LEXICAL SKILLS IN BILINGUAL CHILDREN WITH AUTISM SPECTRUM DISORDER

by

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B.A. McGill University, 2003

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE

In

The Faculty of Graduate Studies

(Audiology and Speech Sciences)

THE UNIVERSITY OF BRITISH COLUMBIA
(Vancouver)

April 2010

Abstract

Bilingual families of children with Autism Spectrum Disorder (ASD) are often advised to reduce language input or to completely drop one language when communicating with their child. While research has explored the impact of bilingualism on the language development of children with language impairments, there is very limited research available on bilingualism and the ASD population. Lexical development is a focus of early language intervention and an accurate measure of language development. Therefore, studying lexical diversity in bilingual children with ASD is a valuable contribution to our knowledge of language development in this population.

This study investigated the lexical production skills of bilingual English-Chinese and monolingual English preschool-age children with ASD, primarily using Communication Development Inventories (Fenson, Dale, Reznick, Thal, Bates, Hartung, Pethick, & Reilly, 1993; Tardif & Fletcher, 2008). Participant use of nouns, verbs, and mental state terms was also explored. In addition, vocabulary comprehension, overall language skills, and nonverbal skills were assessed. Results revealed that bilingual and monolingual participants had equivalent English production vocabularies, and that bilinguals had larger conceptual production vocabularies than monolinguals. The groups did not differ in the number of English mental state words produced. Bilingual participants had a larger number of verbs in their conceptual production vocabularies, and were found to have higher vocabulary comprehension scores and higher language scores. When comparing the two languages of the bilingual participants, there were no significant differences in the size of production vocabularies, vocabulary comprehension scores, or the number of mental-state words

produced. The results from this study provide evidence that bilingual English-Chinese preschool-age children with ASD have the capacity to be bilingual.

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Acknowledgements

I am grateful to the parents, children, speech-language pathologists, and behaviour consultants who made this study possible. Also, I would like to thank Dr. Stefka Marinova-Todd, my supervisor, as well as Dr. Carolyn Johnson and Dr. Pat Mirenda, my committee members, for their time and dedication to this project. A special thank you is given to Pat and her Autism & Developmental Disabilities Laboratory for providing access to the monolingual data as well as much assistance with this project. Dr. Twila Tardif donated a copy of the Chinese Communicative Development Inventories, and Krista Byers-Heinlein and Jacqueline Chong from the UBC Infant Studies Centre provided assistance with conceptual vocabulary calculations. I am also indebted to Alice Hung, Cherry Li, Clinton Tsang, and Susan Yang for their assistance with Chinese data collection and translation, to Dr. Paola Colozzo and members of the Child Language Laboratory for lending testing materials and insight, and to Patty Petersen for early edits of this document. Finally, I am grateful to my family, friends, and colleagues for their advice, input, and morale throughout this project.

Dedication

This study is dedicated to Jacques, the wonderful child who inspired me to ask these questions and who continues to inspire my work today.

1. Introduction

Bilingual families of children with Autism Spectrum Disorder (ASD) are often advised by child development professionals to speak only one language to their child (Besnard, 2008; Kremer-Sadlik, 2005; Leadbitter, Hudry, & Temple, 2009). Many parents and professionals believe that bilingual exposure negatively impacts language development, especially for children with ASD (Hambly & Fombonne, 2009). While research has explored the impact of bilingualism and multilingualism on the language development of children with language impairments (Thordardottir, Ellis Weismer, & Smith, 1997; Kay-Raining Bird, Trudeau, Thordardottir, Sutton, & Thorpe, 2005; Kohnert, 2007), there is a limited amount of research on bilingualism and the ASD population. Research that has examined the effect of bilingualism on children with language impairment has found that (a) children with specific language impairment (SLI) do not experience more severe impairments than same-age monolingual children with SLI, and (b) these children have the capacity to become bilingual (Paradis, Crago, Genesee, & Rice, 2003). Additionally, research on monolingual and bilingual children with Down syndrome (DS) found no evidence that bilingualism had a negative effect on language development (Kay-Raining Bird et al., 2005). In a society in which much professional and societal attention is placed on ASD, in which the population in general is becoming increasingly bilingual, and evidence-based practice is becoming the norm, more research on the bilingual population with ASD is needed so that therapy of the best quality can be provided to these children.

The following sections of this chapter will outline what is known about language ability of children with ASD, typically developing bilingual children, bilingual children with language impairment, and bilingual children with ASD. More specifically, this chapter will

look at lexical skills in these populations. A lexicon may be thought of as a mental dictionary of words, and lexical development is a lifelong process because words are constantly being added and meanings adapted (Gillam, Marquardt, & Martin, 2000). Lexical development is considered to be an accurate measure of language development in children (Genesee, Paradis, & Crago, 2004; Malvern, Richards, Chipere, & Durán, 2004) and a reliable predictor of language development in children with ASD (Condouris, Meyer, & Tager-Flusberg, 2003). Because lexical development is a focus of early language intervention and an accurate measure of language development, studying lexical diversity in bilingual children with ASD is a valuable contribution to our knowledge of language development in this disordered population.

1.1 ASD & Lexical Development

The term ASD is used synonymously with the term Pervasive Developmental Disorders (PDD), which appears in the *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR)* of the American Psychiatric Association (2000). Autistic Disorder, Asperger's Disorder, PDD-not otherwise specified (PDD-NOS), Rett's Disorder, and Childhood Disintegrative Disorder are the five subtypes of PDD. However, Autistic Disorder, Asperger's Disorder and PDD-NOS are the three PDDs most commonly implied by the term ASD (Autism Society Canada, 2005). According to the *DSM-IV-TR*, to be diagnosed with autistic disorder, an individual must present with: (a) qualitative impairment in social interaction; (b) qualitative impairment in communication; (c) restricted repetitive and stereotyped patterns of behavior, interests, and activities. The individual must have also demonstrated a delay or abnormal functioning in at least one of the following areas: (a) social interaction, (b) language as used in social communication (c) symbolic or imaginative

play. There are 12 specific characteristics listed under these three categories, and six or more characteristics need to be demonstrated in an individual in order for a diagnosis. PDD-NOS is diagnosed when the criteria for Autistic Disorder cannot be met because of late ago of onset, atypical symptomatology, or subthreshold symptomatology, or all of these (American Psychological Association, 2000). In 2005, Volkmar and Klin reported that there is general agreement that autism and associated disorders represent the behavioral manifestations of underlying dysfunctions in the central nervous system, and that sustained educational and behavioural interventions are useful and constitute the core of treatment. The current prevalence of ASD in Canada is estimated to be more than 1 in 200 people (Fombonne, 2003), whereas the prevalence in the USA is approximately 1 in 110 (Centre for Disease Control, 2009). Methodological differences in epidemiological surveys of ASD make between-survey comparisons difficult, and as a result a reliable international prevalence rate is not available (Fombonne, 2005).

Many children with ASD begin speaking late and develop speech at a significantly slower rate than typically developing children (Tager-Flusberg, Paul, & Lord, 2005). There is a significant correlation between IQ and language outcomes in children with ASD, although higher levels of nonverbal IQ are not always associated with higher-level language skills (Howlin, Goode, Hutton, & Rutter, 2004). A small percentage of children with ASD do not show any significant language delays, whereas some children with ASD never acquire any functional language (Tager-Flusberg et al., 2005). For some individuals with a diagnosis of high functioning autism, which refers to individuals with autism whose IQs are close to 100 or above (Baron-Cohen, Wheelwright, Lawson, Griffin, Ashwin, Billington, & Chakrabarti, 2005), vocabulary is an area of strength, as is evidenced through high scores on

standardized vocabulary assessments (Tager-Flusberg et al., 2005). While overall lexical knowledge may be a relative strength in ASD, the acquisition of words that map onto mental state concepts and socio-emotional terms tend to be specifically impaired in this population (Tager-Flusberg et al., 2005). As well, errors with temporal and spatial expressions are relatively common (Perkins, Dobbinson, Boucher, Bol, & Bloom, 2006), as are pronoun reversal errors (Tager-Flusberg et al., 2005). Originally viewed as a result of echolalia, difficulty with pronouns is now generally seen as a difficulty with deixis, a challenge linking vocabulary use to semantic processing (Tager-Flusberg et al., 2005). Indeed, Tager-Flusberg (1991) has interpreted previous research to mean that individuals with ASD have the meaning of the words encoded appropriately but that the deficit is a result of failing to use linguistic information to facilitate effective retrieval of stored information.

Most studies on ASD and the lexicon have described the vocabulary skills of individuals with ASD. Few studies have used a longitudinal design to compare lexical development in typically developing children and children with ASD. Peralejo (2008) compared longitudinal parent report data from the MacArthur Communicative Development Inventory (CDI; Fenson et al., 1993) for monolingual children with ASD to the CDI norms for typically developing children. Analysis indicated virtually identical orders of emergence for different predicate types and no differences in the percentages of predicates or nominals for the two groups at three time points. She also found that lexical variables strongly predicted grammatical complexity one year later. Peralejo concluded that lexical development in ASD follows the normal course but emerges later and develops at a slower rate.

In summary, most verbal individuals with ASD begin to talk late and develop speech at a slower rate than typically developing individuals. However, the developmental course for individuals with ASD, particularly in the domain of lexical development, appears similar to that of typically developing individuals. Common differences in vocabulary use include pronoun reversals, a decreased use of mental state and socio-emotional words, and some abnormal use of vocabulary.

