house.	86
2. At Christmas, Johnny/Susie got a new toy house that he/she wanted.	86
3. Johnny/Susie worked hard on a picture and showed it to his/her father. His/her father really liked it and said Johnny/Susie did a good job.	86
4. Johnny/Susie went to the zoo, and his/her aunt bought him/her a real nice balloon that he/she liked a lot.	81
5. It is Johnny's/Susie's birthday. He/she is given a party with lots of cake and fun games to play, and presents, too.	75
Sad	
1. Johnny/Susie and his/her little sister have a pet dog. The dog is sick and going to die.	87
2. Johnny's/Susie's friend, who he/she really liked to play with, moved away. Johnny/Susie couldn't play with his/her friend any more.	79
3. Johnny/Susie was the only one in class not to get any Valentines on Valentine's Day.	75
4. Johnny/Susie couldn't play a game, and some of the kids laughed at him/her.	71
5. Johnny's/Susie's favorite sweater that he/she liked a lot was very old and worn out. He/she had to throw it away and gave it to his/her mom to get rid of it.	71
Surprised	
1. When Johnny/Susie went to bed, he/she was in his/her own bed, and when he/she woke up, he/she was on the couch.	70
2. Johnny/Susie had a dog named Bowser who always barked at him/her when he/she came home from school. One day when Johnny/Susie came home, he/she said, "Hi, Bowser!" and Bowser said, "Hi, Johnny/Susie!"	70
3. It was summertime, and when Johnny/Susie went to bed, the weather was warm. When he/she got up, there was snow on the ground.	69
4. Johnny's/Susie's mother bought him/her new shoes, and Johnny/Susie didn't know she was going to do that.	64
5. Johnny/Susie was walking home from school and suddenly out from behind a tree jumped his/her father, who said, "Boo!"	60
Disgusted	
1. Someone threw up on Johnny/Susie during lunch at school.	93
2. A friend gave Johnny/Susie an apple. Johnny/Susie bit into the apple and found a smelly, squashed, dead worm.	79
3. Johnny's/Susie's friend brought his dog over to Johnny's/Susie's house. The dog made a mess on the carpet and Johnny/Susie stepped in it.	73
4. Johnny/Susie went to a movie with a friend. In the movie, people were eating bugs and worms.	71
5. Johnny/Susie saw a friend who had a baloney sandwich with chili on it. He/she thought it was ugly and would taste terrible.	69
Afraid	
1. Johnny/Susie was dreaming about a monster in his/her nightmare.	81
2. Johnny/Susie and his/her little sister were in their room at night. It was dark, and they saw a tree outside that looked like a person with his hand about to come in the window.	80
3. When Johnny/Susie went to bed, he/she thought there was something in his/her closet trying to get him/her.	79
4. Johnny/Susie was walking in the woods and met a hungry bear who liked to eat little children.	69
5. A bad man was chasing after Johnny/Susie.	69
Angry	
1. Johnny's/Susie's little brother broke his/her favorite toy on purpose.	93
2. Johnny/Susie was trying to tell his/her mom about something exciting, but his/her little brother kept interrupting.	79
3. Johnny/Susie let his/her best friend use his/her new ball. His/her friend wasn't careful and lost the ball and wouldn't give Johnny/Susie another one.	73
4. Johnny's/Susie's friend gave him/her a present because Johnny/Susie helped him with his homework. Later, Johnny's/Susie's friend changed his mind and took the present back.	70
5. Johnny/Susie made his/her dad an ashtray for his birthday. Johnny/Susie told his/her baby brother not to touch it, but his/her brother did, and the ashtray broke.	69

Appendix 8. Sample of the story scripts for the Emotion Elicited Story Retell task in English (top) and Cantonese (bottom).

Page	English Script
1	This story is called, “There’s a witch under the stairs.”
2	One day, a little girl named Kiki was sitting on her bed thinking. She is unhappy because there is a mean and ugly witch in her house. Kiki is worried that the witch might come grab her!
3	Kiki is nervous when she is walking down the stairs. The basement is dark and cold. She is shivering. Every time she goes into the basement she is scared because the witch is hiding under the stairs! When the witch reached out her arms, Kiki screamed! She was scared to death! But fortunately, she escaped the witch!
4	Kiki is sitting and thinking about what she is going to do to kick the mean and ugly witch out of her house! The witch cannot stay forever. Kiki will be unhappy forever if the witch doesn’t leave!
5	Kiki looks at the basement stairs to come up with an idea on how kick out the witch. Suddenly, she sees the ugly witch! She jumps up! “Ahhh!” She is frightened! Her face turned pale.

