COMPARING EARLY LANGUAGE DEVELOPMENT IN MONOLINGUALLY-
EXPOSED AND BILINGUALLY-EXPOSED YOUNG CHILDREN WITH AUTISM

by

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ABSTRACT

By definition, individuals with autism have marked language delays. Parents of children with autism are often advised not to raise their child with autism in a bilingual environment because of the belief that exposure to two languages will overload the child’s language system and result in further delays. This study compared a group of recently-diagnosed bilingually-exposed children with autism (n=20) ages 24-52 months with a matched group of monolingually-exposed children with autism (n=40). The groups were matched with regard to chronological age at the time of language assessment and nonverbal IQ score. The groups were compared with regard to the severity of children’s autism-related communication impairment, age of first words, age of first phrases, receptive vocabulary scores, receptive language scores, expressive language scores, and functional communication scores. Two sets of univariate ANOVAs were performed. First, univariate ANOVAs (without a covariate) were performed for autism-related communication impairment, age of first words and age of first phrases. Second, a series of univariate ANCOVAs, with the total number of speech-language and applied behavior analysis intervention hours entered as a covariate, was performed on the remaining dependent variables. All analyses determined that there were no statistically significant differences between the two groups on all language measures. The results suggest that a bilingual language environment does not disadvantage young children with autism in the early stages of language development. Limitations of the study and implications are discussed with regard to future research and clinical implications.
PREFACE

This study utilized data collected for the “Autism Spectrum Disorders: Pathways to Better Diagnosis and Outcomes” research project that was approved by UBC’s Behavioural Research Ethics Board (BREB) on February 14, 2005 under certificate H05-80036-0. The Pathways research team approved Ms. Ohashi’s use of data for her thesis on December 16, 2010 and her name was added to the BREB ethics certificate on January 5, 2011 (H05-80036-A006). Ms. Ohashi was responsible for all data management and data analysis and is the sole author of this thesis.
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CHAPTER 1: Review of the Literature

Introduction

Bilingual children are as common as children who learn one language worldwide (Petitto et al., 2001). In Canada, 21% of the population speaks a second language in addition to one of the two official languages, French and English, in their homes (Statistics Canada, as cited in Paradis, 2010). Yet, despite the large percentage of bilingual learners, a large proportion of research on child language development focuses on monolingual learning (Bhatia & Ritchie, 1999 as cited in Fernald, 2006; Fennell, Byers-Heinlein & Werker, 2007). Consequently, the majority of the language learning theories are based on research with monolingual individuals (Eng & O’Connor, 2000; Genesee, 2006). However, as bilingualism becomes increasingly common, so does the research in language development comparing monolingual and bilingual children (Scheele, Leseman, & Mayo, 2010). A small proportion of this research has focused on the impact of bilingualism on the language development of children with disabilities such as autism spectrum disorder (ASD).

Bilingual families of children with ASD are often advised by child development professionals to speak only one language to their child (Kremer-Sadlik, 2005; Leadbitter, Hudry, & Temple, 2009). This recommendation stems from the belief that bilingual exposure will have a negative impact on language development in children who already experience significant challenges in this area because they have ASD (Hambly & Fombonne, 2009). However, research on the effects of bilingual exposure on children with language impairments associated with other disabilities (e.g., specific language impairment, Down syndrome) has found that such exposure does not have a negative
impact on language development and that these children have the capacity to become bilingual (Kay-Raining Bird et al., 2005; Paradis, Crago, Genesee, & Rice, 2003). In addition, a recent study of 14 children with ASD who had daily exposure to both English and Chinese in their homes before the age of 4 found that exposure to two languages did not negatively affect the children’s language development (Petersen, Marinova-Todd, & Mirenda, 2010). However, additional research in this area is needed in order to better understand the impact of bilingual exposure for children in this vulnerable population. The purpose of this chapter is to review the major research issues regarding bilingualism, including definitions and categorization; developmental patterns; and relevant factors that influence language development in children who are developing typically, children with disabilities, and children with ASD.

**Definitions and Categorization**

The term “bilingual” refers to a heterogeneous group of individuals whose language proficiency in two or more languages lies on a continuum. On one end of this continuum are individuals who are fluent in both languages and on the other end are those who are fluent in one language and know simple phrases in the second (Chin & Wigglesworth, 2007; Eilers, Pearson & Cobo-Lewis, 2006). In the literature on bilingualism, this diverse group has been described on the basis of factors that influence language development, such as when the second language is acquired and the language of the majority community.

The first major categorization takes into account the age at which an individual is exposed to a second language. *Simultaneous bilingual* children are those who are exposed to two languages before they are 3 years old (Genesee, Paradis, & Crago, 2004). An
example of a simultaneous bilingual environment is one in which the mother speaks one language (e.g., Mandarin) and the father speaks a different language (e.g., English). Another example is an environment in which a grandparent or nanny who shares an ongoing caregiver role speaks a language that is different from that of the parents. In both cases, the child is exposed to two languages on a regular basis during the period of early language development.

The second group of children are second language learners, also referred to as sequential language learners, are exposed to a second language after their first language is already established – typically, after the age of 3 (Genesee et al., 2004). This often occurs when the child’s home language is different from the mainstream language of the community. For example, a child may learn the parents’ (minority) language at home and is then exposed to the dominant language of the community (e.g., English) upon entering daycare or preschool. This group of children does not need to learn what language is and how to use it, as they have already acquired this knowledge when learning their first language. However, they still need to learn the structure and lexicon (i.e., vocabulary) of the new language (Paradis, 2010; Tabors, 2008).

A second way of categorizing bilingual children takes into account the influence of the ethnolinguistic community on language development (Genesee et al., 2004). A majority ethnolinguistic community speaks the language of the largest percentage of the population and is often associated with a higher social status (Genesee et al., 2004). This language is often the official language of the country; examples include English in Western Canada or Japanese in Japan. On the other hand, a minority ethnolinguistic
community speaks a minority language and is often associated with a lower social status (Genesee et al., 2004).

**Language System Hypothesis for Bilingual Language Learners**

Two hypotheses have been proposed with regard to the developmental structure of bilingual language development: the unitary and the dual language hypotheses. Volterra and Taeschner (1978 as cited in Genesee et al., 2004) proposed the unitary language system hypothesis, which posits that a child has only one language system and that, initially, both languages are developed together. Thus, two languages are not differentiated in the initial stages of language development; it is only at the later phases of development that children develop two separate language systems, which typically occurs around the age of 3 (Petitto et al., 2001). This hypothesis was widely accepted in the early 1980s and influenced researchers, educators, and parents to believe that children have the capacity to only learn one language at a time. This, in turn, led to the belief that children who were exposed to two languages simultaneously were at risk of overloading their language learning capacity, resulting in confusion and perhaps even language impairment (Genesee, 2006). This idea was associated with the “limited capacity hypothesis” (MacNamara, 1966 as cited in Genesee et al., 2004), which posited that first language development (L1) would have to slow down in order to free up the capacity to acquire the second language (L2). However, recent research has provided evidence that disproves this theory and that supports infants’ ability to acquire two languages simultaneously (Genesee et al., 2004).

The alternative model of bilingual language development is the dual language system hypothesis proposed by Genesee (1989). According to this hypothesis, children
are able to establish two (or more) language systems from birth and learn them simultaneously. Studies have shown that, within the first few days of life, infants are able to discriminate between a familiar and a foreign language based on prosodic cues (Mehler et al., 1988; Moon, Cooper, & Fifer, 1993). Bosch and Sebastian-Galles (1997) found that 4-month-old infants were able to discriminate between sounds in Spanish and Catalan, two similar-sounding languages, based on differences in stressed and unstressed syllable patterns. More recently, Byers-Heinlein and colleagues (2010) reported that infants demonstrate a preference to languages to which they are exposed prenatally. During a procedure that measures preferences based on the frequency of infants’ sucking responses, 0-5-day-olds who had been exposed to both Tagalog and English prenatally showed increased interest in both languages, while infants exposed only to English showed a significantly lower level of interest in Tagalog (Byers-Heinlein, Burns, & Werker, 2010). This research suggests that children are capable of developing two separate language systems from a very early age.

**Developmental Milestones in Monolinguals and Bilinguals**

Another area of research has sought to compare the patterns of language development in monolingual and bilingual language learners. Overall, this research indicates that both bilingual and monolingual children reach major language milestones – such as the age of onset of canonical babbling (Oller, Eilers, Urbano & Cobo-Lewis, 1997) and the age of first words (Petitto et al., 2001) -- at similar ages (Werker, Byers-Heinlein, & Fennell, 2009; Fennel et al., 2007; Genesee et al., 2004). However, this is not to say that monolingual and bilingual language development is identical; specific differences between the two have been identified at the micro level (Fennel et al., 2007;
Werker et al., 2009). Overall, the similarities in language development patterns are more profound than the differences.

**Babbling**

Infants who are monolingual-exposed (ME) and bilingual-exposed (BE) progress through two important stages of babbling in a similar manner. The earliest phase of babbling is known as canonical babbling, in which infants repeat consonant-vowel pairs (e.g., bababa). In a study of Spanish-English infants, the onset of canonical babbling was the same for both ME and BE participants (Oller et al., 1997). Variegated babbling follows canonical babbling, in which infants pair different consonant-vowel pairs together (e.g., bata bata). Maneva and Genesee (2002; as cited in Genesee et al., 2004) reported that both the onset and nature of variegated babbling were similar in both ME and BE French-English infants.

**Lexical Development**

Pearson, Fernandez, and Oller (1993) compared lexical development in ME and BE children. Prior to this study, bilingual exposure was thought to be associated with lower scores on lexical measures (i.e., smaller vocabulary size) because researchers often compared bilingual children’s vocabulary in one language to the total vocabulary of monolingual children (Genesee, 2006); thus, lexical knowledge in the child’s second language was not taken into account. However, Pearson et al. (1993) found that, for bilingual children, the total *conceptual vocabulary* -- the combined vocabulary of L1 + L2 minus translation equivalents -- was comparable to that of monolingual children of the same age. In another study, Petitto and colleagues (2001) studied two groups of children; the first group was acquiring manual sign language (Langues des Signes Quebecoise) and
spoken French, and the second group was acquiring spoken French and English. Both
groups achieved early lexical milestones at the same rate, comparable to monolingual
equivalents. Specifically, children achieved the first word milestone around 1 year of age,
the first two-word combinations around 1;6; and the first 50 words around 1;7, on
average (Petitto et al., 2001). Together, these studies provide evidence that lexical
development is comparable in bilingual and monolingual children.