1.2 Bilingualism

Among language development researchers today, the most commonly accepted understanding of the term bilingualism is that it refers to individuals who use two or more languages or dialects in their everyday lives (Grosjean, 2010). This is different from earlier definitions that necessitated a certain level of oral fluency in each language or dialect. There are far more bilingual individuals than there are monolingual individuals in today's world. The majority of bilingual children are learning two languages out of necessity, in order to effectively communicate in all aspects of their society (De Houwer, 1995). According to Statistics Canada (2007), 21% of Canadians have neither French nor English as their only mother tongue; thus, we know that at least 21% of Canadians live in bilingual environments. Additionally, more than 60% of the students enrolled in the Vancouver School Board speak a primary language other than English in the home and are considered dual language learners (Vancouver School Board, 2009). Research has shown that bilingual children usually exhibit the same rates and stages of development as monolingual children with respect to phonology and grammar (Genesee et al., 2004; Oller & Eilers, 2002). With regard to vocabulary, bilinguals tend to have smaller vocabularies in each of their languages compared to monolingual children. However, when the two vocabularies are added together, and

translation equivalents are counted only once (creating what is known as the conceptual vocabulary) bilingual children typically have vocabularies of an equivalent or larger size (Genesee et al., 2004; Pearson, Fernandez, & Oller, 1993).

Pearson et al. (1993) created a detailed comparison study looking at lexical comprehension and production development in 25 bilingual and 35 monolingual children. The English- and/or Spanish-speaking children in their study ranged in age from 8-30 months, and were observed at 2-3 month intervals at 1-7 time points using the Communication Development Inventory (CDI) Toddler and Infant forms (1989) and their Spanish adaptations, the Toddler and Infant Inventario del Desarrollo de las Habilidades Communicatives (Jackson-Maldonado & Bates, 1988). The vocabulary of monolinguals was determined by counting the number of words they knew at a given age. For bilingual children, this measure was calculated individually for each of their two languages. Total vocabulary scores, consisting of the sum of the number of English words and the number of Spanish words checked by the parents; and total conceptual vocabulary scores, consisting of all of the words from one language plus all of the non-duplicated words from the other language, were also calculated. When the data were examined longitudinally, both groups seemed to follow the same general upward trend, with neither group consistently above or below development of the other group. Results revealed that, for production, the bilingual children's double-language knowledge, with translation equivalents counted only once, was very close to the monolingual children's averages. In addition, the bilinguals' comprehension appeared to be comparable in each language to that of the monolingual children. Both the monolingual and bilingual groups showed vocabulary acquisition rates similar to those of the norming sample of monolinguals. The study concluded that, before

the age of 30 months, the bilingual and monolingual children developed vocabulary at the same rate. Such findings support the notion that monolingual and bilingual lexical development follow the same developmental path.

An additional study by Allman (2005) built upon previous research and examined the size of the comprehension and production vocabularies of monolingual and bilingual preschool children. Subjects were divided into five groups based on their level of bilingualism: monolingual English, monolingual Spanish, bilingual English dominant, bilingual Spanish dominant, and balanced bilingual. Groups were controlled for nonverbal IQ, age, gender, maternal education, and onset of bilingualism. Participants were then tested using the Peabody Picture Vocabulary Test (PPVT; Dunn & Dunn, 1997), the Test de Vocabulario en Imagenes Peabody (TVIP; Dunn, Lugo, Padilla, & Dunn, 1986) the Expressive One Word Picture Vocabulary Test (EOWPVT; Brownell, 2000) and the Spanish EOWPVT B (Brownell, 2001). Results were discussed in terms of total vocabulary and conceptual vocabulary, as defined above. For conceptual vocabulary comprehension scores, there were no significant differences among the English monolingual group and any of the bilingual groups. This suggests that the number of concepts understood by bilingual children is comparable to that of their monolingual peers who speak the dominant language of the community. For the conceptual production vocabulary, the English monolinguals scored significantly higher than all other groups, which suggested that the English monolinguals were able to speak about more concepts than the bilingual children. The authors argued that bilinguals encounter words and their associated meanings with lower frequencies than their monolingual peers. As a result, they may take longer to negotiate accurate linguistic production rules associated with a concept in each of their two languages, and this may make

them less comfortable producing words for these concepts. Overall, the results of this study support the notion that bilingual preschoolers have a total vocabulary size advantage and a conceptual vocabulary development that is not delayed.

When an individual is learning two languages, the linguistic differences between the languages affect the rate of learning and attainment in each. Linguistic differences known as crosslinguistic influences come in two types – qualitative and quantitative. Qualitative crosslinguistic influences result in target-deviant structures that are not demonstrated in monolingual acquisition of the language (Genesee et al., 2004). The phrase "Where's the Santa Claus give me the gun?" instead of "Where's the gun Santa Claus give me?" is an example of qualitative influence because the child has used Cantonese word order in an English sentence in a way that monolingual English children would not (Yip & Matthews, 2000). Quantitative cross-linguistic influences result in increased frequency in the appearance of target-deviant structures that are also evident in a monolingual child's development of that language (Genesee et al., 2004). The phrase "I like" instead of "I like it", referring to something already mentioned in conversation, is an example of a quantitative influence because both bilingual English-Chinese and monolingual English children make this mistake, but bilingual children make it more because the phrase is acceptable in Chinese (Yip & Matthews, 2000). Both qualitative and quantitative syntactic transfer from Cantonese to English was documented in a case study of a bilingual child from Hong Kong who was dominant in Cantonese. The directionality of the transfer effects appeared to be due largely to language dominance (Yip & Matthews, 2000). Although crosslinguistic transfer effects occur, they do not significantly impede language development.

In summary, the majority of the world's children are bilingual because their environment requires them to be so. The nature of language input plays a very important role in the bilingual acquisition process. The type and amount of language input and the cultural and linguistic differences between languages all affect the rate of learning and attainment in each language of a bilingual communicator. Regardless of these factors, bilingual language acquisition and lexical development follow the same developmental path as monolingual language acquisition.

1.3 Bilingualism in Children with Language Impairments

With regard to the relationship between language impairments and bilingualism, several studies have looked specifically at the bilingual language development of children with DS, and children with SLI (Kay-Raining Bird et al., 2005; Thordardottir et al., 1997). The general finding is that, if given similar opportunities, children with language impairment can indeed learn two languages. They may learn language at a slower pace and perhaps to a lesser extent than their typically developing bilingual peers, but they do learn language to the same level as their monolingual peers with language learning difficulties (Kohnert, 2007).

In one study, the language abilities of 8 bilingual children with DS were compared to the language abilities of 14 monolingual children with DS, 18 monolingual typically developing children, and 11 bilingual typically developing children (Kay-Raining Bird et al., 2005). All the children were in the early stages of language development, with a minimum of 100 words in their production vocabularies as measured by the CDI, and with a mean length of utterance (MLU) of 3.5 or less. Monolingual participants were from English-speaking homes with no exposure to other languages. Bilingual participants had experienced ongoing, intensive, prolonged exposure to two languages with at least one language being English.

They were either balanced bilinguals or English dominant bilinguals and they used both languages productively at least at the one word level. Children with DS were matched to typically developing children according to developmental level. Monolingual children with DS ranged from 31-101 months of age and had an average mental age of 31.4 months; the bilingual children with DS ranged from 55-137 months of age and had an average mental age of 35 months; and the typically developing children ranged from 24-45 months of age. Results indicated similar lexical profiles for the monolingual and bilingual children with DS. Both typically developing groups performed significantly better on all three English measures (total words in language sample [TW], number of different words [NDW], and MLU) than the monolingual DS group, but only the monolingual typically developing group performed significantly better on the total words measure than did the bilingual DS group. Bilingual children with DS with the highest mental age scores also had the highest Preschool Language Scale (PLS-3; Zimmerman, Steiner, & Pond, 1992), PPVT (Dunn & Dunn, 1981) and MLU-English scores. Duration of exposure was not significantly correlated with any second language measure in the bilingual DS group. The fact that the two DS groups did not differ significantly in their performance on any of the English language measures supports the notion that bilingualism is not detrimental to the dominant language development of children with DS, at least when they experience intensive, ongoing, and consistent exposure to both languages. Although little evidence for an advantage of bilingualism was found, the monolingual DS group did differ significantly from typically developing controls more often that the bilingual DS group. Results provided evidence that some children with DS may be more successful than others in becoming bilingual. There was considerable diversity in the

second-language abilities of the bilingual children; however, there was no evidence that bilingualism had a negative affect on language development.

Another study on bilingual language development in children with DS looked more specifically at vocabulary and morphosyntactic skills (Feltmate & Kay-Raining Bird, 2008). Four triads of children were studied, with each triad consisting of one bilingual child with DS, one bilingual typically developing child, and one monolingual child with DS. All bilingual participants had been exposed to two languages since at least 5 months of age. The children in each triad were matched for nonverbal mental age and completed the PPVT and a language sample in their respective languages as well as the PLS in English. Each speaker was compared to the two other speakers in the group, in order to evaluate whether he or she differed from them according to specific criteria. Feltmate and Kay-Raining Bird found that many of the semantic and syntactic production measures revealed difficulties in the language abilities of bilingual children with DS relative to the typically developing bilingual children. However, no significant differences were revealed between bilingual and monolingual children with DS on English measures, with the exception of verb diversity. When comparing the monolingual and bilingual children with DS, no discernable pattern of differences was evident for either TW or NDW. In terms of NDW, bilingual children with DS in three triads exhibited greater diversity in English samples than in French samples. Both monolingual and bilingual DS participants showed similar patterns of language deficits relative to typically developing controls, and they showed equivalent performance on the receptive PLS. However, they did not exhibit consistent similarities or differences when they were compared to each other on the language sample measures of English semantics and morphosyntax. Absence of a pattern of difference on measures of English vocabulary and

morphosyntax production when comparing monolingual and bilingual children with DS provides additional evidence that the introduction of a second language seems to have no detrimental effect on the development of the stronger language. No consistent effect of bilingualism was found.

