PRAGMATIC SKILLS OF BILINGUAL AND MONOLINGUAL CHILDREN WITH AUTISM SPECTRUM DISORDER

by

Tracy Cheuk Sze Lam

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Abstract

Although the pragmatic aspect of language is a major deficit in children with autism spectrum disorder (ASD), there is limited research on the effects of bilingualism on social communication in this population. This study aimed to investigate the influence of bilingualism on pragmatic skills in children with ASD by comparing the pragmatic skills of 8.5 – 9 year old monolingual and bilingual children with autism. The two groups were compared on scores from the Children's Communication Checklist (CCC-2; Bishop, 2006), scores from the Expression, Reception and Recall of Narrative Instrument protocol (ERRNI; Bishop, 2004), and scores from the ERRNI storytelling narrative transcript.

No significant differences were found between the monolingual and bilingual children with ASD on any of the measures of pragmatic skills. Specifically, the two groups performed similarly on the ERRNI protocol, which examined the children's ability to convey main ideas in a storytelling task and to answer comprehension questions. They also had comparable ERRNI transcript scores, which measured the length of the transcript; lexical and grammatical errors in the transcript; and the children's ability to use causal statements, clear references and evaluative devices. The comparable performance on all measures of pragmatic skills between the two groups suggests that bilingualism may not impede the development of pragmatic skills in children with ASD.

Preface

The topic and the design of this study were developed by the author T. Lam and her thesis committee members, Dr. S. Marinova-Todd and Dr. P. Mirenda. With guidance from Dr. P. Colozzo and Dr. S. Marinova-Todd, the author created the coding manual used in this research based on a study by Colozzo, Morris and Mirenda (in press), a study by Colozzo and Whitely (2015) and an unpublished study by Yang (2011).

This study utilized data collected for the "Autism Spectrum Disorders: Pathways to Better Outcomes (Phase II)" research project that was approved by UBC's Behavioural Research Ethics Board (BREB) on June 26, 2009 under certificate H09-01085-0. The Pathways research team approved Ms. Lam's use of data for her thesis on October 28, 2014 and her name was added to the BREB ethics certificate on April 12, 2015 (H09-01085-A03). Ms. Lam was responsible for all data management and data analysis and is the sole author of this thesis.

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Dedication

This thesis is dedicated to the Rouse family, who believed in me and gave me the confidence to take the first step in pursuing my passion.

Chapter 1: Introduction

The decision to raise a child as monolingual or bilingual has lifelong consequences that can influence the child's connection with his or her family. This choice is especially difficult for parents to make when the child has delays in language development. Although bilingualism is well explored in the typically-developing population, there is still limited research on bilingualism in children with autism spectrum disorder (ASD). The pragmatic aspect of language is particularly important to investigate in children with ASD because it is a core area of difficulty for this population (Tager-Flusberg, 1995). In fact, deficits in social communication comprise one of the major diagnostic criteria for ASD in the *Diagnostic and Statistical Manual of Mental Disorders (DSM-5)* of the American Psychiatric Association (2013). This study contributes to the current literature on the effects of bilingualism by examining whether there is a difference in pragmatic skills between monolingual and bilingual children with ASD.

This review of the literature will begin by comparing the pragmatic skills between typically-developing children and children with ASD, to understand the differences between the two groups in infant, toddler, and school-aged populations. Next, the differences in pragmatic skills between bilingual and monolingual children in the typically-developing population will be discussed. An understanding of how bilingualism influences pragmatic skills in the typically-developing population may provide insight on how bilingualism affects pragmatic skills in children with ASD. Research comparing bilingual and monolingual children with ASD will also be reviewed to understand differences in various aspects of their language development, including their development of pragmatic skills.

1.1 Differences in Pragmatic Skills between Typically-Developing Children and Children with ASD

1.1.1 The Importance of Pragmatic Skills

The pragmatics of language, which can be defined as "the ability to use language appropriately in social contexts" (Tager-Flusberg, 1999, p. 329), is an area in which all children with ASD struggle to various degrees (Tager-Flusberg, 1999). Even when all other aspects of language are intact, it is still challenging for someone who has difficulty with pragmatics to engage in meaningful conversations. One aspect of pragmatics with which children with ASD experience difficulty is being aware of the listener's perspective during interactions (Tager-Flusberg, 1996). Such difficulty may lead to a failure to clearly reference characters during storytelling, resulting in an unclear narrative that is hard for the listener to follow. Children with ASD have been found to produce shorter, less complex narratives compared to typically-developing children and children with intellectual disabilities (Tager-Flusberg, 1995), and to include fewer references to characters' emotions compared to typically-developing children (Siller, Swanson, Serlin, & Teachworth, 2014). They have also been found to include more bizarre material in their narratives compared to children with Down syndrome (Loveland, McEvoy, & Tunali, 1990). Even if an individual can communicate in long, grammatical sentences, a lack of pragmatic skills may still impede his or her ability to communicate effectively. The listener may have a difficult time following the disorganized narratives told by an individual with pragmatic problems, and the individual may even appear to be rude or odd when he or she violates social rules unknowingly. Challenges with mastering the pragmatics of language may affect an individual's ability to build personal relationships and to function in society.

1.1.2 Differences in Joint Attention between Typically-Developing Children and Children with ASD in Early Years

To develop language and an understanding of the implicit rules in the social environment, typically-developing infants and toddlers spend a large amount of time observing adults and imitating their speech and actions (Stephens & Matthews, 2014). Around 9 months of age, not only do children share eye contact with other people, but they also develop joint attention, "the ability to share attention to an object or event with another person" (Bean & Eigsti, 2012, p. 1304). Children with ASD have been shown to have deficits in joint attention (McDuffie, Yoder, & Stone, 2006), which may have implications for their language development. A study by Loveland and Landry (1986) compared 11 children with ASD (mean age, 8 years 6 months) and 11 children with developmental language delays (mean age, 5 years 9 months) on their ability to comprehend and produce pronouns, their response to joint attention bids, and their initiation of joint attention. The children were matched on mental age and mean length of utterance. The results indicated that children with developmental language delays responded correctly to more joint attention interactions than did the children with ASD. Furthermore, use of the pronouns "I" and "you" in children with ASD was found to be related to the number of spontaneous initiations of joint attention per session. This suggests that joint attention may be linked to the acquisition of language, especially on aspects of language that require an understanding of the social context of discourse, such as the pronouns "I" and "you" (Loveland & Landry, 1986).

The link between joint attention and the development of language has also been demonstrated in other studies (Bono, Daley, & Sigman, 2004; Toth, Munson, Meltzoff, & Dawson, 2006). A study that followed 60 children with ASD found that the initiation of protodeclarative joint attention (i.e., joint attention for social enjoyment) was strongly associated

with language skills in 3 – 4 year old children with ASD (Toth et al., 2006). Similarly, Bono et al. (2004) found that more frequent initiations of joint attention were linked to greater gains in language age in a group of 29 children with ASD (mean age, 47 months). Language abilities were measured by either the Reynell Developmental Language Scales (Reynell & Gruber, 1990) or the Clinical Evaluation of Language Fundamentals-Revised (CELF-R; Semel, Wiig, & Secord, 1987). Although the studies by Bono et al. (2004) and Toth et al. (2006) only reported a link between language skills and joint attention without specifically addressing the pragmatic aspect of language, it is plausible that the higher performance in general language skills is linked to better pragmatic language. In support of this hypothesis, a study by Whyte and Nelson (2015), which compared 27 children with ASD to 69 typically-developing children aged 5 – 12 years, found that syntax and vocabulary were strong predictors of pragmatic language. Furthermore, both groups were comparable in their rate of pragmatic language development with regard to their vocabulary and theory of mind abilities, suggesting that levels of pragmatic language may be connected to levels of basic language (Whyte & Nelson, 2015). Deficits in joint attention for children with ASD in the early years may be associated with lower levels of general language abilities, which may in turn affect the development of pragmatic skills.