**Phonological Development**

Several studies have demonstrated the similarities between ME and BE children’s
phonological development. As discussed previously, within the first few days of life, both
ME and BE infants are able to discriminate between languages to which they were
exposed prenatally, and between foreign languages based on prosodic cues (Byers-
Heinlein et al., 2010). Thus, it appears that the perceptual and language learning
mechanisms that allow infants to discriminate languages are present at birth. These
similar language development patterns also continue beyond the first post-natal days in
both ME and BE infants. For example, Oller and colleagues (1997) followed the
development of 2-month-old ME English infants and BE Spanish-English infants and
reported a similar age of onset for canonical babbling, regardless of either socio-
-economic status (SES) or the length of gestation. Maneva and Genesee (2002, as cited in
Genesee et al., 2004) reported that BE French-English infants developed two variations
of babbling; the first resembled ME infants. Moreover, they found that infants were able
to match their babbling sounds to reflect the language of a communicative partner; if the
partner spoke English, the infants’ babbling consisted of English sounds, but if the
partner spoke French, the infants’ babbling changed accordingly.
This is not to suggest that phonological development is identical for ME and BE children. Bosch and Sebastian-Galles (2003) investigated vowel perception in ME Spanish, ME Catalan, and BE Spanish-Catalan infants. When comparing the results for each group, they found that the BE infants showed a unique discrimination pattern when compared to the ME infants. Specifically, the BE infants were able to discriminate Catalan sounds at 4 and 12 months of age but not at 8 months, whereas the ME Catalan infants were able to discriminate the same sounds at 4, 8 and 12 months (Bosch & Sebastian-Galles, 2003). They suggested that this unique pattern may be due to differences in the amount of exposure to each language and noted that further research is required before this pattern can be fully understood.

Implications for Assessment

Determining whether or not a bilingual individual has a specific language impairment (SLI) is complex and difficult. For monolingual children, standardized language assessment tools are generally used to diagnosis specific language impairments (SLI) with monolingual children. Most standardized language measures were developed and norm referenced primarily on samples of monolingual children and may not apply to bilingual children (Eng & O’Connor, 2000; Genesee et al., 2004). Unfortunately, creating norms for bilingual children is difficult given the diverse nature of this group, which varies widely with regard to the amount of exposure to each language and the degree to which two languages are similar, in addition to other factors.

Specific patterns of language delay that are associated with language impairments in monolingual children may not hold true for bilingual children (Paradis, 2005; Pearson et al., 1993). For example, monolingual children with unusually small vocabularies (for
their age) are known to be at greater risk of future language impairments (Pearson et al., 1993). However, in bilingual children, it is not clear if a smaller-than-typical vocabulary size at a specific age is a “red flag” for language impairment or if it is simply a characteristic of bilinguality (Genesee et al., 2004; Goldstein & Kohnert, 2005; Pearson et al., 1993). Similarly, Paradis (2005) examined the production of grammatical morphemes (i.e., plurals, past tense, and irregular past tense verbs) in 24 typically developing (TD) children (ages 4 years 4 months to 7 years 10 months) who were raised primarily in minority language environments and had been learning English as a second language for an average of 9.5 months prior to data collection. She found that the TD children’s “accuracy rates and error patterns with grammatical morphemes were similar to those that have been reported for same age monolingual children with SLI” (p. 172). On this basis, she suggested that TD English language learners could easily be mistaken as language impaired, and cautioned against the use of English standardized tests with nonnative English speakers for this reason.

In addition, BE children are rarely equally fluent in both languages, as they are typically exposed to different proportions of each language (Pearson et al., 1993). Therefore, most BE children demonstrate greater understanding and competence with one of the two languages to which they have access (Genesee et al., 2004). Testing a child in only one language often fails to capture the child’s full language competence (Pearson et al., 1993). Unfortunately, there are few formal, validated assessment tools that were specifically designed for BE children (Cheuk, Wong, & Leung, 2005; Jordaan, 2008). As a result, speech language pathologists have no choice but to assess BE children using translated assessment measures (Jordaan, 2008). These may include parent reports such
as one of the translations of the MacArthur-Bates Communicative Developmental Inventories (MCDI; Fenson et al., 1993). Or, they may include assessment tools that were originally designed for English-speaking children and subsequently translated into another language, such as the Spanish or Chinese versions of the Peabody Picture Vocabulary Test (Dunn, Lugo, Padilla, & Dunn, 1986; Liu & Liu, 1994). However, because this situation appears to have resulted in an overrepresentation of BE children with specific language impairments (Eng & O’Connor, 2000; Genesee et al., 2004), researchers have identified the urgent need to develop specific assessment measures that are valid for this population (Cheuk et al., 2005). Separate assessment tools for a range of languages may need to be developed, as language structures are often quite different from one language to the next (Eng & O’Connor, 2000). Two examples of such tools include the Putonghua (Mandarin) and the Cantonese Communicative Development Inventories (Tardif & Fletcher, 2008), which were standardized for typically developing Putonghua- and Cantonese-speaking children between 8 and 30 months of age. Both forms, which were closely modeled on the original MCDI, were adapted linguistically and culturally using samples of Chinese children from Hong Kong and Mainland China (Tardif & Fletcher, 2008). Additional assessment instruments designed for bilingual children are also available (e.g., Marinova-Todd, Zhao, & Bernhardt, 2010). In the interim, it is important to determine the child’s dominant language and assess language competence accordingly, if assessment in both languages is not possible (Genesee et al., 2004).

**Factors Influencing Language Development**

As noted previously, BE children are a heterogeneous group; some may be simultaneous language learners while others are second language learners, and some may
be fluent in two languages while others develop minimal competence in L2. Several factors appear to influence bilingual language development, including language input, culture and socio-economic status.

**Language Input and Culture**

Language input differs between ME and BE children (Jacobson & Cairns, 2008), which consequently influences their language development (Cummins, 1979). Even as infants, BE children often hear input from two languages on a regular basis, while ME children are exposed to only one. Hence, as their total language input is divided between two languages, BE children have less exposure to each (Fernald, 2006; Genesee, 2006; Scheele et al., 2010). Furthermore, BE children may have greater exposure to incorrect input in the majority language (e.g., the use of over-regulations such as *catched* rather than *caught*, or *mouses* rather than *mice*), which delays their lexicalization of irregular forms (Jacobson & Cairns, 2008). This is likely to be especially true when caregivers are non-native speakers of the majority language (Hambly & Fombonne, 2010).

Language input patterns are also influenced by other factors, including the culture of the family (Genesee et al., 2004) and parents’ attitudes towards their role in language development (de Houwer, 1995; Thordardottir, 2010). The following example demonstrates how both culture and parent attitudes influence the language input patterns for young children. Inuit adults do not converse directly with babies and children; rather, Inuit children are expected to learn language by observing adults as they converse with other adults and by talking with their peers (Crago, 1988 as cited in Genesee et al., 2004). In contrast, adults in majority Canadian families often encourage children to initiate and maintain conversations with adults from infancy (Genesee et al., 2004). As a result, the
language input of children growing up in Inuit families compared to majority Canadian families is very different.

**Socio-economic Status**

Language input that is provided at home through both spoken language and literacy activities is known to support and foster language development (Genesee et al., 2004). It is well established that monolingual children in families with low socioeconomic status (SES) receive less language input than those in high SES homes (Hart & Risley, 1995; Scheele et al., 2010).

The relationship between SES and bilingual language exposure is less clear. Scheele et al. (2010) investigated the influence of the home environment on language development in both monolingual and bilingual children. They found that SES, which was based on highest education level of the parents and the status of their current occupations, was positively correlated with the amount and quality of L2 input for a Moroccan-Dutch group of children; children in low SES homes received less language input and had lower scores on a vocabulary test than children from high SES homes. Specifically, the Moroccan-Dutch children engaged in fewer language learning activities such as shared book reading in their homes (Scheele et al., 2010); a low level of book reading has been shown to be correlated with lower expressive vocabulary skills (Patterson, 2002). Thus, from this study, it appears that bilingual children from low SES environments are doubly impacted, as they receive less overall language input which is further divided between two languages (Scheele et al., 2010). However, this relationship was not supported in a longitudinal study by Oller et al. (1997), who followed the language development of 73 ME and BE infants between 4-18 months of age. In this
study, the age at which children started to babble was comparable regardless of SES; in fact, infants from low SES home began to babble slightly earlier (Oller et al., 1997). It is clear that more research in this area is required.

**Bilingualism Maintenance**

The focus of this review thus far has been on factors related to the acquisition of two languages. It is important to note, however, that children who become bilingual will only maintain fluency in both languages if they continue to use both on a regular basis (Chin & Wigglesworth, 2007; de Houwer, 1995). Factors such as parental attitudes toward the two languages (Chin & Wigglesworth, 2007) and the extent to which both languages are spoken at home and at school (de Houwer, 1995) influence language maintenance.

While at McGill University, Wallace Lambert coined terms to describe two types of language learning environments (Genesee et al., 2004), which subsequently have different language outcomes. A *subtractive language environment* is one that supports the acquisition of L2 but provides no support for maintaining L1 (Eilers et al., 2006; Genesee et al., 2004). For example, some immigrants might decide to immerse themselves in the majority language of their new country and, as a result, they lose the ability to understand and speak their native language over time. Conversely, an *additive language environment* is one that supports both the acquisition of L2 and the maintenance of L1. In this type of environment, an immigrant is able to acquire the majority language of his or her new country while continuing to be fluent in the native language as well. As noted previously, language is strongly tied to one’s identity and culture. Thus, individuals in an additive language environment are more likely to maintain their cultural heritage in addition to
their native language, as they learn and become part of the culture of their new country. Clearly, the two types of language environments influence an individual’s competence in both languages.