Studies investigating the language development of bilingual children with SLI have found similar results. Thordardottir et al. (1997) used a single case alternating treatment design to examine the effectiveness of monolingual and bilingual treatment of English vocabulary for an Icelandic-English bilingual aged 4;11 with a language impairment. The boy's Icelandic language comprehension skills were at the 24-month level, his Icelandic language production skills were at the 18-month level, and his English skills were even more limited. Novel vocabulary was presented during 14 biweekly, 50-minute therapy sessions that were randomly led in either English or Icelandic. The treatment approach was the same across conditions in other aspects – vocabulary was presented in semi-structured play matched to the child's needs and interests. Treatment activities included objects and actions that permitted frequent use of target vocabulary. Production and comprehension of vocabulary lists were probed over three sessions. Four pairs of words that were comparable with regard to both comprehension and production were then selected for treatment. One word from each pair was assigned to each condition. The monolingual condition consisted of novel vocabulary only in English. During monolingual sessions, Icelandic utterances were neither answered nor expanded and the boy was reminded to speak in English so everyone would understand. The bilingual condition expanded on the boy's utterances in whichever language he chose to speak. Novel vocabulary was presented and discussed in both languages, words were translated directly, and explicit statements were made about which

words were English and which were Icelandic. The production of words was probed twice at the end of each session. The boy's production of the target vocabulary increased markedly in both conditions, with no clear difference in the total number of words learned between treatments. This suggested that the bilingual intervention did not slow down language growth. For vocabulary words related to the home, the bilingual treatment offered a slight advantage over the monolingual treatment. The finding that bilingual intervention is at least as good as monolingual intervention in promoting vocabulary growth supports the view that bilingual intervention is desirable. Bilingual intervention has the added advantage of avoiding negative side effects that result from the elimination of one of the languages spoken around children who grow up in bilingual environments.

On a larger scale, Bruck (1982) examined the language skills of typically developing children and children with SLI in both additive bilingual immersion and English-only schooling with eventual French as a second language learning. Children with language impairment and typically developing children were matched based on sex, age in months, classroom teacher, and father's occupational status. They were then categorized into four groups – French Immersion with language impairment; English stream with language impairment; French immersion with normal language abilities; English stream with normal language abilities. Subjects were tested at the end of both kindergarten and grade one. Results indicated that the typically developing children performed significantly better on the Wechsler Preschool and Primary Scale of Intelligence (WPPSI) verbal scale (Weschler, 1952) than the children with language difficulties, and that on the WPPSI performance scale there was a significant linguistic ability affect, significant language of instruction affect, and significant interaction effect. The English language impaired group did significantly less

well on the performance scale than the other three groups, who were similar. Overall, the linguistic level language of instruction interaction was not statistically significant, indicating that the language of instruction did not differentially affect the linguistic or cognitive functioning of either group. In summary, the English speaking children with language impairments attending French immersion programs demonstrated comparable cognitive, first language, and academic skills to similar children educated only in their first language. One can conclude that the French immersion children with language difficulties acquired proficiency in French at no cost to first language development, academic progress, or cognitive skills. Such results are consistent with the hypothesis that first language (L1) and pre-literacy skills predict achievement in second language (L2) programs. Because both groups of children with language impairment acquired skills to the same level of proficiency, there is no evidence to support the psycholinguistic position that posits that language education for children with low levels of L1 competence will result in poor levels of L1 and L2 development and poor scholastic achievement. Rather, Bruck argues that the differences are related to social psychological conditions.

To summarize, types of language deficit, severity of language disorder, and the type and availability of input in each language all influence L1 and L2 learning (Guiterrez-Clellen, 1999). Despite this, the evidence suggests that children with language impairment have the capacity to be bilingual. Bilingualism itself does not seem to affect language development in children with language impairment.

1.4 Bilingualism in Children with ASD

To date, there are only five available studies on bilingualism and autism, and only two of them have been published. The first published one was a case study that investigated

bilingual speech-language intervention for a Korean-English bilingual child with autism living in the United States of America (Seung, Siddiql, & Elder, 2006). The child had been diagnosed with a language delay at age 3;0, and with autism at age 3;6. A Korean-English bilingual speech-language pathologist (SLP) provided speech-language intervention. Therapy began shortly after an autism diagnosis was provided and took place twice weekly. For the first 12 months, therapy was provided in Korean, the child's primary language; the next 6 months involved intervention that gradually introduced English; and the final 6 months consisted of intervention that was almost entirely in English. Intervention built on the connection between prelinguistic and linguistic development, including expectant waiting, imitation with animation, joint attention, gestures, and pretend play. The boy's parents were trained to use intervention methods in the home in order to facilitate generalization of the boy's language use. Vocabulary building intervention was provided, and as the child made progress in producing words in his primary language, English interventions were introduced at the single word verb and noun level. Intervention also included pragmatic goals – negotiation to select a toy for an activity, transition from task to task, social greeting, social smiles, verbal requests, and turn taking. Progress was measured using the PPVT and Expressive Vocabulary Test (EVT; Williams, 1997) at four time points every 6 months. When the child could not respond to test questions in English, the question was repeated in Korean. At the last time point, tests were administered in English only. Therapy resulted in notable gains in language production and comprehension development in both languages as well as decreases in aberrant behaviours. The boy went from correctly answering 13 out of 24 administered items on the PPVT at Time 1 to a standard score of 81 on the PPVT at Time 4. He was unable to complete the EVT at Time 1 but obtained a

standard score of 105 on the EVT at Time 4, after two years of treatment. The results support the practice of providing intervention in the home language in order to establish a linguistic foundation when English, the language of the majority culture, is not used at home (Seung et al., 2006).

The second published report on autism and bilingualism investigated the experiences of families who had been advised by professionals to restrict language input to one language for their bilingual children with high functioning autism (HFA; Kremer-Sadlik, 2005). The report highlighted data from parental interviews and video recordings of home interactions of four children who came from homes in which the native language was not English. The interviews found that, when families followed advice to speak only English to their child with HFA, the child did not take part in family conversations, the parents addressed the child infrequently, and the parents rarely ended up using English in family conversations. The paper reported, that based on available research, there is no sufficient support for the claim that multilingualism harms the language acquisition of language impaired children and that it is very important for children with HFA, who suffer from sociopragmatic deficits, to speak the home language. Kremer-Sadlik further stated that because children with HFA need to be exposed to a variety of social situations in order to learn the rules of speech acts and social functioning, their access to conversations should not be limited. When these interactions take place in a language that the child does not understand, the child is deprived of important learning occasions (Kremer-Sadlik, 2005). One family in the study that did not take the professional advice and continued to speak both languages saw their child with HFA develop into a bilingual speaker. The family added more English to the home after their son's diagnosis, and the mother spoke to the boy in English while his grandfather spoke to him in

Chinese. The boy's language skills developed, he began to speak more, and the family returned to speaking mostly in Chinese, with the boy answering back in both languages. These findings demonstrated that limiting the home language input can have negative effects on social functioning, whereas maintaining both languages can resulte in a child being bilingual.

The remaining three papers available on ASD and bilingualism were presented in 2008 and 2009 at the International Meeting for Autism Research (IMFAR). IMFAR was created so that ASD researchers around the world can quickly disseminate current, up-and-coming research, and every year hundreds of presentations are made. All three of the bilingualism papers presented at IMFAR support the finding that bilingualism does not impede language development in children with ASD. One study compared early language milestones and spoken vocabulary in monolingual and bilingual children with ASD aged 18 months to 6 years (Hambly & Fombonne, 2009). Phone interviews were administered to gather information regarding the children's language exposures and developmental history, and the CDI was used to collect a total dominant language vocabulary and a total conceptual vocabulary for the children. The two groups did not differ in mean age in months at time of first spoken word or first spoken phrase. Statistical analysis did not reveal a statistically different size of vocabulary, as measured in raw CDI scores, in either the dominant language (MON = 369, BIL = 394), or the total conceptual vocabulary (MON = 369, BIL = 429). Another study (Leadbitter et al., 2009) matched bilingual children with ASD between 2 and 5 years of age to monolingual children with ASD based on chronological age, gender, autism severity, and socio-economic status. Each child was administered the PLS, the Vineland Adaptive Behavior Scales Classroom Edition (Sparrow, Bolla, & Ciccetti, 1984), and the

CDI. Stepwise regression analyses were conducted to investigate the effect of bilingualism, as measured by questions about family language use, and ethnicity on language scores. While ethnicity significantly predicted language production scores on the PLS and language comprehension scores on the CDI, degree of bilingualism was not a significant predictor of any language scores. Researchers concluded that bilingualism had neither a positive or negative effect on language development in preschool children with autism. The final study looked specifically at monolingual English and bilingual English-Spanish toddler-age children with ASD (Valicenti-McDermott, Schouls, Molly, Tarshis, Seijo, & Shulman, 2008). A retrospective chart review of 50 toddlers with ASD revealed no differences in demographics, maternal education, cognitive testing, and Childhood Autism Rating Scale (Schopler, Reichler, & Renner, 1986) scores between the two groups. The bilingual children were more like to use two or more gestures than monolingual children, but no other differences in expressive skills, communicative function, or speech production were found. This difference in gesture use has also been observed in typically developing children. In summary, from these recent reports there does not appear to be any indication that individuals with ASD should limit language use to one language only.

To conclude, there is very limited research in the area of autism and bilingualism. While Hambly and Fombonne (2009) compared CDI scores of monolingual and bilingual children with ASD, limited information regarding their lexical composites and language use is provided. In addition, while Leadbitter et al. (2009) provided information regarding CDI scores and PLS scores, details regarding the bilingual participants' second language skills are lacking. In order to determine whether bilingualism impacts the language development of children with ASD we need to have a complete description of their lexical abilities and

language use in both languages. Research in the area of lexical ability seems a logical starting point, because it has been investigated in other populations with language impairment, and because lexical development is a reliable predictor of language development in both typically developing children and children with ASD.