1.1.3 Differences in Theory of Mind between Typically-Developing Children and Children with ASD in Later Years

In addition to challenges with joint attention, pragmatic deficits in children with ASD have also been attributed to deficits in theory of mind development (Tager-Flusberg, 1999). Theory of mind is "the ability to attribute mental states, such as desires, knowledge, and belief, to one self and other people as a means of explaining behavior" (Tager-Flusberg, 1999, p. 326). The hypothesis that theory of mind ability is significantly related to pragmatic abilities is

supported by a large-scale longitudinal study using data from 67 participants with ASD (ages 4 – 14; Tager-Flusberg, 2003). The study used the Vineland Adaptive Behavior Scales (VABS; Sparrow, Balla, & Cicchetti, 1984) to obtain an objective measurement of participants' abilities in three subdomains (i.e., Daily Living Skills, Communication, and Socialization) and examined whether IQ, language abilities, or theory of mind scores predicted scores on each subdomain of the VABS. Language ability was measured by a combined receptive and expressive vocabulary score based on the Peabody Picture Vocabulary Test – III (PPVT - III; Dunn & Dunn, 1997) and the Expressive Vocabulary Test (EVT; Williams, 1997). Theory of mind ability was assessed with a series of 10 tasks that were sequenced into three batteries to examine early, middle, and more advanced theory of mind skills. It was found that theory of mind abilities was the single best predictor of Socialization scores in the VABS, supporting the hypothesis that theory of mind is important for pragmatic abilities (Tager-Flusberg, 2003).

1.1.4 Differences in Narrative Performance between Typically-Developing Children and Children with ASD in Later Years

Development of theory of mind is commonly assessed with tasks such as the false belief task, which assesses an individual's ability to understand that people may hold beliefs that are incongruent with reality. Another method of investigating theory of mind deficits is by analyzing narrative productions. When producing narratives, a speaker must consider the listener's perspective and provide appropriate information that will enhance the listener's understanding of the narrative. Deficits in theory of mind may increase the difficulty an individual has with considering the listener's needs (Kimhi, 2014). In addition to considering the listener's needs, theory of mind is also crucial for understanding characters' perspectives. This can be examined through narratives by analyzing the narrator's ability to express the characters' intentions, mental

states, and emotions. A recent study found that children with ASD (mean age, 86 months) generated fewer references to characters' emotions compared to typically-developing peers (mean age, 82 months) in a storytelling narrative elicited by a wordless picture book (Siller et al., 2014). In addition, it was found that the children's use of emotional terms in their narratives was associated with their performance on a battery of theory of mind tasks, which included pretend and desire tasks (Kavanaugh, Eizenman, & Harris, 1997; Wellman & Woolley, 1990), false belief tasks (Baron-Cohen, Leslie, & Frith, 1985; Perner, Leekam, & Wimmer, 1987; Sullivan, Zaitchik, & Tager-Flusberg, 1994; Wimmer & Perner, 1983), a moral responsibility task (Mant & Perner, 1988), and the lies and jokes task (Sullivan, Winner, & Hopfield, 1995). In the false belief task, the first doll character places an object in a basket, leaves the room, and a second doll character hides the object in a new location. The children are then asked whether the first doll character will look for the object in the basket or in the new location (Baron-Cohen et al., 1985). The lies and jokes task tests children's ability to distinguish a joke from a lie (Sullivan et al., 1995). The link between the performance on these theory of mind tasks and narratives supports the use of narratives to understand theory of mind abilities, which can in turn provide information on children's pragmatic skills.

Previous research has identified characteristics in narratives that are specific to the ASD population (Loveland et al., 2013; Tager-Flusberg, 1995). In a study by Tager-Flusberg (1995), children with ASD were found to have significantly shorter and less complex narratives compared to typically-developing children and children with intellectual disabilities. Tager-Flusberg (1995) also compared the use of causal statements between the three groups of children: those with ASD (mean age, 145 months), those with intellectual disabilities (mean age, 135 months), and typically-developing children (mean age, 93 months). Both typically-developing

children and children with intellectual disabilities produced causal statements such as "then he climbed out of the window and helped the dog so he wouldn't get cut," and "the little boy got mad because he [the dog] jumped out of the window," whereas children with ASD did not produce any causal statements to explain relationships between events. One interpretation of this finding is that children with ASD are not aware of the need to explain causal relationships to their listeners (Tager-Flusberg, 1995) due to deficits in theory of mind. Differences in narratives between children with ASD and Down syndrome were also documented in a study that asked children to retell a story and answer questions after watching a puppet show (Loveland et al., 1990). There were 16 children in each group; the group of children with ASD had a mean age of 162 months, and the group of children with Down syndrome had a mean age of 159 months. Each participant was presented with a story twice, and was asked to retell the story to an experimenter who was not present during the story presentation. In the end, they were asked follow-up questions to assess their understanding of the factual and affective information in the story, as well as their understanding of the themes in the story. The story re-tell narratives and responses to follow up questions were all recorded and transcribed. Results indicated that the group of children with ASD included more bizarre language in their narratives and had more bizarre and inappropriate content in their answers to the follow-up questions. According to Loveland et al. (1990), these inappropriate responses to the follow-up questions could reflect three different problems related to theory of mind: (a) a lack of understanding of the characters' affect or the reasons for their actions; (b) poor awareness of social expectations; and/or (c) poor awareness of what information the listener was looking for in the questions.

Children's use of pronouns in narratives can also provide information about their theory of mind abilities. To use pronouns properly in a narrative, the speaker must understand that the

listener does not share the same knowledge and, therefore, will not know which character is being referred to if pronoun references are ambiguous. There have been mixed results in the literature on whether children with ASD have challenges with using pronouns appropriately (Arnold, Bennetto, & Diehl, 2009; Loveland et al., 1990; Perovic, Modyanova, & Wexler, 2013; Tager-Flusberg, 1995). The mixed results may be due to limitations in the methodology of these studies (Novogrodsky, 2013). One methodological problem noted by Novogrodsky (2013) regarding the study by Arnold et al. (2009) is that both third person subject pronouns and zero anaphors were analyzed together, even though they have different developmental trajectories in typically-developing children (Chierchia & McConnell, 1990). Another methodological problem Novogrodsky (2013) discussed was the young age of the participants. In the study by Tager-Flusberg (1995), the results showed no difference between the use of pronouns in typically-developing children and children with ASD. The children with ASD were aged 10 to 12;1 (years; months) and were matched to typically-developing peers with an average age of 6;8 based on receptive language abilities. Novogrodsky (2013) noted that the findings in this study can be attributed to the fact that even typically-developing children at 6;8 years of age do not yet consistently use clear antecedents for pronouns (Berman, 2009); hence, a difference in typically-developing children and children with ASD at this age would not be expected. In the study by Novogrodsky (2013), the limitations mentioned above were controlled for by measuring subject pronouns only and by recruiting older participants with a mean age of 10 years, to ensure that clear antecedents for pronouns were developed in the typically-developing children. The results indicated that children with ASD in this age range produced significantly more ambiguous third person subject pronouns compared to their typically-developing peers (Novogrodsky, 2013).

In summary, research has identified that children with ASD tend to produce shorter narratives with ambiguous pronouns (Novogrodsky, 2013), a lack of causal statements (Tager-Flusberg, 1995), and the inclusion of bizarre material (Loveland et al., 1990). These challenges can all be attributed at least in part to deficits in theory of mind, which could negatively affect pragmatic skills. Consistent with findings from narratives in older children that indicate pragmatic difficulties, younger children with ASD have also been noted to have challenges with joint attention (McDuffie et al., 2006), a skill that is essential for social and language development (Bean & Eigsti, 2012).

1.2 Differences in Pragmatic Skills between Typically-Developing Monolingual and Bilingual Children

Research has identified areas of difficulty in monolingual children with ASD that could negatively impact pragmatic development, but there is still limited information on the pragmatic development of bilingual children with ASD. To understand the similarities and differences in pragmatic skills between monolingual and bilingual children with ASD, it is helpful to gain insight from monolingual and bilingual children in the typically-developing population. A particular area that would provide valuable information is the development of theory of mind in typically-developing bilingual and monolingual children. Since theory of mind deficit is a prevailing hypothesis for pragmatic difficulties in monolingual children with ASD, it is worthwhile to investigate whether the same is true for bilingual children with ASD.