The ‘three generation rule’ describes how the native language is lost over three generations within families who immigrate to North America (specifically, the United States, although there is no reason to suspect that a different pattern would be found in Canada) (Eilers et al., 2006). The first generation of immigrant adults is typically monolingual in their native language. Their children, the second generation, usually become bilingual (e.g., in the native language plus English or French); and their grandchildren, the third generation, are mainly monolingual English or French speakers. Eilers et al. (2006) found this effect among Spanish-speaking immigrants living in Miami, despite a strong Spanish-based infrastructure and a community in which immigrants are both exposed to and have the opportunity to use their native language on a regular basis. Nonetheless Eilers et al. (2006) reported that, as families became more proficient in English, the use of Spanish decreased significantly, despite parents’ initial intent to raise their children in a balanced bilingual environment.

In summary, a large proportion of children worldwide are raised in bilingual environments and learn two languages. Thus, research that deepens our understanding of the language development patterns in bilingual children both with and without disabilities is important in helping practitioners better serve them. However, research on this diverse population is complex and difficult because many factors, such as age of acquisition, social status of the language, and the nature of language input, influence bilingual language development. Overall, current research indicates that both bilingual and
monolingual children reach critical language milestones at similar ages, suggesting children have the capacity to learn two languages from birth.

**Bilingualism and Language Delay**

Bilingual children with language delays present yet another set of issues in addition to those discussed previously. In the last 10 years, there has been an increase in the number of published research studies investigating this population (Kohnert & Medina, 2009; Paradis, 2010). Many of these studies focused on specific language areas, such as morphosyntax (Feltmate & Kay-Raining Bird, 2008; Paradis et al., 2003), article and noun forms (Eng & O’Connor, 2000), and vocabulary acquisition (Feltmate & Kay-Raining Bird, 2008), rather than on language development as a whole. This research has shown that learning a second language is not detrimental to the language development of children with either specific language impairments (Paradis, 2010) or cognitive delays (Kohnert & Medina, 2009). For example, children with Down syndrome in Feltmate and Kay-Raining Bird’s study all developed both expressive and receptive language ability in two languages. Not surprisingly, any language delay will affect both languages (Kohnert & Medina, 2009); for example, if a child is learning English and Chinese, the child’s ability to acquire both languages will be impaired. However, a number of factors that influences language development in typically developing children, such as the recommended language input, and the language to use for interventions bears consideration for bilingual children with specific language delays and cognitive disabilities.
Factors Influencing Language Development

The factors that influence bilingual language development in typically developing children also influence language development in children with language delays. Examples of overlapping factors include the amount of exposure to both languages (Kay-Raining Bird et al., 2005) and whether or not bilingualism is supported and encouraged in the child’s environment (Thordardottir, Weismer, & Smith, 1997). In addition, the syntactic and semantic complexity of each language may also affect a child’s rate of acquisition (Eng & O’Connor, 2000). Finally, the type and severity of the language delay and the type and amount of intervention provided in each language will affect development of both languages (Jordaan, 2008).

Recommended Language Input

Many speech-language pathologists advise parents of children with language delays or disorders to speak only one language to the child, in order to minimize learning demands (Jordaan, 2008). When deciding which language to speak, parents and professionals often choose the language in which the child will be educated at school, believing that this will prepare the child for school success (Jordaan, 2008). Unfortunately, this often results in parents speaking a language to the child in which they are not fluent (Jordaan, 2008; Kay-Raining Bird et al., 2005). As noted previously, this practice is not supported by current research; nonetheless, it still persists.

Many parents find it impractical and impossible to speak only a non-native language at home (Thordardottir et al., 1997) and often report that they prefer to maintain their native language (Jordaan, 2008). Parents who are advised to speak a language in which they are not proficient may find it difficult to communicate with their child. In
addition, parents in this situation are likely to provide poor language models since they, too, are still learning a second language (Thordardottir et al., 1997), which can negatively affect language learning outcomes (Hambly & Fombonne, 2010). Advising parents to switch to a non-native language can have a negative impact on family relationships as well, as language is strongly connected with family culture (Genesee et al., 2004; Kay-Raining Bird et al., 2005); this can lead to decreased communication among family members (Thordardottir et al., 1997) and a decrease in parent-child engagement (Wharton, Levine, Miller, Breslau & Greenspan, 2000, as cited in Hambly & Fombonne, 2010). It seems clear that advising families of children with language delays to limit their input to a single language is outdated and has a number of potentially negative side effects.

**Language of Intervention**

There is also evidence that providing language intervention in both languages is beneficial for language development (Jordaan, 2008), especially when a child lives in a bilingual environment (Kohnert & Medina, 2009). A study by Perozzi and Sanchez (1992) directly investigated this issue. The subjects were 38 grade 1 students with language delays (mean age 6;8) who were randomly separated into two groups. The rates of vocabulary acquisition between the two groups were compared. Group 1 received instruction first in their native language, Spanish, and then in L2, English. Group 2 received instruction in English only. The group that received instruction in both Spanish and English reached the mastery criterion faster, suggesting that using the native language supported the learning of L2.
Similarly, Thordardottir and colleagues (1997) reported the impact of language intervention with a language impaired child who was age 4;11 at the start of the study. He was born in Iceland, where he was exposed to Icelandic only; and he then moved to the United States at age 2;6, where he attended an English daycare. Using an alternating treatment design, the investigators taught novel English vocabulary words under two conditions: a monolingual and a bilingual condition. The intervention occurred during 50-minute sessions that were held twice per week and included semi-structured play activities that provided meaningful contexts to introduce new vocabulary words. In the monolingual condition, new English vocabulary was presented to the child in English only and, when the child spoke in Icelandic, he was reminded to use English. In the bilingual condition, new English vocabulary was introduced and discussed using both English and Icelandic, and the interventionist responded to the child’s utterances in whichever language the child initiated. The child acquired slightly more vocabulary words related to his home environment in the bilingual condition; however, there were no differences between conditions for school vocabulary. This study suggests that bilingual intervention does not increase confusion and may, in fact, be beneficial to a child who is learning a second language (Thordardottir et al., 1997). Furthermore, bilingual intervention may promote maintenance and development of both languages of a child (Thordardottir et al., 1997).

Despite such findings, the majority of speech-language pathologists who responded to a survey on this topic reported themselves to be monolingual, which likely explains why they chose to provide monolingual intervention to their bilingual clients (Jordaan, 2008). Jordaan recommended that speech-language pathologists who are
monolingual find ways to incorporate both languages into intervention (e.g., by using
interpreters), in order to support all of the languages to which the child is exposed.

Bilingualism and Autism Spectrum Disorder (ASD)

Most individuals with autism spectrum disorder (ASD) have a language
impairment that can range from mild to severe. As is the case for other children with
language delays, bilingual parents of children with ASD are often advised to speak only
one language to their child at home, in order to simplify language input (Kremer-Sadlik,
2005; Petersen et al., 2010). Unfortunately, very little research has investigated
bilingualism and ASD; the research that does exist is reviewed in this section.

Language Development

Only a handful of studies have sought to compare language development in
monolingual and bilingual children with ASD. Hambly and Fombonne (2009)
investigated the early language milestones and vocabulary size of 110 children with ASD
between the ages of 18 months and 6 years of age who lived in ME and BE
environments. BE children were exposed to two languages between birth and age 2, and
had at least 10% lifetime exposure to a second language. The ME and BE groups did not
differ significantly on age or other demographic variables. The researchers found no
significant differences in either total conceptual vocabulary size or the age of either first
words or phrases (Hambly & Fombonne, 2009).

In a later study, Hambly and Fombonne (2010) recruited 75 children with autism
aged 36-78 months (30 ME and 45 BE) from families residing in the Canadian provinces
of Quebec or Ontario. Only children who spoke languages in which assessment measures
are available were recruited for the BE group; these included French, English, Chinese,
Farsi, Hebrew, Italian, Romanian, Spanish, and/or Tamil. Parents were asked to complete the MacArthur Communicative Development Inventory: Words and Sentences (Fenson et al., 1993) and a Family Background Information Questionnaire (Hambly & Fombonne, 2005). In addition, trained research assistants contacted the families by phone to complete the Vineland Adaptive Behavior Scales-Second Edition (Sparrow, Cicchetti, & Balla, 2005), a language environment interview designed specifically for the study, and specific questions from the Autism Diagnostic Interview-Revised (Le Couteur, Lord, & Rutter, 2003). Maternal language fluency was also assessed during the phone interview. Data from ME and BE groups were compared using one-way analysis of variance (ANOVA). The characteristics of the mothers (e.g., education) were similar across the groups; however, there were differences in maternal language fluency. The results indicated that the ME and BE children had similar results on measures of receptive and expressive language and early language milestones. The only significant difference was found in families in which mothers were not native speakers of the languages spoken to the children; these children had significantly lower scores on both social and language measures, suggesting that the reduced quality of the language input had a negative effect on language learning outcomes (Hambly & Fombonne, 2010).

Similarly, Petersen et al. (2010) examined language development in two groups of children with ASD – 14 bilingual Chinese-English children and 14 monolingual (English-speaking) children. Language assessments included the MacArthur Bates Development Inventory-English Version (MCDI; Fenson et al., 1993), a parent-report checklist used to measure a child’s single word receptive and expressive vocabulary; the MCDI-Chinese version (Tardiff & Fletcher, 2008); the Peabody Picture Vocabulary Test-III (PPVT-III;
Dunn & Dunn, 1997), which measures receptive vocabulary knowledge; and the Preschool Language Scale-3 (PLS-3; Reynell & Gruber, 1990), which measures receptive and expressive language skills. The monolingual and bilingual groups had similar English CDI scores; however, the bilingual children had a larger conceptual vocabulary size and PPVT-III scores than the monolingual children. Further results showed that the bilingual group had more verbs in their conceptual vocabularies while the monolingual group had more nouns. The bilingual group also had higher PLS-3 Auditory Comprehension and PLS-3 Total Language scores than the monolingual participants.

Leadbitter et al. (2009) compared receptive and expressive language development of children with autism aged 2-5 who lived in monolingual and bilingual homes. The two groups (n=10 in each) were matched on chronological age, gender, autism severity, and socio-economic status. Comprehensive language assessments were completed for all children, using the PLS and the MCDI. Preliminary analyses suggested that both receptive and expressive language scores were similar across the two groups. From these studies, it appears that a bilingual environment does not have a negative effect on language development in children with ASD, and may, in fact, be an advantage with regard to vocabulary development.