1.5 Crosslinguistic Differences in Lexical Development between Chinese and English

Research by Tardif, Gelman, and Xu (1999) has shown that Mandarin speakers use a relatively higher proportion of verb types in their production vocabularies than English speakers, although children use a higher proportion of nouns than adults. In this study, which examined 24 American English- and 24 Chinese Mandarin-speaking mother-child dyads using a modified CDI and parent's retrospective responses regarding their children's first words, the authors found that verbs constituted a larger proportion of the words that Mandarin-speaking children said in comparison to the English-speaking children. Furthermore, Mandarin-speaking children produced significantly more verbs as first words than English-speaking children.

Children with ASD are said to have an impaired theory of mind, the ability to infer mental states, such as beliefs, desires, and emotions, and to realize that other individuals have different perspectives and interpretations of the world, and impaired use of mental state terms (Baron-Cohen et al., 2005). Typically developing children first understand the motivations of other actors in terms of simple wants and needs and then move toward understanding that others' representations of the world may differ from their own and that these differences in information about the world may affect people's actions (Astington & Gopnik, 1991; Flavell, 1988). Mental state references typically depend on verbs such as *want, think,* and *know*. Thus, verb learning could influence the pattern of acquisition of

mental state vocabulary. In fact, one study by Tardif and Wellman (2000) involving ten Mandarin-speaking and eight Cantonese-speaking toddlers found that Chinese-speaking children use desire terms before other mental state references just as English-speaking children, but they use desire terms significantly earlier. Alternatively, Chinese-speaking individuals use terms for thinking much less than English-speaking individuals. Research has examined the difference in the use of nouns and verbs and the difference in the use of mental state words across language, as well as across different populations of developing children. The current study will also investigate these differences in bilingual children with autism.

1.6 The Current Study

A review of the literature revealed that there is no evidence to support the claim that bilingual families with children with ASD should limit linguistic input to one language. Despite this, there are professionals who continue to make such a recommendation. Further research is needed in order to increase our understanding with regards to bilingual language development in children with ASD. Therefore, the current study aimed to address the following main research question:

Do the English lexical skills of bilingual preschool-age children with ASD differ from those of monolingual preschool-age children with ASD?

The following specific questions were also addressed:

a. Is the number of lexemes different for these two groups (when their two vocabularies are added together and translation equivalents are counted only once)?

b. Do bilingual English-Chinese preschool-age children with ASD develop a different number of nouns and verbs than English monolingual children with ASD?

c. Are there more mental state words in Chinese than in English for bilingual English-Chinese children with ASD? Is the number of English mental state words different for bilingual vs. monolingual children with ASD?

2. Method

2.1 Participants

2.1.1 Subject Pool One

Participants for this study were drawn from two pools of data. The first pool came from a previously collected database from the Autism and Developmental Disabilities (ADD) Laboratory at the University of British Columbia. This research was collected between 2001 and 2006 for a project that examined early intervention outcomes for children with autism and their parents in British Columbia, Canada. Seventy children with autism participated in this project and were seen annually for language, cognitive, and social assessment. These data consisted of monolingual participants who had only been exposed to English on a daily basis, and bilingual participants who were also exposed to any additional language. The ADD database includes information on English vocabulary and language skills, which was compared to those of the bilingual participants in the second pool, described below. Fourteen participants were selected from this database to be used in the current study. Four of the participants had a diagnosis of PDD-NOS and 10 had a diagnosis of autism. These 14 participants were matched to the bilingual participants using nonverbal IQ measures, explained in section 2.4 below. Their chronological age ranged from 33 to 67 months, with an average of 55.8 months. The production vocabularies of these participants ranged from 299-678 words, with an average of 526 lexical items, based on the CDI. All of the participants were male. Of the 14 participants, five had mothers with a high school diploma, four had mothers with some trade school or college education, four had mothers with a bachelor's degree, and one had a mother with a graduate degree. Additionally, children had attended an average of 947.1 hours of preschool and/or daycare, and 1891.3

hours of therapy at the time these data that were used. Therapy largely included behavioural therapy interventions, with an average of 910 hours; and speech-language therapy, with an average of 42 hours. Other therapies averaged a total of 29 hours, and included infant development consulting, occupational therapy, physical therapy, auditory integration therapy, and psychological counseling.

2.1.2 Subject Pool Two

Subject pool two consisted of 14 bilingual children. These children all had an autism diagnosis without any other developmental disability or hearing or vision difficulties. The parents for 13 out of the 14 children confirmed that their child had received an ASD diagnosis from the Sunny Hill Health Centre for Children, an agency of the British Columbia Provincial Health Services Authority. Sunny Hill has a specialized multidisciplinary team for children with ASD and is the provincial resource for diagnosis and assessment. The Health Centre follows the *Standards and Guidelines for the Assessment and Diagnosis of Young Children with ASD in BC* that was created for the British Columbia Ministry of Health Planning (Dua, 2003). The Sunny Hill diagnosis was utilized as an inclusion measure to ensure that appropriate, gold standard assessment measures, such as the Autism Diagnostic Interview and the Autism Diagnostic Observation Schedule, were used in the diagnostic process. Only one of the children was diagnosed by a private organization, but a similar diagnostic procedure was used.

For the purposes of this study, bilingual individuals were operationally defined as bilingual learners who were exposed to both Chinese and English on a daily basis before the age of 4. The Chinese language could be either Cantonese or Mandarin. The basic requirement for inclusion was that both languages were currently spoken on a daily basis;

that at least one parent could speak, read, and write in English; and that at least one parent could speak, read, and write in Chinese. Further inclusion criteria required that all participants were verbal, which was operationally defined as having a production vocabulary of at least 30 words across both languages, as indexed by scores on the English and Cantonese or Putonghua CDI (CCDI; PCDI; Tardif & Fletcher, 2008). Thirty was chosen as a vocabulary minimum based on the monolingual data previously collected for the ADD laboratory; the vocabulary size of preschool-age monolingual children with ASD in the ADD data ranged from 32-678 lexical items, and in order to include as many participants as possible, a low number was selected. Inclusion criteria also required that all participants used oral language as their primary means of communication, not picture symbols or sign language, in order to focus specifically on early oral lexical development and control for any extraneous variables. Because ASD occurs more frequently in the male population than in the female population (Fombonne, 2005), gender was not controlled for in either group. A questionnaire was given to the primary caregiver to ensure that the child was bilingual according to the operational definition, and to control for maternal and paternal education.

The 14 bilingual participants were recruited from the Greater Vancouver Regional District. Four of these participants had a PDD-NOS diagnosis and 10 had an autism diagnosis. These participants ranged in chronological age from 43 to 73 months, with an average age of 59 months. The production vocabularies of these participants ranged from 324-926 words, with an average of 666 lexical items. Thirteen boys and one girl made up the bilingual group. Of the bilingual participants, two had mothers with a high school diploma, three had mothers with some trade school or college education, seven had mothers with a bachelor's degree, and two had mothers with a graduate degree. Additionally, these children

had attended an average of 1735.8 hours of preschool, kindergarten and/or daycare, and 1391.6 hours of therapy. Therapy largely included behavioural therapy interventions, with an average of 506 hours, and speech-language therapy, with an average of 107 hours. Other therapies averaged a total of 190 hours, and included Reference & Regulate therapy, social group programs, infant development consulting, supported childcare consulting, occupational therapy, musical therapy, physical therapy, and art therapy.

Ten of the families spoke Mandarin and 4 spoke Cantonese. Thirteen of the families consisted of two primarily Chinese-speaking parents, and one family consisted of a Chinese-speaking mother and English-speaking father. Language use in the home for these individuals consisted of the following:

- Eight families spoke Mandarin at home, with some use of English words.
- One family had a primarily Mandarin-speaking mother and grandparents, and a primarily English-speaking father. The mother spoke to the child in both languages, the grandparents in Mandarin, and the father in English.
- One family spoke Mandarin at home and started to speak to the child primarily in English once the child turned 3. This child had always heard some Cantonese in the home as well.
- One family spoke Cantonese, Minqing, and Chiu Chow at home.
- One family spoke half in English and half in Cantonese at home until the child was in preschool, at which point Cantonese was only used with the grandparents.
- One family spoke Cantonese at home, and English had also been added when the child turned 3.
- One family spoke Cantonese until the child was 3, and then primarily English to the child.

2.2 Procedures

For the bilingual group, once contact was made with a primary caregiver, and two meetings were booked to take place in the family home. These meetings were usually separated by one week, but in some cases schedules did not allow for this, or participants fell sick. The longest time between two meetings was 16 days. At the first meeting, parents were briefly interviewed to determine parental education, the extent to which each language was used, and the amount and types of therapy their child had received. During the each of the two meetings, two assessments were administered for each child, with a total of four tests administered in total. The author of this paper administered all English assessments. Chinese research assistants who were native Chinese speakers and who were practiced in the administration of the Chinese assessment tasks administered the Chinese tasks used in this study.

2.3 Tasks Administered

Administration of the four tests was counter-balanced to ensure that no order effect occurred. Furthermore, the two versions of the Peabody Picture Vocabulary Test, one in Chinese and one in English, were never administered on the same day. Children were randomly assigned to the different testing schedules. The tests used in this study were also used during data collection for the ADD research laboratory, with the exception of the Chinese assessments. Detailed purposes of these tests and how they were administered are outlined below.

2.3.1 The Peabody Picture Vocabulary Tests

The Peabody Picture Vocabulary Test-III (PPVT-III) is norm-referenced standardized assessment tool was designed to measure a child's comprehension vocabulary

attainment for standard English and as a screening test of verbal ability (Dunn & Dunn, 1997. The examiner orally presents a stimulus word and the test taker selects the picture that best represents the meaning of the word from a choice of four. The Chinese version of the PPVT-R (Lu & Liu, 1994) is a norm-referenced standardized assessment tool designed to measure a child's comprehension vocabulary attainment in Chinese. Like its English counterpart, the task of the test taker is to select the one picture, from a choice of four, that best represents the meaning of a stimulus word presented orally by the examiner.