Page	Cantonese Script
1	尼個故仔叫“樓梯底下的巫婆”。
2	有一日，一個叫 KiKi 嘅女仔訓佐系張床霖野。 因為屋企有個又邪惡又醜樣嘅巫婆，所以區唔開心。 KiKi 好擔心巫婆會抓住區。
3	KiKi 每次行樓梯個陣都會騰騰陣。 地下室又黑又凍。 區打嘶冷陣。 每次區去地下室個陣都會好驚因為巫婆就匿埋系樓梯下邊。 當巫婆抓住區只手個陣，區尖叫！ 區嚇死了！ 不過好彩區走乜佐！
4	KiKi 坐系度霖緊區點樣先可以將尼個又可惡又醜樣嘅巫婆踢走！ 尼個巫婆唔可以一直留系度。 如果巫婆一直唔走，KiKi 會一直唔開心！
5	KiKi 望住地下室嘅樓梯霖到一個辦法踢走尼個巫婆。 突然間，區見到個個醜樣嘅巫婆！ 區跳佐起身！ “啊！” 區嚇死啦！

Appendix 9. Sample pictures from the Kai Ming Picture Identification (top) and Picture Naming (bottom) tasks.



Appendix 10. Summary of project challenges and solutions.

The purpose of this appendix is to highlight the major challenges that the principal investigator and the research team encountered and to explain how we problem solved and prepared for these issues. The goal is to assist future researchers conducting online data collection with children using the Zoom platform. Moreover, the data collection took place during a global pandemic, multiple natural disasters, and a national election, which significantly impacted our vulnerable communities. In this chapter, I share my experience in overcoming these major obstacles and how I worked with the community during these especially difficult times.

Scheduling Participants

One challenge we encountered was scheduling participants for two 1-hour session. Children are in school during the day and parents work full-time jobs, and when parents come home they are often getting ready for dinner and running errands. We overcame this challenge by scheduling at a time that worked best for the children and the families. These times included after school and before dinner time (~4:00-6:00 pm), weekends, and school holidays. We learned that Fridays were an ideal day for data collection because many schools had half days (in part due to COVID-19), and so we were able to test several children in one day. We had three RAs to administer the Cantonese tests and so if one was not available, we were able to coordinate who was available to conduct the testing. We explained to parents that they do not have to sit with the child during the testing, so that parents are free to do their home errands (e.g., cook dinner, laundry, etc.). On average, we scheduled 2 to 3 participants every week. The day before testing, we reminded families about their appointment time and sent them the zoom link again. Some parents were late to testing because they forgot, but the research assistants called parents to

remind them and they joined immediately after. We only had only one family who did not continue the remaining tests due to scheduling issues.

Management of Children's Behavior

Since the data collection occurred remotely on Zoom, we implemented child management strategies that would be appropriate in a virtual setting. All the research assistants were trained to work with children. We anticipated that children may have a short attention span or be easily distracted while on Zoom. Therefore, we built in short breaks after 30 minutes of testing. The breaks involved a water or snack break, no screen time, movement breaks, or breathing exercises. We also set expectations for the children so they knew how many tests they will need to complete. The examiners also provided positive reinforcements throughout testing and reminded the child that they will receive a gift if they finish all the tests. Another positive reinforcement that children responded well to was reminding them that "mommy gets a present too" (in the form of a gift card) if they finish all the games. Some children needed extra time to warm up and feel comfortable with the examiner. In those cases, the examiners showed a physical teddy bear on the screen or chatted with the child at the beginning. For example, one examiner who tested on Halloween night dressed up in a unicorn costume and talked about each other's costumes before beginning the testing. Some children found the Witch story scary, and so the examiners reassured the child that the story has a good ending and nothing bad happens to the main character.