**Impact of Forced Monolingual Family Environments**

Bilingual families who decide to speak only a non-native majority language to their child with ASD are likely to experience challenges that are similar to those reported by bilingual families with typically developing children. Kremer-Sadlik (2005) highlighted the fact that imposing a non-native language into a family structure can create social distance between family members and a child with a disability. For example, she
described one family in which the parents spoke Chinese to all family members except the child with ASD, who was often left out of family conversations as a result. Because parents are the primary communication models for children with ASD (Baron-Cohen & Staunton, 1994), children who do not understand the language spoken by their parents are unable to benefit from the models their parents offer (Kremer-Sadlik, 2005). Compounding this concern is the fact that, as noted previously, many parents who are advised to speak a non-native majority language to their children are not fluent themselves in that language, and thus provide models that are grammatically incorrect (Hambly & Fombonne, 2010). The end result is that parents who switch to speaking a non-native language to their child with ASD may adversely affect the child’s language development by talking less and by providing less accurate language models.

**Autism and Language Intervention**

A search of the literature revealed only one article that specifically examined bilingual language intervention with a child with ASD. In this longitudinal study, the language development of a 3-year-old bilingual Korean-English boy who was diagnosed with mild-moderate autism was monitored over a 24-month period (Seung, Siddiqi & Elder, 2006). Measures that were used to track his progress included the MCDI: Words and Sentences (Fenson, et al., 1993), PPVT-III (Dunn & Dunn, 1997), Expressive Vocabulary Test (EVT; Williams, 1997), and Reynell Developmental Language Scales (Reynell & Gruber, 1990). For the first 6 months, the child was provided with speech-language therapy in Korean only and made notable gains. After 12 months, the speech language pathologist (SLP) gradually began to integrate English into his therapy sessions until, at 18 months, therapy was provided mainly in English. After 24 months of
intervention, the child had made significant gains in English proficiency in both receptive and expressive language skills. Although one cannot draw generalized conclusions from this single case study, it does suggest the potential of bilingual speech intervention for this population.

**Statement of the Problem and Research Questions**

A considerable body of research has provided evidence to challenge the widespread belief that bilingual language exposure early in life is harmful to typically developing children’s language development (Petitto et al., 2001) and has suggested that such exposure may, in fact, lead to cognitive and linguistic advantages (Cummins, 1979). This research also applies to children with language delays, for whom bilingual exposure also appears to have no adverse effect on language development. However, only a few studies to date have focused specifically on the impact of bilingual exposure in children with ASD, and none have examined this issue in newly diagnosed children prior to the initiation of intensive early autism intervention. The purpose of this exploratory study is to add to the current research base by investigating whether or not significant differences in specific language measures exist between recently-diagnosed, monolingually-exposed (ME) and bilingually-exposed (BE) children with ASD who are exposed to either English or French and a second language pre-intervention. The specific research questions to be addressed include:

1. Is there a difference between ME and BE groups with regard to the severity of the autism-related communication impairment?
2. Is there a difference between ME and BE groups with regard to the age of first words?
3. Is there a difference between the ME and BE groups with regard to the age of first phrases?

4. Is there a difference between the ME and BE groups with regard to single word receptive vocabulary scores?

5. Is there a difference between ME and BE groups with regard to receptive language scores?

6. Is there a difference between ME and BE groups with regard to expressive language scores?

7. Is there a difference between ME and BE groups with regard to functional communication scores?
CHAPTER 2: Method

Background

Participant data for this study were drawn from a database created for the Pathways in ASD research project, a Canada-wide longitudinal study of children with ASD and their families (Szatmari et al., 2004). The Pathways team has been collecting data since 2004, through a research team located across five university sites: Dalhousie University in Halifax, Nova Scotia; McGill University in Montreal, Quebec; McMaster University in Hamilton, Ontario; the University of Alberta in Edmonton, Alberta; and the University of British Columbia in Vancouver, British Columbia. The following inclusion criteria were met by all of the Pathways participants: (a) an ASD diagnosis within 4 months of entering the study; (b) age 2 years-4 years 11 months at the time of diagnosis; and (c) at least one parent whose English or French language proficiency allowed them to read and understand the information and consent form. Exclusion criteria included the presence of (a) cerebral palsy or other neuromotor disorder that might interfere with the study assessments; (b) a known genetic disorder or chromosomal abnormality; (c) a moderate to severe visual impairment (i.e., severe problem in one eye only, visual acuity 6/6-6/18 corrected in better eye); and/or (d) a moderate to severe hearing impairment (i.e., severe loss in one ear, hearing loss 20-40dB).

Pathways evaluators first met with enrolled children and families within a few months of an autism diagnosis (at Time 1, T1) and at regular intervals thereafter, to conduct language/communication, cognitive, adaptive behaviour, social skills, and other assessments. Assessments were conducted in either English or French, depending on which of these was used in the home; if both were used at home, assessment was in the
primary language of the two. Assessment results across all sites were compiled into a single database, and researchers interested in accessing the database for individual analyses are required to submit a proposal to the *Pathways* Publication & Dissemination Committee for approval. A proposal for the current project was approved by the *Pathways* research team on December 16, 2010 and the author’s name was added as a study team member to the UBC Behavioral Research Ethics Board Certificate on January 5, 2011.

**Dependent Variables**

Seven dependent variables were examined in this study. They included: (a) severity of autism-related communication; (b) age of first words, (c) age of first phrases, (d) receptive vocabulary scores, (e) receptive language scores, (f) expressive language scores, and (g) functional communication scores. These variables were derived from a number of measures, as described in the section that follows.

**Measures**

All measures that are relevant to the study are described in this section in alphabetical order, including those that were used to measure the dependent variables, those used for diagnosis, and those used to match the BE and ME groups. Since standardized scores are based on normative data for typically developing children, raw scores for each measure were used instead. Furthermore, raw scores are more sensitive to small differences and provide data even for children who cannot achieve a basal score on a measure.

**Autism Diagnostic Observation Schedule.** The Autism Diagnostic Observation Schedule (ADOS) is a semi-structured, standardized measure (Lord, Rutter, DiLavore &
Risi, 2003). The ADOS provides structured activities that create a standard context to observe an individual in terms of the following areas: communication, social interaction and play. During the assessment, which can be administered in 30 to 45 minutes, the administrator takes notes on a child’s responses to the structured activities. The information collected during the assessment is used to identify children who meet the criteria for an autism spectrum disorder. In this study, ADOS communication score totals were used to examine the severity of autism-related communication impairments in the two participant groups, in order to answer research question #1: Is there a difference between the ME and BE groups with regard to the severity of the autism-related communication impairment?

**Autism Diagnostic Interview-Revised.** The Autism Diagnostic Interview-Revised (ADI-R) is a standardized measure used to identify individuals with an autism spectrum disorder (Lord, Rutter, & Le Couteur, 1994). It is a semi-structured interview in which a caregiver responds to questions regarding a child’s communication, social development and play, repetitive and restricted behaviors, and general behavior problems. The ADI-R has a strong internal reliability (alpha coefficients >.69 for all items) and inter-rater agreement scores between 90%-93% (Lord et al., 1994). In this study, responses from two items on the ADI-R were examined to answer research questions #2 and #3. Item #9, age of first words in months, indicates the age at which a child first used words repeatedly and consistently with the intent to communicate in reference to a particular concept, object, or event (Lord et al., 1994). This item was used to answer research question #2: Is there a difference between the ME and BE groups with regard to the age of first words? Item #10, age of first phrases, indicates the age in
months at which a child first used at least two words together, with one of the words being a verb (Lord et al., 1994). This item was used to answer the research question #3: Is there a difference between the ME and BE groups with regards to the age of first phrases?

**MacArthur-Bates Communicative Development Inventories.** The MacArthur-Bates Communicative Development Inventories (MCDI) are norm-referenced measures that rely on parent report to measure early communication skills (Fenson et al., 1993). An individual who knows the child, usually a caregiver, completes the form. There are two versions of the MCDI: Words and Gestures, which was designed for infants between the ages of 8 and 16 months; and Words and Sentences, which was designed for children between the ages of 16 and 30 months (Fenson et al., 1993). In the *Pathways study*, the Words and Sentences version was completed for children who (a) had regular, spontaneous, meaningful use of three-word utterances, including a verb and (b) were verbally fluent (i.e., produced a range of flexible sentence types, providing language beyond the immediate context and describing logical connections within a sentence). All other children’s caregivers completed the Words and Gestures version. Both versions provide lists of words that are typically included in the early vocabularies of young children, and respondents are asked to check the words that the child can say and understand. Both versions of the MCDI have been found to have adequate concurrent and predictive validity for young children with autism (Smith & Mirenda, 2009; Smith, Mirenda, & Zaidman-Zait, 2007). In this study, the total number of words produced on the MCDI was used to identify BE and ME children who meet the study criterion of at least 30 words. A minimum of 30 words was selected because it is at about this point in early language development that TD children’s vocabularies begin to include both nouns
and verbs rather than nouns only (Bates, Bretherton, & Snyder, 1988; Nelson, 1973). For this reason, the same criterion was also used in a similar study that examined bilingual language development in children with ASD (Peterson et al., 2010).

**Family Background Information Questionnaire.** The Family Background Information Questionnaire (FBIQ; Hambly & Fombonne, 2005) is a 21-item caregiver report measure that provides information regarding family background (Appendix A). The questions are derived from those used in the Statistics Canada Census and include information regarding marital status, caregiver education, and total household income. In this study, questions regarding the number of languages to which a child was exposed between birth and age 1, ages 1-2, and ages 2-the time of FBIQ completion, as well as the percentage of exposure to each language at the time of FBIQ completion, were used to identify children for the BE and ME groups.

**Merrill-Palmer-Revised Scales of Development.** The Merrill-Palmer-Revised (M-P-R) is a standardized developmental assessment measure for infants and children up to the age of 6 years 6 months (Roid & Sampers, 2004). The M-P-R can be used to measure cognitive development, and a variety of other domains. The cognitive assessment can be completed in about 45 minutes and involves having children engage in tasks that require interactions with the examiner and with various toys. Reliability coefficients for most of the cognitive battery scales range from .91-.98 (Gregory, 1996, as cited in Roid & Sampers, 2004). Content validity has also been confirmed by various analyses (Roid & Sampers, 2004). In this study, cognitive subscale standard scores from the M-P-R were used to estimate a nonverbal intelligence quotient (NVIQ) score that was used to match BE and ME participants.
**Peabody Picture Vocabulary Test.** The Peabody Picture Vocabulary Test-III (PPVT-III) is a standardized, norm-referenced, assessment tool that measures receptive vocabulary and verbal ability (Dunn & Dunn, 1992). The PPVT-III can be used to assess language skills in individuals between 2-90 years of age. The PPVT-III requires an individual to select a picture from a field of four that best represents a word spoken by the examiner (Dunn & Dunn, 1997). The internal consistency for the PPVT-III is high, with alpha coefficients ranging from .92-.95; and there are high correlations between the PPVT-III and other measures of vocabulary (Dunn & Dunn, 1997). In this study, PPVT-III raw scores were used to answer the research question #4: Is there a difference between the ME and BE groups with regard to PPVT receptive vocabulary scores?