In the typically-developing population, there is evidence suggesting that bilingual children have advantages in theory of mind development. The first reason why bilingual children may have advantages in theory of mind is because they must learn two ways to express the same concept, which may lead to a better understanding of the arbitrariness of language and help

develop metalinguistic skills (Goetz, 2003). This may in turn benefit the development of theory of mind because theory of mind tasks have been thought of as problems of metarepresentation (Goetz, 2003). Another reason there may be a bilingual advantage in theory of mind is because bilingual children must learn to choose the appropriate language to speak based on the listener's needs (Goetz, 2003), therefore giving them extra practice considering others' perspectives. In a study by Goetz (2003), 3- and 4-year old Mandarin-English bilingual children performed significantly better than both English monolingual and Mandarin monolingual children on a series of theory of mind tasks. Similarly, Nguyen and Astington (2014) found that, after controlling for age and verbal ability, 3-to-5-year-old English-French bilingual preschoolers achieved higher scores than both English monolingual and French monolingual children in two false belief tasks – the change-in-location task and the unexpected-contents task. In addition, after controlling for age and verbal ability, the bilinguals performed significantly better than the two monolingual groups on the Backward Word Span task, which measures working memory (Nguyen & Astington, 2014). Performance on the Backward Word Span task also had a significant positive correlation with scores on the false belief tasks, leading the authors to conclude that working memory might be the underlying factor responsible for the bilingual advantage in false belief tasks. Furthermore, similar advantages in theory of mind were also noted with bilingual adults when compared to monolingual adults on a false-belief task (Rubio-Fernández & Glucksberg, 2012).

Compared to standardized tests, the task of producing narratives is less structured and can provide important information regarding a child's ability to use language appropriately according to social contexts. Research on bilinguals' narrative production has demonstrated that the language choice in narrative assessment is crucial, as bilinguals may perform differently

depending on the language in which they are assessed (Fiestas & Peña, 2004; Gutiérrez-Clellen, 2002), and that there are aspects of bilingual children's narratives that differ from their monolingual peers (Chen & Lei, 2013; Chen & Yan, 2011; Serratrice, 2007). A study examining the difference in referring expressions in narratives by 9-year-old Chinese-English bilingual children and their monolingual peers compared the three groups' ability to introduce, re-introduce, and maintain reference of characters (Chen & Lei, 2013). Referring expressions, such as noun phrases and pronouns, are used to indicate an entity for the listener (Chen & Lei, 2013). In the study by Chen & Lei (2013), the Chinese monolingual participants were from Beijing, China (mean age of 9;1), the English monolingual participants were from the greater Atlanta area (mean age of 9;5), and the Chinese-English bilingual participants were born and raised in the USA (mean age of 9;3). The study found that, when introducing referents, monolingual English children used more indefinite noun phrases (e.g., *a* dog), and fewer definite noun phrases (e.g., *the* dog) compared to monolingual Chinese children. Interestingly, the pattern used by Chinese-English bilingual children had similar aspects to both their Chinese and their English monolingual peers, indicating that they had developed a pattern that falls between the two monolingual groups and were influenced by both languages (Chen & Lei, 2013).

The indication that bilinguals are influenced by both languages suggests that they may be able to transfer advantages in language development from one language to another language. This can be described as bilingual bootstrapping, in which "something that has been acquired in language A fulfills a booster function for language B" (Gawlitzek-Maiwald & Tracy, 1996, p. 903). An example of bilingual bootstrapping was discussed in a study that analyzed the usage of evaluative expressions in narratives of English monolinguals and Chinese-English bilinguals at the ages of 5, 8, 10, and as young adults (Chen & Yan, 2011). Evaluative expressions include

descriptions of emotional and mental states, which are used to provide information as well as to highlight important details to the listener. Results from the study by Chen & Yan (2011) indicated that bilingual children used more evaluative clauses relative to story length in English narratives compared to same-aged monolingual peers, even though the bilinguals were exposed to English 2 to 3 years later than the monolingual participants. The authors suggested that the bilingual children could have been using the more developed language (i.e., Chinese) to facilitate the use of evaluative expressions in English. Since previous research has shown that Chinese-speaking children include more feeling states of characters (Wang & Leichtman, 2000) and affective elements (Domino & Hannah, 1987) compared to English-speaking children, it is likely that Chinese-English bilinguals are transferring this advantage from Chinese to their production of evaluative clauses in English (Chen & Yan, 2011).

The use of evaluative expressions in narratives has been shown to be linked to performance on theory of mind tasks (Fernández, 2013; Siller et al., 2014). Consistent with a study by Siller at al. (2014) that demonstrated an association between the use of emotion terms in children with ASD and their performance on theory of mind tasks, a study by Fernández (2013) also found that theory of mind scores were a significant predictor of pragmatic language skills in narratives. One hundred and fifteen typically-developing children in Colombia, aged 4.8 to 8.8 years, were divided into groups based on gender and grade level, and completed a storytelling task elicited with a wordless picture book (Fernández, 2013). Some examples of the evaluations coded in the narratives included expressions of desires, intentions, emotions, and the use of reported speech. The children also completed first-order scaled theory of mind tasks (Wellman & Liu, 2004), which assess the child's understanding of a person's mental states; and second-order scaled theory of mind tasks (Banerjee, 2000; Sullivan, Winner, & Hopfield, 1995; Sullivan,

Zaitchik, & Tager-Flusberg, 1994), which evaluate the child's understanding of a character's belief about another character's belief. Results indicated that scores on the second-order theory of mind tasks, along with general language ability, explained 45% of the variance in the participants' pragmatic competence; and that second-order theory of mind scores were a significant predictor of pragmatic skills in narratives (Fernández, 2013). These results suggest that the use of evaluative devices in narratives is linked to theory of mind abilities, and may be used in helping researchers in understanding children's pragmatic skills.

In order to use language in a pragmatically appropriate way, children must learn to consider their interlocutor's perspectives and language capabilities. Both monolingual and bilingual children have opportunities in everyday life to practice pragmatic skills as they speak with different interlocutors. Research by Shatz and Gelman (1973) found that 4-year-old English monolingual children adjusted the complexity of their speech based on the listener; they produced simpler, shorter utterances when speaking with 2-year-olds than when speaking with adults about the same topic. In addition to adjusting their language complexity based on the interlocutor, bilingual children also need to choose between two languages when interacting with different interlocutors. This ability to choose the appropriate language depending on the speaker is called pragmatic differentiation (Tare & Gelman, 2010). Bilingual children as young as 3 years old demonstrated pragmatic differentiation by speaking primarily in the language that matched an unfamiliar interlocutor's language during a free play task (Tare & Gelman, 2010). The additional challenge of pragmatic differentiation that is unique to bilingual children may provide them with more opportunities for making pragmatic judgments. The benefits of having extra practice with considering the listener's needs may even extend to the productions of narratives,

allowing bilingual children to better understand the listener's perspective and produce narratives in a clear and organized manner.

Understanding the social environment and others' perspectives is crucial for developing the pragmatic aspect of language. Hence, investigating the development of theory of mind skills can provide insight into children's pragmatic skills. The current literature suggests that there is a bilingual advantage in theory of mind development. Research has found that bilinguals perform better on a series of theory of mind tasks (Goetz, 2003) and other false belief tasks (Nguyen & Astington, 2014), and that a similar bilingual advantage is also evident in adults (Rubio-Fernández & Glucksberg, 2012). English-Chinese bilinguals were also found to produce more evaluative clauses in narratives compared to English monolinguals and this could be interpreted as an instance of bilingual bootstrapping (Chen & Yan, 2011). In addition, bilingual children as young as 3 years old demonstrated the use of pragmatic differentiation (Tare & Gelman, 2010), which may provide them with additional opportunities to make pragmatic judgments compared to their monolingual peers. Based on the research evidence that supports an advantage in theory of mind for bilinguals in the typically-developing population, it was deemed worthwhile to investigate whether the same advantages are seen in bilingual children with ASD.

1.3 Differences in Pragmatic Development between Monolingual and Bilingual Children with ASD

Early on, bilingual children with ASD show differences in language development that could lead to benefits in acquiring pragmatic skills in later years compared to monolingual children with ASD. A study that compared English monolingual and English-Spanish bilingual toddlers with ASD found that the bilingual toddlers were more likely to coo, point to objects, gesture, and engage in pretend play (Valicenti-McDermott et al., 2013). The higher instances of

cooing, pointing to objects, and gesturing may indicate that the bilingual children with ASD were more interactive compared to their monolingual peers, which could lead to more language exposure and experience interacting with others. This additional experience in engaging with others may benefit pragmatic development because it gives bilingual children more opportunities to observe how others interact in different social contexts. In addition, higher instances of pretend play might reflect that the bilingual participants paid more attention to their interlocutors and were more likely to imitate them. The tendency to pay attention to the social environment and imitate others may also facilitate the development of pragmatic skills, since this is how typically-developing infants acquire pragmatic skills (Stephens & Matthews, 2014).