2.3.2 The Preschool Language Scale

The PLS-3 (Zimmerman et al., 1992) is standardized diagnostic instrument was created to assess comprehension and production language skills in infants and young children. Children are asked to perform brief tasks such as identifying pictures and objects, following directions, finishing sentences, and defining words.

2.3.3 Subtests of the Mullen Scales of Early Learning

The Mullen Scales of Early Learning (MSEL) are a measure of cognitive functioning for infants and children from birth through 68 months of age (Mullen, 1995). The Visual Reception and Fine Motor Scales were used in this study as a measure of the children' non-verbal skills. The Visual Reception Scale primarily tests a child's visual discrimination and visual memory. Abilities involved in processing visual patterns include visual organization, visual sequencing, and visual spatial awareness, including concepts of position, shape, and size. The Fine Motor Scale examines visual-motor ability and primarily tests unilateral and bilateral manipulation in tasks related to writing readiness, the intrasensory activities require visually directed motoric planning. The MSEL was chosen because it was included in the ADD lab study and could be administered by the author of this paper.

2.3.4 The Communicative Development Inventories

In addition to the parent interview and testing activities, parents were given both the MacArthur Communicative Development Inventory – Words and Sentences (CDI; Fenson et al., 1993) and a Putonghua (Mandarin) or Cantonese Communicative Development Inventory (PCDI; CCDI; Tardif & Fletcher, 2008).

The CDI focuses on emerging behaviours, and thus relies on parents' recognition of their child's vocabulary, as opposed to recall (Pearson et al., 1993). Use of the CDI has been suggested for children with autism who are older than 2 years but functioning at the toddler level (Charman, Drew, Baird, & Baird, 2003).

The CCDI and PCDI were standardized for typically developing Cantonese- and Putonghua-speaking children between 8 and 30 months of age, respectively. The forms, which were closely modeled on the original CDI, were adapted linguistically and culturally Chinese children from Hong Kong and Mainland China (Tardif & Fletcher, 2008). Four forms are available in each language: (a) Words and Gestures Long Version, (b) a Words and Sentences Long Version, (c) a Words and Gestures Short Version, and (d) a Words and Sentences Short Version. The long forms were used for the purposes of this study because they are a more thorough assessment of language ability.

The Words and Gestures form includes a list of words divided into semantic categories that the parent checks off if the child can *understand* and if the child can *say* the word. The Words and Sentences includes is a list of words that the parent checks off if the child can *say them*. The semantic categories included on the CCDI and PCDI are the same as those on the English CDI, with an additional category for non-translatable words that convey expression and emotion, and an additional category for classifiers.

The checklists were usually given at the first meeting and picked up at the second meeting. However, because access to the CCDI and PCDI did not occur until testing had already begun, the first three families were given the English and Chinese CDI forms after the two meetings and then asked to mail them back in a self addressed envelope within 2 weeks.

2.4 Data Preparation

Children from the monolingual pool were matched to the bilingual participants based on non-verbal ability using scores from the MSEL. Matching on nonverbal ability is frequently implemented when studying the language abilities of children with language impairment because it allows researchers to compare their findings to the profile of language abilities that are seen in typical development. The MSEL has been used in previous studies as a non-verbal measure for children with ASD (Chawarska, Paul, Klin, Hanngen, Dichtel, & Volkmar 2007; Lord, Risi, Lambrecht, Cook, Leventhal, DiLavore, Pickles, & Rutter 2000) and has been found to correlate highly with language comprehension and production measures (Taylor, Pickering, Lord, & Pickles, 1997). For each MSEL subcategory a standardized *T* score is calculated. *T* scores have a mean of 50, and a standard deviation of 10. Nonverbal scores were calculated by adding the fine motor subcategory *T* score and the visual recognition subcategory *T* scores together. Once the scores were calculated for the bilingual children, monolingual children with matching nonverbal *T* scores were selected from the ADD database. When exact matches could not be made, due to a lack of such scores in the ADD database, participants with the closest available score were selected. This resulted in a slightly lower mean nonverbal *T* score for the monolingual group. The bilingual group had a mean nonverbal score of 91.36, and the monolingual group had a mean

nonverbal score of 77.14. This difference, however, was not statistically significant, as is explained in the following chapter.

Standard scores were calculated for the MSEL subcategories, the English and Chinese PPVTs, and for the PLS Auditory Comprehension component, Expressive Communication component, and Total Language score. Several scores were calculated using the English and Chinese Communication Development Inventories (CDIs). These included: (a) an English CDI raw score for each child, which was the total number of words parents checked off as spoken by their child; (b) a Chinese CDI raw score for all bilingual children, which was the total number of words parents checked off as spoken by their child in Chinese; (c) a total CDI score for each child, which consisted of the English CDI raw score for the monolinguals and the English CDI raw score summed with the Chinese CDI raw score for the bilinguals; and (d) a total conceptual CDI score for each child, which was designed as a measure of all concepts lexicalized in either language by the child. For the monolinguals, this measure consisted of the English CDI raw score. For the bilinguals, this measure consisted of all the words in one language plus all the words from the other language that represented concepts or linguistic functions not on the CDI in the first language (Pearson et al., 1993). A single concept known by different words in English and Chinese was counted only once in the total conceptual vocabulary. For example, “mother” in English and the equivalent “媽媽” in Chinese were counted only once. In addition to these CDI scores, the number of nouns and the number of verbs on each form were calculated, and scores were determined for each participant. These included: (a) an English total noun score; (b) an English total verb score; (c) a Chinese total noun score for bilingual participants only; (d) a Chinese total verb score for bilingual participants only; (e) a conceptual noun score,

which consisted of all the nouns in one language plus all the nouns from the other language that represented concepts not on the CDI in the first language; and (f) a conceptual verb score, all the verbs in one language plus all the verbs from the other language that represented concepts not on the CDI in the first language. Because we were looking for general trends when comparing the monolingual and bilingual groups, nouns other than common nouns were not included in this grouping; pronouns and proper nouns were excluded from the noun category, so that only object nouns were included.

Once all scores were calculated, statistical analyses were performed.

3.0 Results

3.1 Lexical Scores

Independent groups *t*-tests were run on the CDI scores. Table 3.1 provides a summary of the descriptive statistics on the CDI and PPVT variables. Statistical analyses revealed no significant difference between the two groups on their English CDI scores, $t(1,26) = -.951$, $p = .351$. Significant differences were found, however, for the total vocabulary size and the conceptual vocabulary size. The bilingual participants had larger scores than monolinguals for total vocabulary, $t(26) = 3.505$, $p = .002$ and conceptual vocabulary, $t(1,26) = 2.179$, $p = .039$. Statistical analyses were also run to compare the English vocabulary comprehension skills of the two groups using the English PPVT. The bilingual children were found to have significantly higher standard scores, $t(1,26) = 2.415$, $p = .023$. Table 3.1 provides a summary of the descriptive statistics on the CDI and PPVT variables.

Table 3.1 DESCRIPTIVE STATISTICS COMPARING MONOLINGUAL AND BILINGUAL PARTICIPANT GROUPS ON COMMUNICATIVE DEVELOPMENT INDEX (CDI) MEASURES AND ENGLISH PEABODY PICTURE VOCABULARY TEST (PPVT) SCORES

Measure	**Monolingual**	**Bilingual**
	Mean (SD)	**Mean (SD)**
English CDI Score	526.00 (148.69)	476.79 (124.15)
Chinese CDI Score	-	378.21 (273.31)
Total CDI Score (English; English + Chinese)*	**526.00 (148.69)**	**855.00 (318.22)**
Conceptual CDI Score*	**526.00 (148.69)**	**666.14 (189.19)**
English PPVT Standard Scores*	**81.71 (15.64)**	**96.79 (17.35)**

Additional analyses were run to compare the language comprehension and production skills of the two groups. Table 3.2 provides a summary of the descriptive statistics on these variables. There was no significant difference between groups on the production component of the Preschool Language Scale (PLS-3), $t(1,26) = 1.314$, $p = .200$. However, bilingual children were found to have significantly higher standard scores on the Auditory Comprehension component of the PLS-3, $t(1,26) = 2.321$, $p = .028$, and on the Total Language score of the PLS-3, $t(1,26) = 2.349$, $p = .027$.

Table 3.2 DESCRIPTIVE STATISTICS COMPARING THE MONOLINGUAL AND BILINGUAL GROUPS ON THE PRESCHOOL LANGUAGE SCALE (PLS-3)

Measure	**Monolinguals**	**Bilinguals**
	Mean (SD)	**Mean (SD)**
PLS-3 Auditory Comprehension Standard Score*	**74.21 (16.58)**	**89.57 (18.38)**
PLS-3 Expressive Communication Standard Score	68.00 (18.99)	78.86 (24.38)
PLS-3 Total Language Standard Score*	**69.93 (18.00)**	**86.64 (19.61)**

In addition to analyses comparing the monolingual and bilingual participants, analyses were also run to compare the English and Chinese vocabulary skills of the bilingual participants. The descriptive statistics on these variables are presented in Table 3.3. No significant differences were found between the English and Chinese CDI scores, $t(1,13) = 1.313$, $p = .212$ or the English and Chinese PPVT scores, $t(1,13) = 1.964$, $p = .071$. However, the mean English PPVT score was higher than the mean Chinese PPVT score, and while the English mean score was close to the standard mean, the Chinese mean score was almost one standard deviation below the mean.

Table 3.3 DESCRIPTIVE STATISTICS COMPARING THE ENGLISH VOCABULARY SKILLS AND CHINESE VOCABULARY SKILLS OF BILINGUAL PARTICIPANTS ON THE CDIS AND PPVTS

Measure	**English**	**Chinese**
	Mean (SD)	**Mean (SD)**
CDI	476.79 (124.15)	378.21 (273.31)
PPVT Standard Score	96.79 (17.35)	79.50 (36.15)

3.2 Nouns and Verbs

The descriptive statistics on the noun and verb scores are presented in Table 3.4.