**Preschool Language Scale, 4th Edition.** The Preschool Language Scale, 4th edition (PLS-4) is a standardized language measure that is used to assess children’s comprehension and expressive language skills (Zimmerman, Steiner, & Pond, 2002). The test is divided into two subscales: Auditory Comprehension (AC), which measures a child’s understanding of spoken language; and Expressive Communication (EC), which measures a child’s expressive language ability (Zimmerman & Castilleja, 2005). During the assessment, a child and an examiner engage in a variety of interactive play activities with toys and other objects. Test-retest reliability for both subscales ranges from .82-.95 (Zimmerman et al., 2002). Substantial evidence of validity was found for the PLS-4, through the standardization process and through independent research (Zimmerman et al., 2002). The PLS-4 has also been found to be effective for identifying differences in language abilities among children with various diagnoses (Zimmerman & Castilleja, 2005). In this study, PLS-4 AC raw scores were used to answer research question #5: Is
there a difference between the ME and BE groups with regard to receptive language scores? and the PLS-4 EC raw scores were used to answer research question #6: Is there a difference between the ME and BE groups with regard to expressive language scores?

*Pathways Services Log.* The *Pathways* Services Log was developed specifically for the *Pathways* study to collect information about the services/treatments a child receives as a result of his or her autism diagnosis (Appendix B). This measure provided information regarding the type of intervention, the number of hours per week of intervention, and the length of time during which a child received an intervention prior to the time of T1 language assessments. The total number of hours of autism-related interventions that included applied behaviour analysis (ABA) and speech-language therapy was calculated and used as a covariate in the study.

*Vineland Adaptive Behavior Scales, 2nd Edition.* The Vineland Adaptive Behavior Scales, 2nd edition (VABS-II) is a standardized, norm-referenced assessment instrument that measures adaptive behaviour in individuals from birth-age 90 (Sparrow et al., 2005). Administration involves a semi-structured interview with a respondent (e.g., a caregiver) who is familiar with the individual of interest. Four domains of adaptive behaviour that are assessed include communication, daily living skills, socialization, and motor skills. Internal consistency scores for children aged birth to 5 ranges from .79-.95 and test-retest reliability scores range from .73-.96 (Sparrow et al., 2005). In this study, the VABS-II Communication sums of v-scale scores were used to answer research question #7: Is there a difference between the ME and BE groups with regard to functional communication?
Independent Variable

The type of early language exposure in recently-diagnosed young children with autism was the independent variable in this study. Two groups of children with autism were included: bilingually-exposed (BE) children and monolingually-exposed (ME) children. Participants from both the BE and ME group met a number of identical criteria. First, the participants were between 24-52 months of age. Second, they had all received a diagnosis of autism or autism spectrum disorder through a multidisciplinary diagnostic team in the province in which they lived at the time of diagnosis. Third, their primary mode of communication was verbal speech, not American Sign Language or a picture communication system. This criterion resulted in one BE child who used ASL being excluded from the study. Fourth, they were able to produce at least 30 English or (if they lived in Quebec) French words at T1, as reported by a primary caregiver on the MacArthur Communicative Development Inventory (MCDI; Fenson et al., 1993).

In addition to these general criteria, the BE and ME each groups met separate, additional sets of criteria in order to be included, as defined in the sections that follow.

Bilingual-exposed (BE) Group

As a number of researchers have noted, bilingual studies are difficult to conduct because there is great variability within the bilingual population (Kohnert & Goldstein, 2005). Factors such as controlling for a child’s age of acquisition, “identifying relatively balanced bilingual infants, [and] quantifying the degree of exposure to each language” are especially challenging (Werker & Byers-Heinlein, 2008, p. 149). Similar challenges were met when defining a set of criteria for the BE group in this study. The exploratory nature of the current study, the advice of two experts in bilingual language development,
the information that was available in the *Pathways* database, and the methods employed in previously published studies of this nature were all taken into consideration when the BE criteria were determined.

Because parental report is commonly used in bilingual research (e.g. Gutierrez-Clellen, Simon-Cereijido & Wagner, 2008; Paradis, 2005), information obtained from the primary caregiver on a Family Information Background Questionnaire (FBIQ; Hambly & Fombonne, 2005) designed for the *Pathways* study (Appendix A) was used to determine bilingual language exposure. Bilingual exposure was operationally defined as (a) exposure to two languages, one of which was English or French, through primary caregivers between birth-age 2 and (b) at least 20% exposure to two languages, one of which was English or French, between age 2 at the time of the T1 language assessments. It was important for the children to have had reasonable exposure to English or French, since all of the assessment measures were administered in one of these two languages. Previous studies have used different language exposure criteria for their participants ranging from a minimum of 20% for either language (Gutierrez-Clellen et al., 2008) to 30% (Fennell et al., 2007) or higher. Because the effect of the quantity of language input was not the focus of this study, a lower limit of 20% exposure to two languages was selected in order to include BE individuals across the range of exposure.

**Monolingual-exposed (ME) Group**

In addition to the general inclusion criteria described previously, children in the ME group had exposure to only one language -- either English or (if living in Quebec) French -- from birth-age 2 and from age 2- the time of the T1 language assessments, according to parents’ responses on the FBIQ.
Participants

Bilingual-exposed (BE) Group

Twenty children (16 males and 4 females) were identified for the BE group. The chronological age of the BE participants ranged between 31.5 months and 49.5 months ($M=40.87$). Cognitive standard scores from the M-P-R Scales (Roid & Sampers, 2004) were used to estimate a nonverbal intelligence quotient (NVIQ), which ranged from 38-104 for the children in this group ($M=63.21$). The number of English or French words produced, as reported by parents on the MCDI (Fenson et al., 1993), ranged from 30-656 ($M=229.85$). The highest level of education the primary caregivers attained is summarized in Table 1. Total annual household income is summarized in Table 2.
Table 1. Education level of the primary caregiver

<table>
<thead>
<tr>
<th>Education</th>
<th>BE group</th>
<th></th>
<th></th>
<th>ME group</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percent</td>
<td>Frequency</td>
<td>Percent</td>
<td>Frequency</td>
</tr>
<tr>
<td>Some high school</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>Complete high school</td>
<td>1</td>
<td>5</td>
<td>4</td>
<td>10.0</td>
<td></td>
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<tr>
<td>Some trade/vocational school or college</td>
<td>3</td>
<td>15</td>
<td>12</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Diploma/certificate from trade/vocational/college</td>
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<td>15</td>
<td>7</td>
<td>17.5</td>
<td></td>
</tr>
<tr>
<td>Some university</td>
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<td>10</td>
<td>0</td>
<td>0</td>
<td></td>
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<tr>
<td>Bachelor/undergraduate degree</td>
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<td>12</td>
<td>30.0</td>
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<td>2</td>
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<tr>
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<tr>
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<td>100</td>
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<td>100</td>
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</table>
Table 2. Total household income

<table>
<thead>
<tr>
<th>Total Household Income/Year</th>
<th>BE group</th>
<th></th>
<th>ME group</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percent</td>
<td>Frequency</td>
<td>Percent</td>
</tr>
<tr>
<td>Less than $10,000</td>
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<td>10</td>
</tr>
<tr>
<td>$30,001-$50,000</td>
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<td>10</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>$50,001-$70,000</td>
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<td>6</td>
<td>15</td>
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<td>0</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>100</td>
<td>40</td>
<td>100</td>
</tr>
</tbody>
</table>

All of the BE participants were simultaneous language learners who were exposed to two languages, one of which was English or French, before the age of 2. Sixteen out of the 20 BE children (80%) were primarily exposed to English at the time of the assessment; 2 children (10%) were primarily exposed to French; 1 child (5%) was equally exposed to French and Spanish; and 1 child (5%) was primarily exposed to Cantonese, but had 30% exposure to English. The second languages to which the BE children were exposed included Mi’kmaq, French, English, Croatian, Cantonese, Greek, Urdu, Arabic, Italian, Spanish, Mandarin, Japanese, and Berbere. Language exposure is summarized in Table 3.
Table 3. Primary and secondary languages of all BE children

<table>
<thead>
<tr>
<th>Primary Language(s)</th>
<th>Secondary Language</th>
<th>Other Language</th>
<th>$n$</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>French</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>English</td>
<td>French</td>
<td>Greek</td>
<td>1</td>
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<tr>
<td>English</td>
<td>French</td>
<td>Italian</td>
<td>1</td>
</tr>
<tr>
<td>English</td>
<td>French</td>
<td>Berbere</td>
<td>1</td>
</tr>
<tr>
<td>English</td>
<td>Croatian</td>
<td>French</td>
<td>1</td>
</tr>
<tr>
<td>English</td>
<td>Arabic</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>English</td>
<td>Greek</td>
<td></td>
<td>1</td>
</tr>
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<td>English</td>
<td>Japanese</td>
<td></td>
<td>1</td>
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<tr>
<td>English</td>
<td>Mandarin</td>
<td></td>
<td>1</td>
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<tr>
<td>English</td>
<td>Mi’kmaq</td>
<td></td>
<td>1</td>
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<tr>
<td>English</td>
<td>Spanish</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>English</td>
<td>Urdu</td>
<td></td>
<td>1</td>
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<tr>
<td>French</td>
<td>English</td>
<td></td>
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<tr>
<td>French and Spanish</td>
<td>English</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Cantonese</td>
<td>English</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

Monolingual-exposed (ME) Group

Forty children (33 males and 7 females) were identified for the ME group. Two ME children were matched to each BE child based on chronological age and NVIQ score. The chronological age of the ME children ranged from 31.1-51.7 months ($M=41.0$). All ME children had a cognitive standard score on the M-P-R within ±8 points of their BE
matches, with the exception of 1 ME child whose cognitive score differed by 13 points. Cognitive standard scores ranged from 10-117 \((M=59.60)\). The number of words produced, as reported by parents on the MCDI (Fenson et al., 1993), ranged from 33-676 words \((M=223.23)\). The highest level of education attained by the child’s primary caregiver, according to responses in the FBIQ, is summarized in Table 1. Information for the highest level of education was missing for one primary caregiver in this group. Total household income is summarized in Table 2.