As children advance from cooing and babbling to learning words, some parents become concerned that learning an additional language might impede the language development of children with ASD, and this belief is sometimes reinforced by professionals (Yu, 2013). In contrast to this view, the literature to date has not found any negative effects of bilingualism on children with ASD (Hambly & Fombonne, 2012; Ohashi et al., 2012; Petersen, Marinova-Todd, & Mirenda, 2012; Reetzke, Zou, Sheng, & Katsos, 2015). A study by Hambly and Fombonne (2012) examined the effects of bilingualism on language development in 75 children with ASD (ages 36 to 78 months). The monolingual participants spoke French, English, or Spanish; and the multilingual participants either had bilingual exposure to French and English, bilingual exposure to French or English plus a minority language, or trilingual exposure to French, English, and a minority language. The bilingual/trilingual group was further categorized as having simultaneous or sequential exposure to the languages, based on whether dual-language exposure occurred before 12 months of age. To obtain information about the children's language skills and early language milestones, Hambly and Fombonne (2012) used a variety of parent report measures,

including the MacArthur-Bates Communicative Development Inventory: Words and Sentences (MCDI; Fenson et al. 1993), the Vineland Adaptive Behavior Scales- 2nd edition (VABS-II; Sparrow, Cicchetti, & Balla, 2005), and the Autism Diagnostic Interview-Revised (ADI-R; Le Couteur, Lord, & Rutter, 2003). No significant differences were found between the monolingual group, the simultaneous bilingual exposure group, and the sequential bilingual exposure group in either early language milestones or in expressive and receptive language in their dominant language. The results from this study demonstrated that bilingual exposure was not associated with any language delay, regardless of age of exposure to the two languages (Hambly & Fombonne, 2012).

Similarly, a study by Ohashi et al. (2012) found no differences between monolingual and bilingual children who were recently diagnosed with ASD on a variety of language measures. In this study, a group of bilingual-exposed children (ages 24 – 52 months) was compared to a group of monolingual children with ASD matched on age and nonverbal IQ. The bilingual-exposed participants were exposed to two languages before the age of 2, one of which was English or French, and received at least 20% ongoing exposure to each language prior to the time of the language assessment. The monolingual participants were exposed to only one language, either English or French, from birth to the time of the language assessment. The two groups were compared on the severity of ASD-related communication impairment as measured by the Autism Diagnostic Observation Schedule (ADOS; Lord, Rutter, DiLavore, & Risi, 2003); age of first words and first phrases, as assessed by the ADI-R (Le Couteur, Lord, & Rutter, 2003); receptive and expressive language, as measured by the Preschool Language Scale, 4th edition (PLS-4; Zimmerman et al., 2002); and functional communication scores, as indicated on the VABS-II (Sparrow, Cichetti, & Balla, 2005). On all of these language measures, no statistically significant

differences were found between the two groups. In fact, the authors noted that the study may have underestimated the bilingual children's abilities because their expressive and receptive language skills were tested in only one language. Consistent with the study by Hambly and Fombonne (2012), the results from this study suggest that bilingual exposure does not have a negative effect on the language abilities of children with ASD.

In addition, similar results were reported in a study by Petersen, Marinova-Todd, and Mirenda (2012), which compared preschool-age English-Chinese bilingual children with ASD with English monolingual children with ASD who were matched by chronological age at the time of testing. In this study, the PPVT-III (Dunn & Dunn, 1997) was used to measure receptive vocabulary and the Preschool Language Scale (PLS-3; Zimmerman et al. 1992) was used to assess receptive and expressive language. In addition, the Communicative Development Inventories (Fenson et al. 1993) and the Chinese Communicative Development Inventories (Tardif and Fletcher, 2008) were used to examine the children's vocabulary in English and Chinese. After controlling for nonverbal IQ, as measured by the Mullen Scales of Early Learning (MSEL; Mullen 1995), the bilingual group was found to have a larger total production vocabulary size, with no significant difference in conceptual vocabulary and English vocabulary size compared to the monolingual group. Conceptual vocabulary refers to the number of different concepts for which a child has a label, regardless of which language the child knows the labels in. For example, if a child knows the English and Chinese word for the concept 'mom', this would count as one concept with two labels, one in each language. The results indicated not only that bilingualism did not impede the language development of children with ASD, but also that bilingual children with ASD may have larger total production vocabularies compared to their monolingual peers.

Consistent with findings on language development at the word level, an unpublished study that compared the narratives of monolingual and bilingual children with ASD also found that bilingualism did not have a negative impact on the performance on narratives (Yang, 2011). The study examined the areas of global structure, local linguistic structure, and evaluative comments in narratives elicited with a wordless picture book and found no group differences between 13 English monolingual children with ASD (mean age of 8;9 years) and 10 Mandarin-English bilingual children with ASD (mean age of 8;8 years). Furthermore, the findings revealed that the use of evaluative devices in the 10 bilingual children with ASD was similar to 10 typically-developing bilingual children. This finding suggests that certain aspects of language development, such as the use of evaluative devices, may be minimally affected in bilingual children with ASD.

A recent study from Guangzhou, China also examined the effects of bilingual exposure on children with ASD with a focus on the pragmatic aspects of language (Reetzke et al., 2015). The bilingual-exposed participants (mean age, 61 months) had ongoing exposure to two mutually unintelligible Chinese languages, one of which was either Mandarin or Cantonese. The monolingual participants (mean age, 60 months) were all exposed to a Chinese language. The study used the Chinese version of the Children's Communication Checklist- 2nd Edition (CCC-2; Bishop, 2006) adapted by Lam and Ho (2014) to assess structural and pragmatic abilities in the children's dominant language; and the Chinese adaptation of the Social Responsiveness Scale (SRS; Constantino & Gruber, 2005) validated by Wang, Lee, Chen, & Hsu (2012) to assess the children's social functioning. Results indicated no significant difference in performance on any of the measures between the bilingual and monolingual Chinese participants. In addition to

examining structural language competence, this study demonstrated that bilingual children with ASD are comparable to monolingual peers in terms of their levels of pragmatic skills.

Thus far, the literature does not support the view that bilingualism has a negative effect on language development in children with ASD. The current study sought to expand this literature by investigating the differences in pragmatic development between bilingual and monolingual children with ASD. Since there is evidence from the typically-developing population that bilinguals have an advantage in theory of mind (Goetz, 2003; Nguyen & Astington, 2014), which may facilitate pragmatic development, it is valuable to examine whether similar advantages are seen in bilingual children with ASD. This study extended the research on bilingual children with ASD by Reetzke et al. (2015) from a non-Western context to a Western setting. In addition to using the CCC-2, narratives were used to measure the effects of bilingualism on the pragmatic abilities of children with ASD. The primary objective of this study was to investigate whether there is a difference in the development of pragmatic skills in bilingual and monolingual children with ASD. Specifically, this study examined the children's ability to produce narratives using clear references, evaluative devices, and causal statements. In addition, pragmatic skills were also measured by parent evaluations using the Children's Communication Checklist – 2 (Bishop, 2006). Based on previous research showing comparable results between the two groups, it was hypothesized that bilingualism would not impede the development of pragmatic skills in bilingual children with ASD.

Chapter 2: Method

2.1 Participants

The data in this study comprises a subset of the data collected from a larger project, "Pathways in Autism Spectrum Disorders," a longitudinal, cross-Canada study of children with ASD and their families (Szatmari et al., 2004). All participants in the original database met the following criteria: (a) clinical diagnosis of ASD, confirmed by the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2003), the Autism Diagnostic Interview-Revised (ADI-R; Le Couteur et al., 2003), and a clinician using DSM-IV criteria (American Psychiatric Association, 2000); (b) diagnosis received between age 2 to 4;11; and (c) language proficiency level of at least one parent to read and understand the information and consent form in French or English. Children were excluded from the original database based on the following exclusion criteria: (a) the presence of cerebral palsy or other neuromotor disorder interfering with study assessments; (b) any known genetic or chromosomal disorder; and (c) presence of a severe visual or hearing impairment.