Technology and Internet Access

We anticipated that we would encounter technology and internet problems during testing, and so we prepared for these problems during the research assistant. The research assistants practiced troubleshooting potential scenarios and learning to resolve issues quickly so that it

would not interfere with testing or impact the child's attention span. If the internet stopped and the videos were frozen, RAs called the parents immediately and provided instructions over the phone. The issue was resolved after logging out and logging back in and restarting the wi-fi connection. Another common problem that we encountered was that some participants' technology devices did not have the "remote control" function for children to use the mouse to point to the answer on the screen. We learned that Android and Samsung devices, and computers loaned by the school did not have the "remote-control" Zoom function. For those children, the research assistants were trained to use the "annotation" function in Zoom and type in the number 1, 2, 3, and 4 in the Picture Identification task. Children were asked to say the number instead of pointing to the correct picture.

Incomplete or Unreturned Parent Questionnaires

We occasionally had parents who returned an incomplete questionnaire or did not return the questionnaire. The principal investigator reviewed all the questionnaires prior to starting the study to ensure that it was completed correctly. If there were incomplete sections or clarification questions, the PI would follow-up with the parents on Zoom after finishing the testing. If the parents did not return the questionnaire before the study began, the examiners reminded the parents on Zoom after testing and withheld the gift card until the PI received the questionnaire.

Mailing Delays: COVID-19, Natural Disasters, and 2020 Election

Another major challenge we experienced during the data collection stage was significant mailing delays caused by COVID-19, natural disasters, and mail-in votes. When the data collection process started in August 2020, COVID-19 cases were at its peak and that impacted shipping, delivery, and mailing. Between September to October 2020, San Francisco experienced severe wildfires and was in a state of emergency. Consequently, the U.S. Postal Service was at a

lower functioning capacity and parents were less likely to leave their house to drop off their mail, and so there were delays in receiving the parents' consent form and parent questionnaires. Around the same time in October 2020, Boulder also experienced severe wildfires requiring many parts of the county to evacuate. The wildfires also impacted the mailing schedule, and so there were delays in both outgoing and incoming mail. In November 2020, majority of the states participated in mail-in voting for the 2020 United States election for the first time. Since the mail-in votes took priority, there were delays with other mailing services. During this time, incoming and outgoing mail between Boulder and San Francisco took about 2 weeks.

The research team took extra steps to prepare for these problems and alleviate the issue for families. First, to reduce the amount of incoming and outgoing mail, we asked parents who were comfortable using email to complete and return the forms by email and receive an electronic gift card instead of a physical one. Only about 10% of the families preferred to use the email option. Second, we followed up with parents to reassure them that their book and gift card were in the mail and that it may take about 2 weeks due to current delays. They were encouraged to contact the principal investigator directly if they still have not received their gift after 2 weeks. Additionally, the PI tracked on Amazon the location of the book, so that the PI knew whether it was still in transit to reassure the parents. When the PI received email notification from Amazon that the book was delivered, the PI contacted the parent to inform them that it was delivered so they can retrieve it. It is not uncommon for minorities to feel uncomfortable or lack trust with professionals. The PI was prepared for this because the recruitment manager shared that several parents declined participation because they did not trust that they would receive the gift card. Therefore, for each participant the PI took a picture of the gift card showing the serial number

and the mailing envelope so that parents knew that the gift card existed. All the gift cards were eventually delivered to the families' mailboxes.

Appendix 11. Pearson's correlation analyses indicating relationships among measures from the vocabulary and story retell tasks in English.

	Picture Naming	Picture Identification	Total Number of Words	Number of Different Words	Type Token Ratio
Picture Naming	--	--	--	--	--
Picture Identification	.78**	--	--	--	--
Total Number of Words	.61**	.52**	--	--	--
Number of Different Words	.72**	.58**	.94**	--	--
Type Token Ratio	-.36*	-.29	-.63**	-.55**	--

*$p < 0.05$, **$p < 0.01$

ACRONYMS

ACES – Assessment of Children's Emotion Skills

EL – Emotion-laden words

EM – Emotion words

ER – Emotion-related words

ERV – Emotion Recognition Vignettes

L1 – First language, home language, or Cantonese

L2 – Second language or English

LI – Language Impairment

MLU – Mean Length Utterance

NDW – Number of Different Words

SALT – Systematic Analysis of Language Transcripts

TD – Typically developing

TNW – Total Number of Words

TTR – Type-Token Ratio

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