**Procedure**

**Participant Identification**

The *Pathways* database was received as an SPSS file and included the data for 418 participants at T1, as of March 2011. A series of steps was used to identify children in the *Pathways* database who met the basic study criteria. First, the database was searched to identify all children whose parents reported they were able to say 30 or more words on either version of the MCDI. A total of 213 children met this criterion. Second, the database for this subset was searched to identify children who were between 24-52 months of age at the time of the first language assessments. Because the language measures were often administered over more than one month, each child’s mean age (in months) at the time of the PLS, VABS, MCDI, and PPVT-III assessments was calculated and used for this index. On average, the four language assessments were administered within 2.29 months of one another, with a range of 0.0-9.47 months. A total of 174 children met this criterion.

Next, the data for these 174 children were examined to identify all BE children, defined as those who had exposure to more than two languages at home prior to the time
of language assessment, according to parents’ responses to FBIQ question #11. A total of 58 children met this criterion. This subset of 58 children was then examined to identify those who met the specific study criteria for bilingual exposure, using additional information from the FBIQ (see Independent Variables section for these criteria). Two experts in bilingual language development were consulted in making these determinations. Only children for whom there was agreement across both the researcher and the two experts were included as BE candidates. A total of 20 BE children were identified in this manner and included in the study. On average, the language assessments used to calculate chronological age for this group were all conducted within 2.28 months of one another, with a range of 0.23-4.96 months (except for one participant for whom the language measures were conducted over 8.2 months).

Next, ME participants were identified. Data for the 174 children who met the basic study criteria were examined to identify those who were exposed to only one language at the time of assessment, according to question #11 in the FBIQ. A total of 98 children met this criterion. On average, the language assessments used to calculate chronological age for this group were all conducted within 1.90 months of one another, with a range of 0.03-5.49 months (except for one participant whose the language measures were conducted over 9.37 months).

Finally, two ME participants were matched to each BE child. This type of matching is often used in epidemiological and other studies that have limited access to participants in one group (e.g., BE children) and greater access to participants in the other (e.g., ME children). This allows for an increased number of participants which increases the power of the statistical analysis. First, all ME children who were within ±3 months of
age (a 6-month range) were identified for each BE child. This 6-month age range was within the 10-month age range criteria that Feltmate and Kay-Raining Bird (2008) used when they match bilingual and monolingual children with Down syndrome on mental age. Then, an attempt was made to match two age-matched ME children to each BE child using NVIQ scores within ±5 points. If a ME participant within ±5 points was not available, a ME participant with the next closest NVIQ score was selected. In the end, all but one ME participant fell within ±8 points of the BE cognitive score; this ME participant had a cognitive score that was 13 points lower than the BE match. A total of 40 ME participants were identified for this study.

**Data Analysis**

The data for the 60 BE and ME participants were isolated from the entire *Pathways* database and saved as a new file, with a language code added to distinguish the two groups. A series of analyses were then performed using SPSS software.

The first set of analyses was performed to confirm that the BE and ME groups were equal with regard to chronological age and NVIQ (the matching variables), and to provide descriptive statistics related to gender and the number of words produced according to the MCDI. Independent t-tests with a Bonferroni adjustment for multiple tests were performed for each variable. Table 4 displays the results.
Table 4. Descriptive information for BE and ME children

<table>
<thead>
<tr>
<th>Descriptor</th>
<th>BE group</th>
<th>ME group</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Chronological age (mo)</td>
<td>40.87</td>
<td>5.29</td>
<td>41.00</td>
</tr>
<tr>
<td>M-P-R Cognitive score (NVIQ)</td>
<td>63.21</td>
<td>15.78</td>
<td>59.60</td>
</tr>
<tr>
<td>Number of words produced on MCDI</td>
<td>229.85</td>
<td>169.98</td>
<td>223.23</td>
</tr>
</tbody>
</table>

None of the group differences were significant for the matching variables, confirming that the BE and ME groups were well matched. In addition, there were no significant differences across the two groups with regard to MCDI words produced. The ME group was comprised of 33 males (82.5%) and 7 females and the BE group had 16 males (80%) and 4 females.

Two sets of analyses were used to answer the seven research questions. Separate univariate ANOVAs were performed for ADOS communication scores, the age of first words and the age of first phrases. The number of autism-related intervention hours was not used as a covariate in these analyses because these variables represent language measures prior to diagnosis and were thus unaffected by the amount of subsequent intervention.

A series of analyses of covariance (ANCOVAs) with the number of autism-related intervention hours entered as a covariate was performed for the remaining four dependent variables. The number of autism-related intervention hours was calculated
using the speech-language pathology (SLP) and applied behaviour analysis (ABA) services information from the *Pathways* Services Log (Appendix B). First, the number of months the child received SLP and ABA was calculated using the “begin and end date” provided. Then, the total number of weeks was calculated by multiplying the number of months by 4 weeks. Third, the total number of weeks was multiplied by the number of hours per week the service was provided. Finally, the sum of the SLP and ABA intervention hours were entered into the SPSS database as the number of autism-related intervention hours.

A statistical consultant at the University of British Columbia was consulted to confirm the appropriate statistical analyses were performed.
CHAPTER 3: Results

The main purpose of this exploratory study was to investigate differences between matched groups of BE and ME young children with ASD with regards to the following variables (the assessment related to each variable is in parentheses): (1) severity of the autism-related communication impairment (ADOS), (2) age of first words (ADI-R), (3) age of first phrases (ADI-R), (4) single word receptive vocabulary scores (PPVT-III raw score), (5) receptive language scores (PLS-4-AC raw score), (6) expressive language scores (PLS-4-EC raw score), and (7) functional communication scores (VABS-II communication subscale raw score). Descriptive information for all seven variables is summarized in Tables 5 and 6.

Table 5. Means and standard deviations for age of first words, age of first phrases, and ADOS communication scores

<table>
<thead>
<tr>
<th>Variable</th>
<th>BE group</th>
<th>ME group</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADI-R age of first words (mo)</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td></td>
<td>22.55</td>
<td>7.03</td>
</tr>
<tr>
<td>ADI-R age of first phrases (mo)</td>
<td>29.64</td>
<td>7.65</td>
</tr>
<tr>
<td>ADOS communication scores</td>
<td>4.95</td>
<td>1.43</td>
</tr>
</tbody>
</table>
Table 6. Means and standard errors for four language measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>BE group</th>
<th></th>
<th>ME group</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SE</td>
<td>Mean</td>
<td>SE</td>
</tr>
<tr>
<td>PPVT raw score</td>
<td>24.71</td>
<td>4.36</td>
<td>19.34</td>
<td>3.51</td>
</tr>
<tr>
<td>PLS-AC raw score</td>
<td>27.87</td>
<td>2.03</td>
<td>29.04</td>
<td>1.44</td>
</tr>
<tr>
<td>PLS-EC raw score</td>
<td>33.39</td>
<td>1.63</td>
<td>31.57</td>
<td>1.16</td>
</tr>
<tr>
<td>VABS communication raw score</td>
<td>32.97</td>
<td>1.95</td>
<td>29.79</td>
<td>1.37</td>
</tr>
</tbody>
</table>

As described in Chapter 2, two sets of analyses were conducted. First, separate ANOVAs were run for ADI-R age of first words and age of first phrases, as well as for ADOS communication scores. The number of autism-related intervention hours was not used as a covariate in these analyses because these measures represent language abilities prior to the initiation of intervention and were thus unaffected by this variable. The results are summarized in Table 7.

Table 7. Results for age of first words, age of first phrases, and ADOS communication scores

<table>
<thead>
<tr>
<th>Measure</th>
<th>n for analysis</th>
<th>BE</th>
<th>ME</th>
<th>df</th>
<th>F</th>
<th>p</th>
<th>Partial η²</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADI-R age of first words</td>
<td>20</td>
<td>39</td>
<td>1</td>
<td>57</td>
<td>0.89</td>
<td>0.35</td>
<td>0.02</td>
</tr>
<tr>
<td>ADI-R age of first phrases</td>
<td>11</td>
<td>25</td>
<td>1</td>
<td>34</td>
<td>0.28</td>
<td>0.60</td>
<td>0.01</td>
</tr>
<tr>
<td>ADOS communication scores</td>
<td>20</td>
<td>40</td>
<td>1</td>
<td>58</td>
<td>2.47</td>
<td>0.12</td>
<td>0.04</td>
</tr>
</tbody>
</table>

The results indicate no significant differences between the BE and ME groups on any of these variables. Data were missing for some children in two of the three analyses. For ADI-R age of first words, data for 1 ME child was missing, with a note that this
milestone had not yet been reached. For ADI-R age of first phrases, data were missing for 24 children (9 BE and 15 ME), with notes in the database stating that this milestone had not yet been reached.

It was anticipated that the remaining dependent variables would be correlated, as all four are language measures. To examine this further, a Pearson’s product-moment correlation was run. The results are presented in Table 8.