A total of 44 participants (22 in the bilingual group and 22 in the monolingual group) in the Pathways database were identified for this study; all had tests available for the measures required and met the present study's inclusion criteria for either bilingual or monolingual children. Information about language exposure for all children was based on information reported by parents on the Family Background Information Questionnaire (FBIQ; Hambly & Fombonne, 2005). The following criteria were used to identify the bilingual children from the Pathways database: (a) ability to understand and speak two languages at age 8.5 – 9.0; (b) exposure to at least two languages at age 8.5 – 9.0; (c) exposure to both languages since the age of 5;11 or younger; and (d) at least 20% exposure to the language spoken less frequently since

the age of 5;11 or younger. Thirteen participants were exposed to two languages since birth and five participants - since age 2;0. Information on early language exposure was incomplete for four participants; however, they all reported being exposed to two languages since the age of 5;11.

A comparison group of 22 monolingual participants was also included. Children were considered to be monolingual based on the following criteria from the FBIQ: (a) ability to speak and understand one language only at age 8.5 – 9.0; (b) exposure to one language only at age 8.5 – 9.0; (c) no reports of exposure to an additional language from birth to age 8.5 – 9.0. Each monolingual participant was matched to one bilingual participant based on the following variables from the Pathways database: (a) a non-verbal intelligence quotient (NVIQ), using the Perceptual Reasoning Index score of the Wechsler Intelligence Scale for Children (WISC IV; Kaplan, Fein, Kramer, Delis, & Morris, 2004) at the age of 8.5 – 9.0; and (b) language ability, based on the Core Language score of the Clinical Evaluation of Language Fundamentals, 4th Edition (CELF-4; Semel, Wiig, & Secord, 2003) at the age of 8.5 – 9.0. Due to incomplete CELF-4 data for two of the bilingual participants at the age of 8.5 – 9.0, one of these participants was matched based on the Core Language score of the CELF-4 at the age of 7.0, and the other participant was matched based on the Total Language score of the Preschool Language Scales, 5th Edition (PLS – 5; Zimmerman, Steiner, & Pond, 2011) at the age of 3;8.

The languages spoken by the participants at the age of 8.5 – 9 years, as reported by a parent on the FBIQ, are displayed in Table 2.1.

Table 2.1 Monolingual and bilingual participants' spoken languages at 8.5 – 9 years

Languages Spoken at age 8.5-9	Monolingual group	Bilingual group
English only	22	0
English and French	0	13
English, French and another language (Arabic, Greek)	0	2
English and another language (Greek, Tagalog, Chinese, Arabic, Polish, Spanish)	0	7

At the time of assessment (age 8.5 – 9 years), all monolingual and bilingual participants could speak English. Fifteen bilingual participants also spoke French, and seven spoke English and another language. The two participants who could speak three languages were only fluent in two of these - one participant spoke French, Arabic, and some English, and another participant spoke English, French, and some Greek. At age 8.5 – 9, English was the dominant language that most of the bilingual participants were exposed to. Nineteen participants were exposed to English at least 50% of the time, and the remaining three participants were exposed to English 5%, 7%, and 40% of the time.

The mean age of children in the two groups at the time of test administration for the present study is summarized in Table 2.2.

Table 2.2 Monolingual and bilingual participants' age of testing for the CCC-2 and ERRNI

	Monolingual group			Bilingual group		
Measure	Age range	Mean	SD	Age range	Mean	SD
CCC-2	8;5 – 9;2	8;8	1.98	8;6 – 8;11	8;7	1.62
ERRNI	8;6 – 9;3	8;9	2.73	8;5 – 9;3	8;9	2.65

The bilingual group consisted of 18 males and 4 females; their age of diagnosis ranged from 2;1 to 4;7 (M = 3;3). The monolingual group consisted of 20 males and 2 females; their age of diagnosis ranged from 2;1 to 4;11 months (M = 3;7).

Information from the FBIQ about the household income and highest level of education completed by each child's primary caregiver is summarized in Table 2.3.

Table 2.3 Participants' annual household income and primary caregiver's education

Variable	Bilingual group	Monolingual group
Annual household income		
Low (<$50,000/yr)	5	2
Middle (<$50,001-$80,000/yr)	6	6
High (>$80,000/yr)	10	14
No information	1	0
Highest level of education of primary caregiver		
Some/all high school	0	2
Some trade/tech/vocational school/business college/community college/ CEGEP/nursing school/university	2	4
Diploma/certificate from trade/tech/vocational school/business college/community college/ CEGEP/nursing school	1	3
Bachelor degree/teacher's college degree	12	8
Master's degree	5	1
Degree in medicine, dentistry, veterinary medicine, optometry, or law	0	2
Doctorate	1	0
No information	1	2

Overall, a higher proportion of bilingual group families were in the low income category (23.8%) compared to those in the monolingual group (9.1%). Conversely, there were a higher proportion of monolingual families in the high income category (63.6% vs. 47.6%). The pattern for education was the opposite, with 85.7% of primary caregivers in the bilingual group completing a bachelor degree or higher, compared to only 55% of caregivers in the monolingual group.

2.2 Measures

The independent variable in the present study was participants' ability to understand and speak one or more than one language at age 8.5 – 9.0. This age range was selected because it was the youngest age in which the children from the Pathways database were assessed on their narrative abilities. The dependent variable was participants' level of pragmatic skills, which was measured using scores from the CCC – 2 and the ERRNI. In addition, transcripts of the ERRNI Fish Story were transcribed and coded to analyze five variables: lexical errors, grammatical errors, references, evaluative devices, and causal statements.

2.2.1 Children's Communication Checklist – 2 (CCC-2)

The CCC – 2 is a checklist completed by parents to provide information on their child's strengths and difficulties in communication. It consists of 70 items that are divided into 10 scales (Bishop, 2006). Each item consists of a statement that describes either the difficulties the child has when communicating with others, or strengths (Bishop, 2006). The parents rate each item on a scale of 0 to 3, with 0 indicating that the behavior described happens less than once a week, and 3 indicating that it happens several times a day (Bishop, 2006). Scales A to D assess structural language abilities (i.e., A: Speech, B: Syntax, C: Semantics, D: Coherence); scales E to H assess pragmatic aspects of language (i.e., E: Initiation, F: Scripted Language, G: Context, H: Non-verbal communication); and scales I to J assess behaviors commonly seen in children with ASD (i.e., I: Social Relations, J: Interests; Volden & Phillips, 2010). In the pragmatic measurements, Scale E examines the child's ability to initiate conversations (e.g., talks to people without any encouragement or starts conversations with strangers); Scale F measures how often the child uses scripted language that he or she has memorized without fully understanding the meaning of (e.g., repeats what others have just said); Scale G looks into the child's ability to

understand and use language appropriately according to the context (e.g., is too literal); and Scale H analyzes the child's non-verbal behavior during communication (e.g., stands too close to other people when talking to them). In the scales that measure behavior commonly seen in children with ASD, Scale I investigates how the child relates to peers and adults (e.g., is babied, teased, or bullied by other children); and Scale J examines the child's range of interests (e.g., shows interest in things or activities that most people would find unusual; Bishop, 2006).

The scaled scores of the CCC-2 subtests can be used to derive a General Communication Composite (GCC) norm-referenced standard score. The GCC score represents the overall score of scales A to H and weighs each of the subtests evenly (Bishop, 2006). It can be used to identify significant communication problems (Bishop, 2006). A Social Interaction Difference Index (SIDI) is calculated by subtracting the total scaled scores of subtests measuring structural language abilities (i.e., Scales A, B, C, D; Speech, Syntax, Semantics, Coherence) from the total scaled scores of subtests measuring pragmatic language abilities and behaviors (i.e., Scales E, H, I, J; Initiation, Nonverbal Communication, Social Relations, Interests; Bishop, 2006). A negative SIDI score indicates that the severity of the child's pragmatic deficit is greater than expected, considering his or her structural language competence (Volden & Phillips, 2010). Based on the CCC-2 normative sample, SIDI scores within -10 to 10 are typical, SIDI scores of 11 or greater are more consistent with children with specific language impairment, and SIDI scores of -11 or less are more consistent with children with ASD (Bishop, 2006). The use of both the GCC score and the SIDI score has been found to identify 13 out of 16 children with previous diagnosis of ASD as having pragmatic impairments, while not identifying any of the 16 participants in the control group as having pragmatic impairments (Volden & Phillips, 2010). This suggests that the CCC-2 has good sensitivity and specificity.

2.2.2 Expression, Reception and Recall of Narrative Instrument (ERRNI)

Two sets of variables were based on the ERRNI: scores that were derived from the published ERRNI protocol (Bishop, 2004), and scores that were derived from transcripts of one of the ERRNI narrative tasks (the Fish Story).