Table 3.4 DESCRIPTIVE STATISTICS ON VOCABULARY MEASURES COMPARING THE USE OF NOUNS AND VERBS AMONG MONOLINGUAL AND BILINGUAL GROUPS

CDI Scores	**Monolinguals**	**Bilinguals**
	Mean (SD)	**Mean (SD)**
English Nouns	277 (58.37)	246.29 (52.52)
English Verbs	89.57 (37.58)	85.93 (30.81)
Conceptual Nouns	277 (58.37)	306.21 (71.78)
Conceptual Nouns Percent Correct*	**82.93 (17.48)**	**64.07 (16.15)**
Conceptual Verbs*	**89.57 (37.58)**	**147.43 (59.62)**
Conceptual Verbs Percent Correct	72.24 (30.31)	59.36 (22.51)

A repeated-measures ANOVA comparing English noun scores and English verb scores for the monolingual and bilingual groups revealed a significant main effect of word type, $F(1, 26) = 849.01$, $p < .0001$, in which the children produced more nouns than verbs in English; a non-significant language group effect, $F(1, 26) = 1.097$, $p < .305$; and an interaction effect of word type and language group, $F(1, 26) = 5.14$, $p < .032$. Figure 3.1 illustrates the interaction between language groups and the proportion of English nouns and

verbs used. Because the interaction between word type and language group was significant, an additional independent *t*-test was run to compare the language groups on number of nouns and verbs separately. The *t*-test analysis revealed that the bilinguals did not have a significantly larger number of nouns, $t(1,26) = -1.464$, $p = .155$ or verbs, $t(1,26) = -.280$, $p = .781$ in their English vocabularies than the monolinguals.

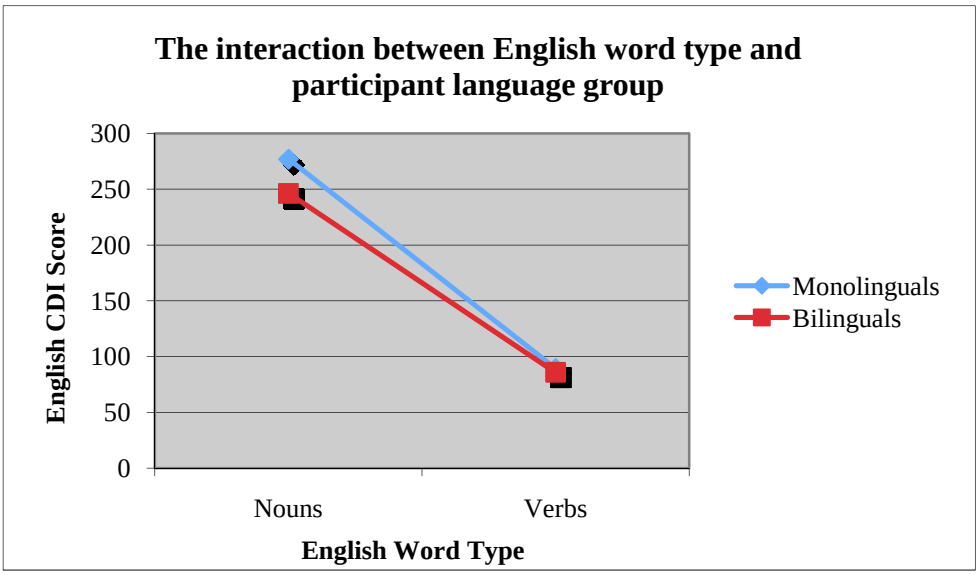

FIGURE 3.1 THE INTERACTION BETWEEN ENGLISH WORD TYPE AND PARTICIPANT LANGUAGE GROUP

Next, a repeated-measures ANOVA comparing conceptual noun scores and conceptual verb scores for the monolingual and bilingual groups revealed a main effect of word type, $F(1, 26) = 921.808$, $p < .0001$, in which the children produced more conceptual nouns than verbs; a language group effect, $F(1, 26) = 4.206$, $p < .050$, in which bilingual participants had significantly more nouns and verbs in their conceptual vocabulary than the monolingual participants; and an interaction effect of word type and language group, $F(1, 26) = 6.309$, $p < .019$. Figure 3.2 illustrates interaction between language groups and the proportion of conceptual nouns and verbs used. Because the interaction between word type

and language group was significant, an additional independent *t*-test was run to compare the number of nouns and verbs in the conceptual vocabulary of monolinguals and bilinguals. The *t*-test analysis revealed that the bilinguals did not have a significantly larger number of nouns in their conceptual vocabularies, $t(1,26) = 2.179$, $p = .039$. However, the bilinguals did have a larger number of verbs in their conceptual vocabulary than the monolinguals, $t(1,26) = 3.072$, $p = .005$.

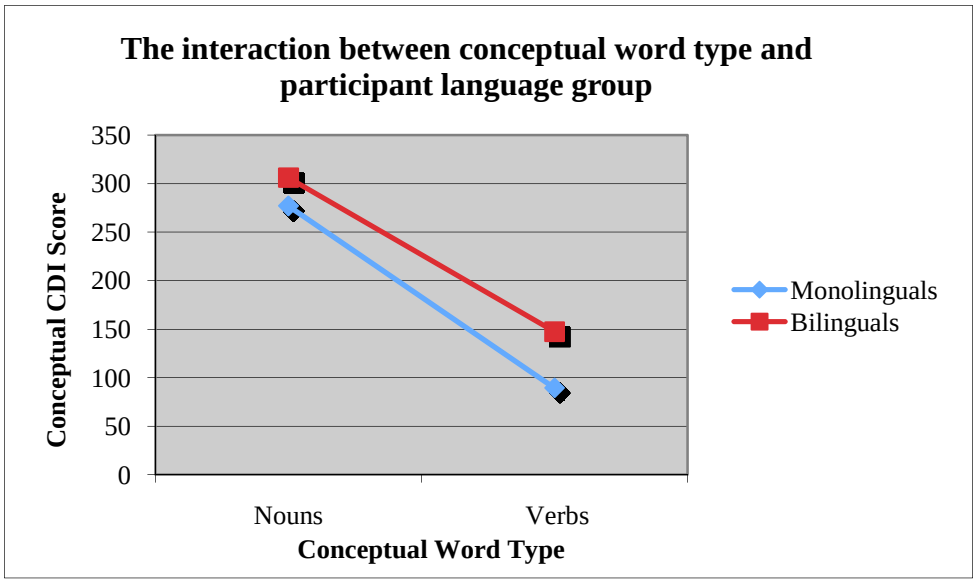

FIGURE 3.2 THE INTERACTION BETWEEN CONCEPTUAL WORD TYPE AND PARTICIPANT LANGUAGE GROUP

Finally, the percent of nouns and verbs checked off on the CDIs were also used in the analysis because there were more nouns and verbs in the conceptual vocabulary checklist for the bilingual participants than for the monolingual participants. While monolinguals could get a maximum of 334 nouns and 124 verbs on their conceptual vocabulary checklist, Mandarin-speaking bilinguals could get a maximum of 472 nouns and 253 verbs, and Cantonese-speaking bilinguals could get a maximum of 501 nouns and 225 verbs on their conceptual vocabulary checklists. A repeated-measures ANOVA comparing conceptual

noun percent checked off scores and conceptual verb percent checked off scores for the monolingual and bilingual groups revealed a main effect of word type, $F(1, 26) = 9.581$, $p < .005$, in which the children had a higher percent of nouns checked off than verbs; no interaction effect of word type and language group, $F(1, 26) = 1.447$, $p < .240$; and no language group effect, $F(1, 26) = 3.877$, $p < .060$. In summary, significant differences were only found between the percent of conceptual nouns and the percent of conceptual verbs used, but there was no difference between groups.

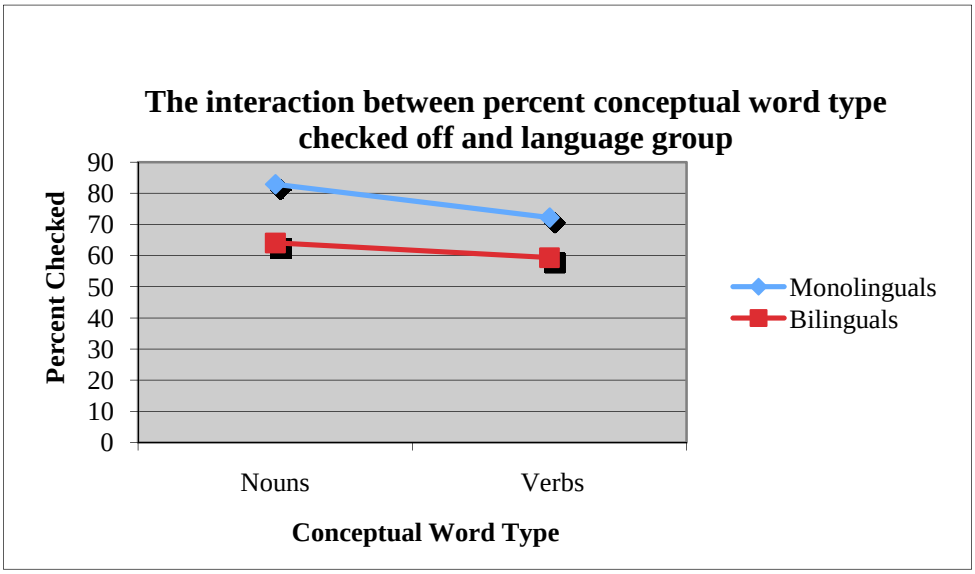

FIGURE 3.3 THE INTERACTION BETWEEN PERCENT CONCEPTUAL WORD TYPE CHECKED OFF AND PARTICIPANT LANGUAGE GROUP

After groups were compared on their use of nouns and verbs, the two languages of the bilingual participants were also compared (see Table 3.5 for the descriptive statistics). Using paired samples *t*-tests, the bilingual participants were found to have a larger number of English nouns than Chinese nouns in their vocabularies, $t(1,13) = 2.765$, $p = .016$. There was no significant difference in the number of verbs, $t(1,13) = -.524$, $p = .609$ although the children tended to produce more verbs in Chinese than in English.