**Table 8. Results for Pearson’s product-moment correlations**

<table>
<thead>
<tr>
<th>Measure</th>
<th>PPVT raw score</th>
<th>PLS-AC raw score</th>
<th>PLS-EC raw score</th>
<th>VABS comm. raw score</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPVT raw score</td>
<td>N/A</td>
<td>0.73*</td>
<td>0.72*</td>
<td>0.50**</td>
</tr>
<tr>
<td>PLS-AC raw score</td>
<td>0.73*</td>
<td>N/A</td>
<td>0.80*</td>
<td>0.63*</td>
</tr>
<tr>
<td>PLS-EC raw score</td>
<td>0.72*</td>
<td>0.80*</td>
<td>N/A</td>
<td>0.75*</td>
</tr>
<tr>
<td>VABS comm. raw score</td>
<td>0.50**</td>
<td>0.63*</td>
<td>0.75*</td>
<td>N/A</td>
</tr>
</tbody>
</table>

*p< .0001

**p< 0.003

Because of the significant correlations, a multivariate analysis of covariance (MANCOVA) with autism service hours entered as the covariate was attempted. A general rule for the sample size needed for a MANCOVA is a minimum of 10 subjects per variable (Maria Trache, personal communication March 25, 2011). The current analysis, including the covariate, consisted of five variables and thus required approximately 50 participants. When the MANCOVA was run, only 13 BE and 19 ME participants were included in the analysis; the remaining participants were dropped from the analysis due to one or more variables that were missing data. Specifically, for the
PPVT-III, 2 BE children had missing data because they were unable to produce a pointing response, which is required to complete this measure; and 5 BE children were reported to be “untestable.” Twenty ME children were also missing PPVT-III data -- 7 who lacked a pointing response, 6 who refused to cooperate with testing, 1 who was “untestable”, 1 who was too tired, 2 who were described as “too low” to take the test, 1 who could not pass the training items, and 2 for non-specific reasons. For the PLS-4, the EC raw score was missing for 1 ME child but no reason was provided in the database.

Since the minimum participant criterion was not met, a series of univariate ANCOVAs was run instead, with the number of autism-related service hours as the covariate. These results are summarized in Table 9.

**Table 9. Results for the four language measures**

<table>
<thead>
<tr>
<th>Measure</th>
<th>n for analysis</th>
<th>df</th>
<th>F</th>
<th>p</th>
<th>Partial η²</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPVT raw score</td>
<td>13</td>
<td>20</td>
<td>1, 31</td>
<td>0.91</td>
<td>0.35</td>
</tr>
<tr>
<td>PLS-AC raw score</td>
<td>20</td>
<td>40</td>
<td>1, 58</td>
<td>0.22</td>
<td>0.64</td>
</tr>
<tr>
<td>PLS-EC raw score</td>
<td>20</td>
<td>39</td>
<td>1, 57</td>
<td>0.82</td>
<td>0.37</td>
</tr>
<tr>
<td>VABS communication raw score</td>
<td>20</td>
<td>40</td>
<td>1, 58</td>
<td>1.76</td>
<td>0.19</td>
</tr>
</tbody>
</table>

The results indicate no significant differences between the BE and ME groups on any of the variables.
CHAPTER 4: Discussion

The primary objective of this study was to compare the early language abilities of young ME and BE children with ASD. Results indicated no statistically significant differences between BE and ME groups of children with ASD on seven indices of early language development. These findings are consistent with the limited research that is available on bilingual children with ASD (e.g., Hambly & Fombonne, 2010; Peterson et al., 2010), as well as with research on bilingual children with Down syndrome (Feltmate & Kay-Raining Bird, 2008; Kay-Raining Bird et al., 2005).

In this study, the BE and ME groups were similar on several variables that have been shown to influence language outcomes in previous studies. The two groups were systematically matched on age and NVIQ. Although the primary caregiver’s level of education and total household income was not specifically matched, similarities were evident across the two groups with regard to both variables (see Tables 1 and 2). Thus, it is unlikely that these variables played a significant role in the findings.

The BE group included children with a variety of second languages, including Japanese, French, Urdu, and Spanish. It has been suggested by previous studies that specific language pairings may result in different language outcomes because some languages have similar semantic and syntactic structures while others do not (e.g., Werker & Byers-Heinlein, 2008). Additional research investigating early language development in children with ASD who are exposed to various combinations of primary and secondary languages is required to clarify this issue.

Research on typically developing children has demonstrated that developmental language milestones are achieved at similar ages for both bilingual and monolingual
children (e.g., Fennel et al., 2007; Oller et al., 1997). Research questions 2 and 3 investigated two such milestones, age of first words and age of first phrases, and no significant differences were found between the BE and ME groups. These findings support Hambly and Fombonne’s (2010) findings of no significant differences between monolingual and bilingual children with ASD on the same two indices. The findings for the severity of autism-related communication, early receptive vocabulary, receptive language, expressive language, and functional communication abilities were also similar across the two groups and provides support for the contention that early bilingual language exposure does not add an additional burden to the developing language system in young children with ASD.

The results of this study suggest that a bilingual language environment does not interfere with early language development in young children with autism. This is positive news for the growing number of families in which more than one language is spoken and who are often told that they should restrict their minority language usage in order to simplify language input for their children with ASD. Question #13 on the FBIQ sheds some light on this belief by asking “Explain the reason(s) behind any changes you made in the number of languages spoken to your child” (Hambly & Fombonne, 2005). A total of 8 out of 20 BE families (40%) indicated that they decreased exposure to the non-majority language in order to simplify the language input provided to their child with ASD. Specifically, 5 caretakers indicated that they simplified the language environment because they were concerned about their child’s language delay and/or didn’t want to confuse their child with two languages; 1 family made this change based on the recommendation of their physician; and 2 families changed in order to prepare their
children for an English/French speaking society. In general, these families moved to a simplified language environment because they believed that it would optimize the language learning of their children with ASD. However, it is well known that bilingual families who change to a monolingual household and move away from their native language often face challenges in family dynamics, such as decrease in communication, since language and culture are closely tied. Furthermore, caregivers who switch to a language in which they themselves are not fluent may inadvertently impact language development of their children with ASD in a negative direction (Hambly & Fombonne, 2010). Unfortunately, the language proficiency of the caregivers was not captured in the database, and therefore could not be investigated further.

**Limitations and Future Research**

There are several limitations to the current study. The data used for the analyses were obtained from a pre-existing database. As a result, some factors that have been shown in previous research to influence language outcomes, such as the quality of language input (Hambly & Fombonne, 2010), were not examined because the information was not available. Furthermore, previous studies have emphasized the importance of including measures in all languages to which the child has been exposed when assessing the language ability of children who are bilingual (e.g., Genesee et al., 2004; Pearson et al., 1993; Peterson et al., 2010). For example, previous studies have reported that, when both languages are taken into account, bilingual children have larger conceptual vocabularies (i.e., the combined size of both vocabularies, minus translation equivalents) than their monolingual peers (Pearson et al., 1997; Peterson et al., 2010). Because the *Pathways* database contains measures for only one language, either French
or English, examination of conceptual vocabulary size was not possible. Thus, it is possible that the current study actually under-estimates the language ability of the BE participants. Future research should endeavour to include language measures from all languages to which participants have been exposed on a regular basis.

It can be challenging to get accurate assessment results when testing children with ASD, as evidenced by the number of missing assessment scores in the current database. It is not clear whether or not the missing data occurred at random; regardless, assessment challenges resulted in decreased sample sizes, especially for the PPVT-III. Assessment scores on this measure in particular may under-represent the vocabulary abilities of participants who were simply unable to conform to the requirements of the test (e.g., by producing a pointing response).

It is important to note that the language abilities of children with ASD can be arranged on a continuum, ranging from children who are nonverbal to those who are able to construct full sentences and engage in conversations. Individual child language profiles should be taken into consideration when making language intervention-related recommendations. In this study, children with <30 words on the MCDI were excluded; thus, the sample does not represent the entire range of the continuum. The decision to include only children with at least some speech ability was made because the purpose of the study was to compare verbal receptive and expressive language abilities in BE and ME children.

This was an exploratory study with the purpose of examining the impact of bilingual exposure in very young children with ASD prior to the initiation of extensive early intervention aimed at improving communication, language, and related outcomes. A
true experiment was not conducted and no variables were manipulated systematically; thus, causal relationships were not established. In future studies, early bilingual and monolingual language environments could be defined and manipulated more systematically, in order to examine the impact of such environments more carefully.

Because research investigating the effects of multi-lingual exposure on the language development of children with ASD is still in its early phases, the full impact of such exposure is not yet understood. Longitudinal studies of BE and ME children with ASD would allow practitioners to understand the developmental patterns of language development in these two groups. Another area that requires further research is determining the optimal language to use in autism-related therapy. A recent case study of a 3-year-old boy with autism reported that bilingual speech therapy resulted in positive language gains (Seung et al., 2006), suggesting that bilingual language intervention is beneficial. However, further research with larger samples, including a control group, is required before a conclusion can be made. Finally, no research to date has compared the language development of children who are learning two versus three or more languages. Therefore, it is not known if the language outcomes for children who are exposed to two languages are similar to language outcomes of children who are exposed to three or more languages. Research on bilingual individuals with autism is still in its infancy. As a result, there are many other interesting and important research questions that have yet to be addressed.

Implications for Practice

The results of this study, combined with those from other, recent studies of bilingual children with ASD (Hambly & Fombonne, 2010; Peterson et al., 2010), suggest
that families of children with ASD can provide bilingual home environments without interfering with their children’s language development. Unfortunately, many professionals continue to recommend limiting language exposure to a single language for children with ASD and other types of developmental delays (Jordaan, 2008) -- which, as noted previously, may have negative affects on family relationships. In addition, most language intervention with children with ASD is delivered using only a single language (Jordaan, 2008). Current research does not appear to support either of these practices.

Just as the language abilities of bilingual individuals lie on a continuum, the language of intervention can also be viewed in this way (Thordardottir, 2010). On one end of this continuum, language intervention can occur in only one language -- often the language spoken by a monolingual SLP. However, no research to date has demonstrated that monolingual interventions are more effective than bilingual approaches (Thordardottir, 2010). On the other end of the continuum, language intervention can be delivered equally in both languages to which a client is exposed to regularly. This approach is most supported by current research and is recommended by both the Canadian Association of Speech-Language Pathologists and Audiologists (CASLPA, 1997 as cited in Thordardottir, 2010) and the International Association of Logopedics and Phoniatry (IALP, 2006 as cited in Thordardottir, 2010). Based on these endorsements, monolingual SLPs and other early language interventionists who are not able to provide bilingual services should be encouraged to seek the assistance of interpreters in order to provide bilingual support (Jordaan, 2008). The specific strengths and weaknesses, learning environments, cultural preferences, and family dynamics that affect both
children with ASD and their families should be taken into consideration when specific language interventions are designed.

**Conclusion**

In summary, the current study found no significant differences on seven language variables between children with ASD raised in monolingual and bilingual environments. These findings suggest a bilingual environment does not put young children with ASD at further language risks. This is good news for minority language families, who often feel pressured to switch to a monolingual environment. These findings provide support for the preservation of bilingual language environments, at least for young children with ASD in the early stages of language development. Because this study provides a snapshot of language development at a single time point, additional, longitudinal studies are needed to understand the influence of bilingual exposure on the language development of children with ASD over time.
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Guidance Service.