2.2.2.1 ERRNI Protocol

The ERRNI tests a child's narrative abilities and comprehension skills. First, the child is given a storybook and is asked to look at all the pictures before telling the story to the examiner. When the child is ready, he or she tells the story to the examiner while looking at the pictures. Between 10-30 minutes later, the child is asked to recall the story and retell it without using the pictures. The time frame between the initial storytelling and the story recall may be used to complete other assessments. Finally, the child is asked a series of comprehension questions regarding the story.

This study only examined the initial storytelling narratives because the story-retell narratives are influenced by memory and may not truly reflect the participants' language abilities (Homzie, Gravitt, & Deese, 1978). During the initial storytelling task, the examiner is only permitted to give open-ended prompts that do not provide the child with any information about the story. Only six prompts are allowed by the examiner; any information elicited by other prompts is not included in the scoring of the narratives. Some examples of the permitted prompts include, "what happened on this page?," "what happened next?," and "tell me a bit more."

There are two stories in the ERRNI: the Beach Story and the Fish Story. All of the participants in the present study were examined with the Fish Story. The main plot of the story revolves around a boy not knowing that a girl has switched the fish in his bag with the doll in her bag. The participant must understand that even though he or she knows the boy is carrying a doll,

the boy still thinks he is carrying a fish. This is similar to false belief tasks that are used to assess children's theory of mind and their ability to take other peoples' perspectives.

The narratives from the ERRNI can be used to derive a story content score, which reflects the number of main ideas the child is able to convey. In addition, a comprehension score can be obtained to assess the participants' understanding of the story, by asking them comprehension questions after the story-recall. Of the nine comprehension questions, five are inferential questions about the characters' feelings and thoughts. These inferential questions provide important information regarding participants' ability to understand the perspectives and emotions of others.

Acceptable internal consistency ($\alpha = .86$) was reported for the ERRNI Fish Story content score as well as the comprehension score ($\alpha = .76$; Bishop, 2004). Scores on the ERRNI are not expected to be highly correlated with tests measuring receptive language because they measure different aspects of language. Thus, Pearson correlations indicated weak correlations with comprehension scores on the Test for Reception of Grammar-2 (TROG-2; Bishop, 2003) and the Clinical Evaluation of Language Fundamentals, 3rd Edition (CELF-3; Semel, Wiig, & Secord, 1995) ($r = .31$ and .26, respectively; Bishop, 2004). Overall, the ERRNI has demonstrated acceptable internal consistency and low concurrent validity with other receptive language tests, which confirms that it measures language skills that are mostly independent from those measured in receptive language tests (Bishop, 2004).

2.2.2.2 ERRNI Transcripts

A coding manual was adapted from Colozzo et al. (in press), Colozzo and Whitely (2015) and Yang (2011) and was used to analyze five aspects of the Fish Story transcripts: lexical

errors, grammatical errors, causal statements, evaluative devices, and references. Refer to Appendix A for a detailed description of the codes.

Lexical and grammatical errors were coded to allow for the comparison of structural language abilities between the bilingual and monolingual group. Furthermore, they were used to compare structural language abilities and pragmatic abilities within each group. It is possible for a child to have poor structural language abilities (i.e., many lexical and grammatical errors), but still display adequate pragmatic skills by referencing characters clearly and by describing the characters' emotions and intentions. The opposite may also be true, in which a child has adequate structural language abilities (i.e., good vocabulary and grammar), but does not reference characters clearly or talk about their emotions and intentions. Another possibility is that structural language abilities are closely linked to pragmatic abilities, so that participants with less vocabulary and grammatical knowledge would also display lower pragmatic abilities. The relationship between structural language abilities and pragmatic abilities can be compared by coding lexical and grammatical errors in addition to coding the pragmatic aspect of language.

Causal statements were coded in the transcript to examine participants' ability to explain relationships between events (Tager-Flusberg 1995). Instead of describing the pictures as a series of isolated events, a more complex narrative would include causal statements to explain how events are related to each other (e.g., "the boy's mom gave him money **so** he can buy another fish"). Coding for causal statements can provide information on the participants' ability to convey the reason behind a character's action or emotion. Understanding another person's reasoning for the behavior he or she is displaying requires perspective taking.

Evaluative devices were coded in the transcript to examine the participants' ability to describe the emotions and intentions of the characters, as well as to express the opinion of the

narrator. Some examples of evaluative devices include the expression of a character's emotions (e.g., "the boy is confused"), the expression of a character's cognition (e.g., "the boy thinks the fish is inside"), the use of quotations of a character's speech (e.g., "the boy said 'where is my fish'"), and the use of descriptions when talking about characters (e.g., "the little boy with the blue shirt"). The use of evaluative clauses demonstrates an understanding of a character's thoughts and emotions, as well as the importance of highlighting information and making the story engaging for the listener.

References to characters were coded in the transcript to examine the participants' ability to introduce, maintain, and re-introduce characters clearly. References include proper nouns, noun phrases, and pronouns. Each reference was coded as adequate or inadequate, depending on its level of ambiguity and accuracy. Examples of an adequate character introduction reference include the use of indefinite determiners (e.g., "*A* boy is talking"), or possessives (e.g., "A boy and *his* mom are talking"), and examples of an inadequate character introduction reference include the use of definite determiners (e.g., "*The* boy is talking"), and pronouns (e.g., "*He* is talking*"*). For references that maintain a recently mentioned character, the use of an incorrect pronoun would be considered as an inadequate reference (e.g., using *"she"* to refer to the boy). Finally, adequate references for the reintroduction of a character include the use of definite determiners (e.g., "*The* mom called the girl") and the use of a pronoun that is unambiguous. A reference to reintroduce a character was considered inadequate if the child used an incorrect reference or an ambiguous pronoun (e.g., "The mom [introduction] called the girl [introduction of another character]. The girl [maintenance of 'the girl'] answered the phone. *She* [ambiguous re-introduction of 'the mom'] wants the fish back"). Unambiguous references to characters may be indicative of a higher awareness of the listener's perspective; the narrator may be motivated to

provide clear references to characters if he or she understands that the listener does not share the same knowledge and requires clear references in order to follow the story.

2.3 Procedure

Research staff involved in the Pathways study (i.e., psychometrists, speech-language pathologists, psychologists, and/or doctoral-level research assistants) began conducting assessments with all participants within 4 months of diagnosis, and continued collecting data from the participants approximately every 6 – 12 months thereafter. Data for the participants that matched the criteria for this study at Time 6 (i.e., age 8.5 – 9) were used. Scores from the ERRNI and the CCC-2 were available for all 44 participants in the present study.

The ERRNI narratives were transcribed following the conventions used in Codes for the Human Analysis of Transcripts (CHAT; MacWhinney, 2000). Twenty-two of the ERRNI narratives were first transcribed by researchers from the Pathways study and were then converted into CHAT format by the author of the present study. Twelve additional narratives in audio format and six in video format were also transcribed by the author of the present study following CHAT conventions. All utterances were segmented into communication units (C-units). The transcripts included only the participants' utterances pertaining to the narrative and excluded all of the examiners' utterances. Aspects of speech dysfluency were also excluded from the transcripts because they are not pertinent to the children's pragmatic skills, which was the main focus of this study. In addition, in order to be consistent with the ERRNI manual (Bishop, 2004), the transcripts in this study complied with the following guidelines: (a) fillers (e.g., "uh", "um") were not transcribed, and false starts such as "He wants a… He wants a fish" were transcribed as "He wants a fish"; (b) if revisions were made in a sentence, only the final production was included in the transcript (e.g., "He has a case… a suitcase" was transcribed as "He has a

suitcase"); and (c) utterances that were an exact repetition of the previous utterance were not transcribed. None of the participants had significant sound changes that impacted intelligibility. Narratives from the ERRNI were available for 20 participants in the bilingual group and 22 participants in the monolingual group. Two narratives from the bilingual group were excluded because they were conducted in French, resulting in 18 transcribed narratives for this group. Eighteen narratives from the matching participants in the monolingual group were also analyzed. Thus, a total of 36 narratives from the ERRNI were analyzed in this study.