Table 3.5 DESCRIPTIVE STATISTICS ON VOCABULARY MEASURES COMPARING THE USE OF NOUNS AND VERBS IN THE TWO LANGUAGES OF BILINGUAL PARTICIPANTS

Measure	English	Chinese
	Mean (SD)	Mean (SD)
Nouns*	**246.29 (52.52)**	**156.93 (118.22)**
Nouns Percent Correct*	**73.74 (15.73)**	**46.31 (34.86)**
Verbs	85.93 (30.81)	96.64 (75.83)
Verbs Percent Correct	69.30 (24.84)	46.93 (36.79)

The percent of verbs checked off was also used in the analysis because there were more verbs on the Chinese CDI (206 for Mandarin; 181 for Cantonese) than on the English CDI (124). The number of nouns was almost the same on the English (334) and Chinese CDIs (339 for Mandarin; 331 for Cantonese). Paired *t*-tests found that, while the percentage of nouns checked off was significantly different for English than for Chinese in the bilingual participants vocabularies, $t(1,13) = 2.874$, $p = .013$, the percentage of verbs checked off was not significantly different, $t(1,13) = 2.064$, $p = .060$.

3.3 Mental-State Terms

A mental-state score, representing the total number of mental-state words used on the CDI, was created for each language of every participant. We used the 78-item internal-state list from the work of Bretherton, McNew, and Beeghly-Smith (1981) to create the mental-state list. This list consisted of six categories: perception, physiology, affect, volition/ability, cognition, and moral judgment. The affect category was further divided into positive affect, negative affect, and expression. Words from the internal-state list were identified on the CDI forms and then a tally of these words was calculated. Forty-six of the internal-state words

were on the English and Mandarin CDIs, and 52 were on the Cantonese CDI. Therefore, the English and Mandarin mental-state scores were out of 46, and the Cantonese mental-state score was out of 52.

Independent group *t*-tests were run to compare the English mental state total scores and sub-categorical scores of the monolingual participants to the bilingual participants. Of the 46 words on the mental-state list, bilingual participants had an average of 33.6 words, and monolinguals had an average of 34.2 words. There was no difference in the total overall mental state score between the groups, $t(1,26) = -.128$, $p = .899$. Furthermore, no sub-categories differed significantly between the two groups.

Paired *t*-tests were run to compare the English mental-state scores to the Chinese mental-state scores of the bilingual participants. Bilingual participants had an average of 33.6 mental-state words in English, and 24.7 mental-state words in Chinese. Because the number of words in each sub-category varied for the different languages, scores for the percent of mental-state words checked off on the CDIs were calculated and analyzed with paired *t*-tests. Bilingual participants had significantly higher scores in English for percent checked off in the perception subcategory, $t(1,13) = 2.765$, $p = .016$; and for percent checked off in the moral judgment subcategory, $t(1,13) = 2.765$, $p = .016$. It is worth mentioning that 4 of the 14 bilingual participants had very low Chinese production vocabularies. The 4 participants were English-Cantonese bilinguals. Two of these children were spoken to in Chinese until the age of 3, and then their parents began to speak to them only in English. One child's parents started speaking to him largely in English at age 3, but kept speaking some Cantonese. The fourth child's parents continued to speak Cantonese to their child, but each parent spoke a different dialect. These children, despite being raised in bilingual

households, were much more proficient in English than Chinese and had less knowledge of Chinese than the other 10 participants in the bilingual group. Because of this, analyses were additionally run with these four participants removed from the bilingual group. Statistics run on the remaining 10 English-Mandarin participants revealed that the bilingual participants had an average of 34.5 words in English and 34.6 words in Chinese. Paired *t*-tests were run comparing the two languages of the remaining 10 English-Mandarin participants, and none of the percent checked off scores for the sub-categories differed significantly.

3.4 Summary

In summary, this study found no difference in the English CDI scores of monolingual English children with ASD and bilingual English-Chinese children with ASD. However, the bilingual participants had larger conceptual vocabulary scores and total vocabulary scores than the monolingual participants. While the bilinguals had a larger number of verbs in their conceptual vocabularies, the monolinguals had a higher percentage of the nouns on their conceptual checklist checked off. Both groups had a larger number of nouns than verbs in both their English and conceptual vocabularies. The groups did not differ in the number of English mental state words used. Bilingual participants were found to have higher English PPVT, PLS-3 Auditory Comprehension, and PLS-3 Total Language scores.

When comparing the two languages of the bilingual participants, there was no significant difference in the size of the English vocabulary and Chinese vocabulary of the bilingual children or in the PPVT scores for either language. The children had a greater number of nouns in English than in Chinese. When the four bilingual children with limited Chinese production vocabulary skills were removed from the group, the number of mental-state words did not differ between the two languages.

4. Discussion

4.1.1 Lexical scores

The primary goal of this study was to compare the production vocabularies of monolingual English and bilingual English-Chinese participants with ASD. Results demonstrated that the bilingual children had larger total production vocabularies and larger conceptual production vocabularies than the monolingual children, as well as equivalently sized English production vocabularies. This is consistent with previous research that has found typically developing bilingual children to have conceptual vocabularies of a size equal to or larger size than monolingual typically developing children (Nicoladis & Genesee, 1997; Pearson et al., 1993). The bilingual children with ASD in this study are not different from bilingual typically developing children when compared to their monolingual counterparts. This is also similar to previous research on children with language impairments, such as DS, which found no evidence that bilingualism had a negative effect on language development (Kay-Raining Bird et al., 2005). The current research further supports the position that bilingualism does not negatively affect language development, and expands this line of research to the ASD population.

It was expected that the two groups of children in this study would have similar English PPVT and PLS-3 scores because the bilinguals were receiving less English input than the monolinguals. However, the bilingual participants had higher English PPVT and PLS-3 scores than the monolingual participants. This may be related to the fact that both groups received their schooling and therapy in English, and therefore both groups were receiving a large amount of English input. Additionally, the bilingual data was collected approximately five years after the monolingual data was collected, and anecdotal evidence

suggests that both the quantity and quality of therapy services that children with ASD receive has increased significantly within the last five years. It is possible that the children in the bilingual group received a better quality of therapy and that this contributed to the difference in language scores. Although the total number of therapy hours did not differ between groups, the bilinguals received significantly more speech-language therapy and significantly less behavioural therapy than the monolingual group. It is also possible that having language input in two languages provided the bilingual children with a stronger language foundation. A large body of research has shown that bilingual children have better cognitive and linguistic abilities compared to their monolingual peers, including higher levels of metalinguistic awareness of words (Ben-Zeev, 1977; Marinova-Todd, in press; Rosenblum & Pinker, 1983).

This study also compared the English CDI with the Chinese CDI, and the English vocabulary comprehension skills (PPVT-III) with the Chinese vocabulary comprehension skills (Chinese PPVT-R) of the bilingual children with ASD. No significant differences were found on either of these measures when examining the bilingual group as a whole. Closer examination revealed that the standard deviation for the English and Chinese CDI scores were considerably different; the mean and standard deviation for the English CDI were 476.780 and 124.15 respectively, and 378.21 and 273.31 for the Chinese CDI. The large Chinese CDI standard deviation is due to the four Cantonese-English participants who had low Chinese production vocabularies. Removing the four participants from the sample would lessen the standard deviation, however, including the four participants did not result in a significantly different mean for the English and Chinese CDIs. These findings led us to conclude that the bilingual participants were balanced bilinguals, with the exception of the

four participants who showed larger production vocabularies in English. The majority of the participants were exposed to a large amount of Chinese, and their language skills were not suffering as a result.

4.1.2 Mental-State Vocabulary

Children with ASD are known to have an impaired use of mental-state terms (Baron-Cohen et al., 2005). Additionally, there are cultural differences in the use of mental-state terms between English and Chinese. Chinese-speaking children use desire terms significantly earlier than English-speaking children, and they also use terms for thinking much less than English-speaking individuals (Tardif & Wellman, 2000). We explored the use of mental-state terms among our participants to see if cultural differences carried over from one language to another in the vocabularies of bilingual English-Chinese children with ASD. No differences were found in the use of English mental-state terms for the monolingual and bilingual participants. Similarly, no differences were found in the use of mental-state terms between the two languages of the balanced bilinguals. What is interesting, however, is that, although neither the monolingual nor bilingual group produced all of the mental-state words expected of typically developing 30-month-old children (the age for which the CDIs are standardized), the monolingual and bilingual participants had learned the same number of mental-state terms in English, and the bilinguals had learned the same number of mental-state terms in English and Chinese. Additional research, in which parents are asked to fill out Bretherton et al.'s 78-item internal-state checklist for each of the child's languages in addition to the CDI forms, is needed to better understand crosslinguistic differences. In the meantime, the results of this study support previous findings that children

with ASD, both monolinguals and bilinguals, have an impaired use of mental-state words (Baron-Cohen et al., 2005).