APPENDICES

Appendix A: Family Background Information Questionnaire

Instructions: We ask that the following questions be answered by the person most knowledgeable (PMK) about the child. The PMK is the person who knows the child the best. These Statistics Canada Census questions are asked because many psychological journals are now requiring that a description about participants’ background is given so that the reader can make links to the populations they study and/or serve. For example, a study that includes only English speaking, African-Canadian children from wealthy homes may not represent the realities of children from other language or cultural groups. In order to see how the findings may relate to other groups of children we need to describe our participants’ background which is why we are asking the following questions.

This information will only be used for descriptive purpose. No individual information will be shared. Further, should your personal circumstances place you in a small group in which there are not many people, we will combine your group with another one to ensure your confidentiality.

1. What is your current marital status?

   Married  Common Law  Single  Legally Separated  Divorced  Widowed
   [ ]    [ ]    [ ]    [ ]    [ ]    [ ]

   Note: If your answer to question 1 (above) is “married” or “common law” please continue completion of questionnaire by providing information for both you (PMK) and your partner (where applicable).

2. How many years of school have you (and your partner) successfully completed?

   PMK  Partner

   1 to 6 years  ○  ○
   7 years   ○  ○
   8 years   ○  ○
   9 years   ○  ○
   10 years   ○  ○
   11 years   ○  ○
   12 years   ○  ○
   13 years   ○  ○
   No schooling   ○  ○
   Don’t know   ○  ○
3. **What is the highest level of education you have ever attained? Please Check ONE**

<table>
<thead>
<tr>
<th>PMK</th>
<th>Partner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Some High School</td>
<td></td>
</tr>
<tr>
<td>Completed High School</td>
<td></td>
</tr>
<tr>
<td>Some Trade, Technical or Vocational School or Business College</td>
<td></td>
</tr>
<tr>
<td>Some Community College, CEGEP or Nursing School</td>
<td></td>
</tr>
<tr>
<td>Some University</td>
<td></td>
</tr>
<tr>
<td>Diploma or Certificate from Community College, CEGEP or Nursing School or University</td>
<td></td>
</tr>
<tr>
<td>Diploma or Certificate from Trade, Technical or Vocational School or Business College</td>
<td></td>
</tr>
<tr>
<td>Bachelor or Undergraduate Degree or Teacher’s College (e.g., B.A., B.Sc., B.Ed.)</td>
<td></td>
</tr>
<tr>
<td>Master’s (e.g. M.A., M.Sc., M.Ed.)</td>
<td></td>
</tr>
<tr>
<td>Degree in Medicine (M.D.), Dentistry (D.D.S., D.M.D.), Veterinary Medicine (D.V.M.), Optometry (O.D.) or Law (LL.B.)</td>
<td></td>
</tr>
<tr>
<td>Earned Doctorate (e.g. Ph.D., D.Sc., Ed.D.)</td>
<td></td>
</tr>
<tr>
<td>Other (Specify)</td>
<td></td>
</tr>
</tbody>
</table>

4. **How would you describe:**

   a) **Your (and your partner’s) current employment status?**

<table>
<thead>
<tr>
<th>PMK</th>
<th>Partner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full time</td>
<td></td>
</tr>
<tr>
<td>Part time</td>
<td></td>
</tr>
<tr>
<td>Unemployed</td>
<td></td>
</tr>
<tr>
<td>Retired</td>
<td></td>
</tr>
<tr>
<td>Student</td>
<td></td>
</tr>
<tr>
<td>Homemaker</td>
<td></td>
</tr>
<tr>
<td>Company paid sick leave</td>
<td></td>
</tr>
<tr>
<td>Government disability</td>
<td></td>
</tr>
</tbody>
</table>
b) Your (and your partner’s) current employment position?

<table>
<thead>
<tr>
<th>PMK:</th>
<th>Title</th>
<th>Employer</th>
<th>Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Partner:</th>
<th>Title</th>
<th>Employer</th>
<th>Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. Please estimate in which of the following groups your household income falls?

- less than $5,000
- less than $10,000
- less than $15,000
- less than $20,000
- less than $30,000
- less than $40,000
- less than $50,000
- less than $60,000
- less than $70,000
- less than $80,000
- more than $80,000

6. What is the primary language spoken to your child at home? The primary language spoken is the one you use most often when speaking to your child.

- English
- German
- Persian (Farsi)
- Tagalog (Filipino)
- French
- Greek
- Polish
- Ukrainian
- Arabic
- Hungarian
- Portuguese
- Vietnamese
- Chinese
- Italian
- Punjabi
- Other (please specify)
- Cree
- Korean
- Spanish
- Other (please specify)
### 7. How would you best describe your (and your partner’s) ethnic or cultural heritage?

<table>
<thead>
<tr>
<th>PMK</th>
<th>Partner</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>White/Caucasian</td>
</tr>
<tr>
<td></td>
<td>Chinese</td>
</tr>
<tr>
<td></td>
<td>South Asian (e.g., East Indian, Pakistani, Punjabi, Sri Lankan)</td>
</tr>
<tr>
<td></td>
<td>Black (e.g., African, Haitian, Jamaican, Somali)</td>
</tr>
<tr>
<td></td>
<td>Native/Aboriginal People (North American Indian, Métis or Inuit/Eskimo)</td>
</tr>
<tr>
<td></td>
<td>Arab/West Asian (e.g., Armenian, Egyptian, Iranian, Lebanese, Moroccan)</td>
</tr>
<tr>
<td></td>
<td>Filipino</td>
</tr>
<tr>
<td></td>
<td>South East Asian (e.g., Cambodian, Indonesian, Laotian, Vietnamese)</td>
</tr>
<tr>
<td></td>
<td>Latin-American</td>
</tr>
<tr>
<td></td>
<td>Japanese</td>
</tr>
<tr>
<td></td>
<td>Korean</td>
</tr>
<tr>
<td></td>
<td>Other (please specify) __________________________</td>
</tr>
</tbody>
</table>

### 8. In what country were you born?

<table>
<thead>
<tr>
<th>PMK</th>
<th>Partner</th>
<th>Child (participating in study)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>__________________</td>
<td>__________________</td>
</tr>
<tr>
<td></td>
<td>__________________</td>
<td>__________________</td>
</tr>
<tr>
<td></td>
<td>__________________</td>
<td>__________________</td>
</tr>
</tbody>
</table>
9. Date of birth? Date/Month/Year

<table>
<thead>
<tr>
<th>PMK</th>
<th>Partner</th>
<th>Child (participating in study)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

10. What is your relationship to the child participating in current study?

- Biological father
- Biological mother
- Adoptive father
- Adoptive mother
- Foster father
- Foster mother
- Other → please specify: ______________________

11. Are there any languages spoken regularly in your home other than the primary language you indicated in Question 6 above?

- YES ○
- NO ○

Please proceed and answer questions 12 to 21. Please stop here and do not answer any more questions.

12. What language(s) did your family and other caregivers speak to your child from:

- **Birth to age 1?**
  - PMK: _________ Partner: _________ Other caregivers: _________
- **Age 1 to age 2?**
  - PMK: _________ Partner: _________ Other caregivers: _________
- **Age 2 to present?**
  - PMK: _________ Partner: _________ Other caregivers: _________

13. Please explain the reason(s) behind any CHANGES you made in the NUMBER of languages spoken to your child:
14. Please list the language(s) the following people CURRENTLY speak to your child: *Circle “NA” if not applicable.*

<table>
<thead>
<tr>
<th></th>
<th>Primary language</th>
<th>and</th>
<th>Other language(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMK</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Partner</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child’s siblings</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relatives</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educators/Therapists</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daycare workers/Nannies</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

15. During a **typical** week what PERCENT of time does your child hear **each** language:

*Exclude time spent watching TV.*

<table>
<thead>
<tr>
<th>Languages</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary language:</td>
<td></td>
</tr>
<tr>
<td>Other (please specify):</td>
<td></td>
</tr>
<tr>
<td>Other (please specify):</td>
<td>= 100%</td>
</tr>
</tbody>
</table>

16. How many **hours per week** does your child spend watching **TV or movies in:**

- French: ___ hours per week
- English: ___ hours per week
- Other (specify)_____: ___ hours per week

17. What language(s) does your child **currently** UNDERSTAND?

| Primary language:                |                  |
| Other languages:                 |                  |
18. What language(s) does your child currently SPEAK?  
NA (not yet speaking)
   
   Primary language:  
   
   Other languages:  

19. Does your child “switch” languages to use the same language as the person he/she is talking to? (Example: English with mother, French with father)
   
   Yes ☐ No ☐ NA ☐

20. Does your child use words in both languages to refer to the same object? (Example: can ask for “water” and “l’eau”, or “cookie” and ‘biscuit”)
   
   Yes ☐ No ☐ NA ☐

21. Does your child “mix” languages within a sentence? (example: “I want l’eau”)
   
   Yes ☐ No ☐ NA ☐

Thank you!
### Appendix B: Pathways Services Log

**Autism Spectrum Disorders: Pathways to Better Outcomes**

**Services Log**

<table>
<thead>
<tr>
<th>Child’s Name: ______________________</th>
<th>Date: ____________</th>
</tr>
</thead>
</table>

Please summarize any educational or specialized treatment program your child has participated in, including speech therapy, occupational therapy, applied behavior analysis (ABA), regular education, special education, etc. Please use the back of this sheet if necessary. We have provided some examples.

<table>
<thead>
<tr>
<th>Program</th>
<th>Brief Description of Program</th>
<th>Hours per Week</th>
<th>Begin and End Date OR Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning to Learn</td>
<td>Social skills group (after school)</td>
<td>5</td>
<td>9/2004 - ongoing</td>
</tr>
<tr>
<td>Sands Elementary</td>
<td>Regular pre-school with Group speech therapy</td>
<td>30 hours</td>
<td>9/2004 - ongoing</td>
</tr>
<tr>
<td></td>
<td>Individual occupational therapy</td>
<td>2, 1</td>
<td></td>
</tr>
<tr>
<td>Sands Elementary</td>
<td>Special education summer school</td>
<td>15</td>
<td>Only 6 weeks</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>