A coding manual adapted from Colozzo et al. (in press), Colozzo and Whitely (2015) and Yang (2011) was developed to code all of the transcripts, as described previously (see also Appendix A). Although some of the narratives were transcribed by researchers at the Pathways study, the author reviewed all of the transcripts to ensure that utterances were segmented into C-units. To check for inter-rater reliability on utterance segmentation, a second coder independently segmented utterances into C-units for 10% of the transcripts. The level of agreement was 98.57%, which indicated high inter-rater reliability for utterance segmentation. In addition, the author coded all of the transcripts, and a second coder independently coded 10% of the transcripts to check for inter-rater reliability of coding. A Cohen's Kappa score of .86 indicated a satisfactory level of inter-rater reliability of coding. The coded transcripts were then analyzed with the Child Language Analysis software (CLAN; MacWhinney, 2000).

2.4 Data Analysis

Independent sample t-tests, multivariate analysis of variance (MANOVA), and one-way analysis of variance (ANOVA) were used to compare the means between the two groups on the relevant variables. However, due to the small sample size, the scores for some of the variables were either not normally distributed or there was a lack of homogeneity of variance between the

two groups. Normality was tested with the Shapiro-Wilk test and variance was tested with Levene's test (Levene, 1960). The null hypothesis of the two groups having no significant difference in normality and variance was rejected if $p < .05$. Within the ERRNI, all variables with scores that violated the assumptions of the independent sample t-test were analyzed using the Mann-Whitney U test instead. For the CCC-2, three composite scores (i.e., General Communication Composite, Structural Language Composite, Pragmatics Language Composite) were analyzed with the MANOVA, and one composite score (i.e., Social Interaction Difference Index) was analyzed with the ANOVA. The null hypothesis was rejected for the CCC-2 scores if $p < .05$. A Bonferroni correction was applied to ERRNI protocol scores (significant if $p < .016$), ERRNI transcript general scores (significant if $p < .01$), and ERRNI transcript scores that measure pragmatics (significant if $p < .016$).

Chapter 3: Results

Results from the CCC-2 and the ERRNI for bilingual and monolingual children with ASD were analyzed to compare the pragmatic skills of the two groups. It was hypothesized that bilingualism would not hinder the development of pragmatic skills in children with ASD. Thus, the bilingual participants were expected to perform similarly to the monolingual participants on all of the measures.

3.1 Matching

A series of non-parametric and parametric tests were used to confirm whether the two groups were well matched. The means, standard deviations, ranges and medians for these variables are presented in Table 3.1.

Table 3.1 Means, standard deviations, ranges and medians of monolingual and bilingual participants' matching variables

	Monolingual group			Bilingual group		
Matching Variable	Mean (SD)	Range	Median	Mean (SD)	Range	Median
CELF-4 Core Language Score (SS)	91.0 (17.93)	42-114	93	91.74 (17.02)	48-115	91
WISC IV Perceptual Reasoning (SS)	100.91 (15.28)	72-126	101	101.86 (14.61)	76-130	104
ADOS Severity	6.95 (2.87)	1-10	7.50	6.27 (2.16)	3-10	6

The CELF-4 Core Language score is a standard score with a mean of 100 and standard deviation of 15 (Semel, Wiig, & Secord, 2003). The normative sample consisted of over 4,500 children and 7% of the sample population was receiving speech and language services (Semel,

Wiig, & Secord, 2003). The normative sample included some bilinguals, but all of the children spoke English as their primary language (Semel, Wiig, & Secord, 2003). In the current study, the Mann-Whitney U test showed no significant difference between the monolingual and the bilingual participants on their Core Language scores on the CELF-4; $U = 179$, $p = 0.965$.

The Perceptual Reasoning Index score on the WISC-IV is also a standard score with a mean of 100 and standard deviation of 15. An independent samples t-test revealed no significant difference between the monolingual and the bilingual groups for the Perceptual Reasoning Index score on the WISC-IV; $t\ (42) = -0.212$, $p = 0.833$.

Although the participants were not intentionally matched on ASD severity, a Mann-Whitney U test also demonstrated no significant difference in ADOS severity scores between the two groups; U=196, $p = 0.275$. These tests confirm that the two groups of participants were well matched on nonverbal intelligence, language abilities, and severity level of ASD.

3.2 Comparison between Monolingual and Bilingual Children with ASD on the ERRNI Protocol

The story content standard scores, comprehension question standard scores, and inferential question scores from the ERRNI were compared for 22 bilingual and 22 monolingual participants. To calculate the story content raw score, each participant was evaluated on how many main ideas from the story they were able to convey. There are a total of 24 main ideas, and each main idea is given a score of 0, 1, or 2. Each participant can receive a maximum score of 48, and a minimum score of 0. The mean raw score in the normative sample for children age 8;0 to 8;11 was 25 out of 48, and the scores were converted to standard scores with a mean of 100 and standard deviation of 15 (Bishop, 2004). A Mann-Whitney U test indicated no significant difference between the two groups on the story content score; $U = 194$, $p = 0.511$.

There are nine comprehension questions in the ERRNI protocol, which includes four literal questions and five inferential questions. The answer to each question is given a score of 0, 1 or 2. The total score a participant can receive for the comprehension questions range from 0 to 18. The mean raw score in the normative sample for children age 8;0 to 8;11 was around 13 (Bishop, 2004). The raw scores were converted into standard scores with a mean of 100 and standard deviation of 15. An independent samples t-test showed no significant difference between the monolingual and the bilingual group on their comprehension questions standard score; t (41) = -0.558, p = 0.580.

The five inferential comprehension questions were also analyzed separately. The total raw score a participant can receive for all the inferential questions ranges from 0 to 10. A standard score for the inferential comprehension questions is not available; hence the total raw score of the inferential questions were analyzed. A Mann-Whitney U test found no significant difference on inferential question scores between the monolingual and the bilingual participants; U = 230, p = 0.774. The means, standard deviations, ranges and medians of the monolingual and bilingual participants' main scores on the ERRNI protocol are listed in Table 3.2.

Table 3.2 Means, standard deviations, ranges and medians of monolingual and bilingual participants' scores on the ERRNI protocol

	Monolingual group			Bilingual group		
ERRNI Main Scores	Mean (SD)	Range	Median	Mean (SD)	Range	Median
Story Content (SS)	81.35 (14.49)	65-105	78	78.39 (14.09)	65-116	72
Comprehension Questions (SS)	86.08 (14.92)	65-111	86.50	88.47 (13)	65-107	88
Inferential Questions	5.64 (2.42)	2-9	5.50	5.95 (2.01)	1-9	6.50

Based on these results, monolingual and bilingual children with ASD demonstrated comparable performances on their ability to convey main ideas in a story, and to answer comprehension questions, including inferential questions.

3.3 Comparison between Monolingual and Bilingual Children with ASD on ERRNI Transcripts

ERRNI transcript scores were of two types: general language measures (length, lexical errors, and grammatical errors) and pragmatic measures (causal statements, evaluative devices, and clear references).

3.3.1 General Language Measures from ERRNI Transcripts

The length of the transcripts, the frequency of lexical errors, and the frequency of grammatical errors produced in the transcripts were analyzed for 18 bilingual participants and 18 monolingual participants. The length of the transcripts was measured by counting the number of

words used, the number of utterances used, and the mean length of utterances in words (MLUw). Utterances were segmented at the C-unit level, and MLUw for each participant was calculated by dividing the number of words used by the number of utterances used. To obtain the percentage of lexical errors per utterance for each participant, the total number of lexical errors was divided by the total number of utterances in the transcript. Similarly, the percentage of grammatical errors per utterance was calculated by dividing the total number of grammatical errors by the total number of utterances in the transcript. An independent samples t-test indicated no significant difference between the two groups' mean number of words used [t (32) = 0.49, p = 0.63], mean number of utterances [t (32) = 0.69, p = 0.5], and MLUw [t (34) = 0.28, p = 0.78]. Furthermore, the Mann-Whitney U test showed no significant difference between the two groups' frequency of lexical errors (U = 134.5, p = 0.36), and frequency of grammatical errors (U = 148, p = 0.66). The means, standard deviations and medians for these variables are presented in Table 3.3.

Table 3.3 Means, standard deviations and medians of monolingual and bilingual participants' general scores from ERRNI transcripts

	Monolingual group		Bilingual group	
ERRNI Transcripts	Mean (SD)	Median	Mean (SD)	Median
Number of Words	144.67 (51.26)	130	129.72 (30.46)	128.50
Number of Utterances	19.56 (5.28)	20.50	17.94 (2.51)	17
Mean Length of Utterance (MLUw)	7.42 (1.63)	7.20	7.27 (1.50)	7
Lexical Errors per Utterance (%)	5.51 (0.07)	2.30	8.60 (0.10)	5.30
Grammatical Errors per Utterance (%)	18.46 (0.17)	13.80	16.04 (0.15)	12.50

The results show that monolingual and bilingual participants produced transcripts using a similar numbers of words, utterances, and MLUw. In addition, the frequency of lexical and grammatical errors was comparable between the two groups. Because no significant difference was found, no further analyses were conducted for the different types of grammatical errors.