4.1.3 Nouns and Verbs

This study also addressed whether the number of nouns and verbs that the monolingual children had in their production vocabularies differed from those of the bilingual children, and whether the number of nouns and verbs in English differed from the number of nouns and verbs in Chinese for the bilingual children. The study found that the number of English nouns and verbs did not differ between groups. Overall, both groups used more nouns than verbs in English and both had a higher percentage of nouns checked off than verbs checked off in English. The Chinese vocabulary checklists were designed for monolingual children living in China or Hong Kong. The bilingual children may have scored lower than the monolinguals on percent conceptual vocabulary nouns checked off because they had Chinese concepts on their conceptual checklist that were not relevant to their lives in Vancouver, and therefore, were not words to which they would ordinarily be exposed. Also, the bilingual conceptual checklist had more items than the monolingual checklist, and although percent checked off is a measure that can be used to reduce differences in raw scores, it was potentially more likely for monolingual participants to approach ceiling on the conceptual checklist because their checklist had fewer items and they were older than the group for which the checklist was standardized. In addition to differences in the percent of conceptual nouns checked off, there was also a significant difference in the number of conceptual verbs between the two groups. Bilingual participants were found to have a larger number of conceptual verbs in their production vocabulary than the monolingual participants. This may be because the bilinguals had almost double the number of verbs on

their conceptual checklists. Alternatively, this may be because the bilingual children used different concepts and/or more verbs at home in Chinese than the monolingual children used at home in English.

With regard to the percentage of nouns and verbs used in each language by the bilingual participants, the children were found to have a larger number of English nouns than Chinese nouns. There was no significant difference in the number of verbs between the two languages, although the bilingual participants tended to produce more verbs in Chinese than in English. Tardif et al., (1999) found that the Mandarin-speaking children had a tendency to produce more verb types than nouns types and that this was unrelated to overall vocabulary size. Our results support this notion that there is not a noun bias in the production vocabulary of Chinese monolingual children. The data also suggest that this lack of a noun bias carries over into the English production vocabulary of bilingual English-Chinese children, as reflected in the fact that the bilinguals had a lower percentage of nouns checked off than the monolinguals. However, more research is needed to further explore the vocabularies of English-Chinese bilingual children. A focus on the proportion of nouns to verbs is necessary to make any proper comparisons between our ASD group and work done by Tardif and her colleagues.

In summary, the facts that the English production vocabularies of the bilingual participants were not significantly different than those of the monolingual participants and that their conceptual production vocabulary was larger than the monolinguals supports our hypothesis that, for bilingual English-Chinese children with ASD, learning two languages does not negatively affect language development. This is consistent with research on typically developing bilingual children and bilingual children with language impairment.

4.2 Limitations

The study could be methodologically strengthened with alternative measures of non-verbal intelligence. The two nonverbal subtests of the MSEL have been used in other research with children with ASD (Anderson, Lord, Risi, DiLavore, Shulman, Thurm, Welch, & Pickles, 2007). However, it appeared that many children in the bilingual group reached high levels of the MSEL. In the monolingual group, if the children were above 69 months, the WPPSI was administered. This was not possible in the current study because the WPPSI needs to be administered by a psychologist, and a psychologist was not available.

The study could be strengthened methodologically by additional measures of production vocabulary. Although the CDI is commonly used in similar research with children older than the norming sample, one cannot be sure that these children did not have additional vocabulary items that were missed by the CDI. Additional measures, such as language sampling during play, could provide further insight regarding the vocabulary of these children.

Interpretation of the results of this study is somewhat limited by the measure of bilingualism that was used. Although all children were exposed to Chinese in the home, 3 of 14 were only spoken to in English. There was a large range of Chinese skills in the bilingual group, which is similar to the diversity in second-language abilities found in bilingual children with DS (Kay-Raining Bird et al., 2005). Determining levels of bilingualism in greater detail could provide more information regarding the possibility that some children may be more successful than others in becoming bilingual. The different amount of speech-language therapy and behavioural therapy between the two groups may also be seen as a limitation. Although there is the possibility that more speech-language therapy resulted in

better speech-language skills, this is a variable that needs to be controlled before concluding that the bilingual children had better language skills than the monolingual children.

Finally, the sample size of the current study is small and it is possible that the sample may not be fully representative of the bilingual English-Chinese community in the Greater Vancouver Regional District. Anecdotal evidence tells us that there is a notion of perceived shame around having a child with ASD in the Asian community. Supporting this notion, several SLPs and behaviour consultants reported to have clients who met the participant recruitment criteria but were not interested in participating because they didn't want to disclose their child's diagnosis. The results should be interpreted with caution.

4.3 Implications and Future Directions

This was the first study to evaluate the lexical development of bilingual children with ASD in both of their languages and have both of the languages be the same for all bilingual participants. Studying both languages of the bilingual participants gives a better understanding of the participants' language abilities. Additionally, the bilingual participants in this study spoke the same languages. Having the whole bilingual group speak the same languages allowed us to eliminate the possibility that some participants spoke languages that were more similar to each other than other participants. It is likely that the similarity between the two languages and the bicultural environment in which the child is raised are important factors that affect bilingualism in these children. The results from this study imply that children from minority language families should be encouraged to continue speaking their home-language, to ensure that the child is receiving high-quality social input and language input during his/her language development. Additionally, if possible, children could be provided with speech-language therapy in their first language when they have not

yet had any exposure to English. This could be gradually changed to include both English and the home language, in order to prepare the child for schooling and therapy in the majority language. A Canadian Association of Speech-Language Pathology and Audiology position paper on multiculturalism and multilingualism reported that intervention services should be provided by the SLP in the client's first language when appropriate, and that it is preferable for bilingual individuals to have bilingual/bicultural intervention (Crago & Westernoff, 1997). An example of such therapy for a child with ASD has been studied and resulted in positive outcomes (Seung et al., 2006).

Limited research has examined the lexical abilities of bilingual children with ASD, yet many early childhood professionals continue to recommend that families limit language input to one language only. Further research is needed to determine if specific levels of bilingualism in the environment, types of therapy, or any other confounding variables are correlated with levels of bilingualism acquired by children with ASD. Previous research on the typical population has established that bilingual children develop their lexicon at the same rate as monolingual children, and may even acquire a large number of conceptual lexemes at the same rate (Genesee et al., 2004). Bilingualism has been known to put children at certain cognitive and linguistic advantages (Marinova-Todd, in press). Research is needed to investigate the possibility that learning two languages results in children with ASD learning language differently. Additionally, a different measure of lexical skills may be necessary to remove the potential of CDI ceiling effects and to capture the vocabulary of bilingual atypical children more effectively. More investigation is needed to explain the reason for higher language comprehension scores among the bilingual children in this study. Exploring the language skills of monolingual and bilingual children with ASD by collecting

data for both groups at the same time would assist in bridging the gap between what the current study suggests, and what previous research has found. A longitudinal study would also allow for more vocabulary measures. Furthermore, additional research investigating the potential differences in mental state-terms, as well as differences in the use of nouns and verbs is needed.

4.4 Conclusion

The results from this study show that the English-Chinese bilingual preschool-age children with ASD had a larger conceptual production vocabulary than the English monolingual preschool-age children with ASD. Due to the limited sample size and vocabulary measures in this study, these results are preliminary and need to be replicated. Further investigation into the relationship between bilingualism and language comprehension scores is needed because the higher comprehension scores among bilingual participants were unexpected. A study comparing monolinguals and bilinguals during the same time period would be beneficial. This study suggests that children with ASD have the potential to be bilingual, and that speaking Chinese in the home and English at school and in therapy should not be considered a disadvantage to the language development of children with ASD. The information resulting from this study should influence the recommendations of speech-language pathologists, behaviour interventionists, infant development consultants, supported child development consultants, ECE workers, general practitioners, pediatricians, and any other early child development professionals. Families need not change their home language in order to help with the language development of their child with ASD. A suspicion or diagnosis of language delay in a child raised bilingually should not result in a recommendation to eliminate either language. Support for two languages does not

necessarily mean treating both in the same way at the same time, but that goals be consistent with the child's previous experiences and current and future needs (Kohnert, 2007).

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Appendix A: UBC Research Ethics Board Certificate of Approval

The University of British Columbia
Office of Research Services
Behavioural Research Ethics Board
Suite 102, 6190 Agronomy Road,
Vancouver, B.C. V6T 1Z3

CERTIFICATE OF APPROVAL - FULL BOARD

PRINCIPAL INVESTIGATOR:	INSTITUTION / DEPARTMENT:	UBC BREB NUMBER:
Stefka Marinova-Todd	UBC/Medicine, Faculty of/Audiology & Speech Sciences	H09-00542

INSTITUTION(S) WHERE RESEARCH WILL BE CARRIED OUT:

Institution	Site
UBC	Vancouver (excludes UBC Hospital)

Other locations where the research will be conducted:
Health Units in Greater Vancouver
Autism Therapy Clinics
In subjects' homes

CO-INVESTIGATOR(S):
Jill Petersen

SPONSORING AGENCIES:
N/A

PROJECT TITLE:
Lexical Development in Monolingual and Bilingual Children with Autism

REB MEETING DATE:	CERTIFICATE EXPIRY DATE:
March 12, 2009	**March 12, 2010**

DOCUMENTS INCLUDED IN THIS APPROVAL: **DATE APPROVED: April 9, 2009**

Document Name	Version	Date
Consent Forms:		
Consent Form	2	March 26, 2009
Advertisements:		
Participant Recruitment Poster	N/A	February 26, 2009
Questionnaire, Questionnaire Cover Letter, Tests:		
Questionnaire - Mandarin Version	N/A	February 24, 2009
Cantonese Version of Questionnaire	N/A	February 27, 2009
Parent Interview	N/A	February 26, 2009
Letter of Initial Contact:		
Parent Letter	N/A	February 26, 2009

The application for ethical review and the document(s) listed above have been reviewed and the procedures were found to be acceptable on ethical grounds for research involving human subjects.

Approval is issued on behalf of the Behavioural Research Ethics Board

and signed electronically by one of the following:

Dr. M. Judith Lynam, Chair
Dr. Ken Craig, Chair
Dr. Jim Rupert, Associate Chair
Dr. Laurie Ford, Associate Chair
Dr. Anita Ho, Associate Chair