3.3.2 Pragmatic Measures from ERRNI Transcripts

In order to examine the participants' level of pragmatic skills, narratives from the ERRNI were examined for the frequency of use of causal statements, evaluative devices, and clear references. To obtain a rate of causal statements used for each individual, the total number of causal statements used was divided by the total number of utterances in the transcript. Likewise, the rate of evaluative devices used for each participant was calculated by dividing the total number of evaluative devices by the total number of utterances in the transcript. The percentage of reference errors was calculated for each participant by dividing the number of reference errors they made by the total number of attempts to produce the reference. The total number of attempts included both correct and incorrect productions of the reference. A Mann-Whitney U test demonstrated that there was no significant difference in the use of causal statements between the two groups; $U = 145.5$, $p = 0.473$. Furthermore, independent samples t-tests indicated no significant difference in the two groups' use of evaluative devices [$t\ (34) = 0.386$, $p = 0.695$] and frequency of all reference errors [$t\ (34) = 0.231$, $p = 0.819$]. The mean percents, standard deviations and median percents for these variables are presented in Table 3.4.

Table 3.4 Mean percents, standard deviations, and median percents of monolingual and bilingual participants' pragmatic measurements from ERRNI transcripts

	Monolingual group		Bilingual group	
ERRNI Transcript Variable	Mean % (SD)	Median %	Mean % (SD)	Median %
Frequency of Causal Statements per Utterance	1.85 (0.04)	0	2.85 (0.05)	0
Frequency of Evaluations per Utterance	25.61 (0.18)	24.50	23.50 (0.14)	22
Proportion of All Reference Errors	24.92 (0.13)	23.30	24.05 (0.10)	24.40

The monolingual and bilingual participants produced comparable rates of causal statements and evaluative devices in their narratives. In addition, the frequency of errors they made when referencing characters was also similar. Because no significant difference was found on any of these variables, no further analyses were conducted. Detailed information (means and standard deviations) for the specific types of evaluations used and the specific categories of reference errors is presented in Table 3.5.

A mean percentage of how often participants made errors when attempting each reference type was calculated. This was obtained by dividing the total number of errors for a specific type of reference by the total number of attempts at that type of reference. For example, to calculate the proportion of reference introduction errors for a participant, the number of incorrect attempts at reference introduction was divided by the total number of correct and incorrect attempts at

reference introduction. Based on the percentage of each participant, a group mean percentage was obtained for each reference type.

A mean percentage of how often each type of evaluative device was used per utterance was also calculated for each participant. This was accomplished by dividing the number of each type of evaluative device (e.g., emotions) by the total number of utterances in the transcript. After calculating a percentage for each participant, a group mean percentage was obtained for the monolingual and the bilingual group.

Table 3.5 Mean percents and standard deviations of monolingual and bilingual participants' different types of reference errors and evaluations on the ERRNI transcripts

	Monolinguals (n = 18)	Bilinguals (n = 18)
ERRNI Narrative Variables	Mean % (SD)	Mean % (SD)
References		
Proportion of reference introduction errors	39.0 (0.25)	34.0 (0.27)
Proportion of reference maintenance errors	11.0 (0.18)	7.0 (0.67)
Proportion of reference reintroduction errors	36.0 (0.18)	41.0 (0.27)
Evaluations		
Emotions	1.10 (0.03)	0.35 (0.01)
Cognition	1.73 (0.02)	0.88 (0.02)
Intentions	3.26 (0.04)	2.61 (0.04)
Physical State	0 (0)	0.69 (0.03)
Reported Speech – Direct	3.06 (0.05)	5.67 (0.07)
Reported Speech – Indirect	1.49 (0.03)	1.07 (0.03)
Repetition	0 (0)	0.28 (0.01)
Description of Character	9.47 (0.10)	6.73 (0.09)
Adverbs	1.15 (0.02)	1.27 (0.02)
Intensifiers	1.61 (0.04)	0.91 (0.02)
Distancing	0.67 (0.02)	2.58 (0.06)
Character's Internal State	0.22 (0.01)	0.26 (0.01)
Narrator's Internal State	1.05 (0.02)	1.67 (0.05)

3.4 Comparison between Monolingual and Bilingual Children with ASD on the CCC-2

Three composite scores and the Social Interaction Difference Index (SIDI) were compared between the monolingual and bilingual groups. The three composite scores, which consist of the General Communication Composite (i.e., Scales A – H), the Structural Language Composite (i.e., Scales A – D), and the Pragmatics Language Composite (i.e., Scales E – H), were analyzed using a multivariate analysis of variance (MANOVA). The use of a MANOVA helps to reduce the possibility of Type I errors that may occur with the use of multiple independent ANOVAs. The between-subjects independent variable was the children's bilingual status, and the within-factor dependent variables were the three composite scores. There was no statistically significant difference between the two groups; Wilks' Lambda = 0.895, F (2, 33) = 1.941, p = 0.160. In addition to analyzing the three composite scores, the SIDI score was also compared between the two groups using a one-way analysis of variance (one-way ANOVA). There was no significant difference between the two groups on this variable; F (1, 34) = 0.873, p = 0.357. The results indicate that the monolingual and bilingual groups performed similarly on all composite scores and the SIDI of the CCC-2; hence, no further analyses on the specific subscales were performed.

The means and standard deviations for the CCC-2 composite scores, SIDI scores, as well as the subscale scores are presented in Table 3.6. All of the subscale scores on the CCC-2 are scaled scores with a mean of 10, standard deviation of 3, and a range of 1 – 19 (Bishop, 2006). The lowest scaled score of 1 indicates the most difficulty with communication, and the highest scaled score of 19 reflects strengths in the child's communication.

Table 3.6 Means and standard deviations of monolingual and bilingual participants' subscale scores and composite scores on the CCC-2

	Monolingual group	Bilingual group
CCC-2 Subscales and Composite Scores	Mean (SD)	Mean (SD)
Scale A - Speech	8.09 (4.28)	9.05 (3.75)
Scale B - Syntax	6.86 (3.98)	7.82 (3.40)
Scale C – Semantic	5.91 (2.89)	7.41 (4.14)
Scale D – Coherence	5.14 (1.75)	6.59 (3.20)
Scale E – Inappropriate initiation	6.05 (2.08)	6.82 (2.72)
Scale F – Scripted language	5.86 (2.62)	6.55 (2.37)
Scale G – Use of context	4.27 (2.62)	5.59 (3.49)
Scale H – Nonverbal communication	4.36 (2.17)	5.50 (3.36)
Scale I – Social relations	4.09 (2.74)	5.05 (3.93)
Scale J – Interests	5.93 (2.36)	6.86 (3.62)
Structural language composite (Scales A – D)	6.50 (2.71)	7.72 (2.80)
Pragmatics composite (Scales E – H)	5.14 (1.93)	6.11 (2.53)
General Communication Composite (GCC)	46.55 (16.94)	55.32 (20.25)
Social Interaction Difference Index (SIDI)	-5.55 (9.29)	- 6.64 (8.13)

Chapter 4: Discussion

4.1 Pragmatic Skills in Monolingual and Bilingual Children with ASD

The results of this study suggest that monolingual and bilingual children with ASD have similar levels of pragmatic skills. On the CCC-2, which has been demonstrated to have good sensitivity and specificity in identifying pragmatic language impairments (Volden & Phillips, 2010), the two groups obtained comparable composite scores and scores on all of the subscales. In addition, monolingual and bilingual participants also performed similarly on all aspects of the ERRNI protocol and the ERRNI narratives. Their ability to answer both literal and inferential comprehension questions, and the number of main ideas they conveyed in their narratives were similar. Furthermore, the clarity of their references to characters and the frequency in which they used causal statements and evaluative devices were also comparable.

This lack of difference in the two groups' pragmatic skills is consistent with results from previous research on monolingual and bilingual children with ASD that focused on other aspects of language development. When comparing the two groups' language development, previous research found no difference in early language milestones (Hambly and Fombonne, 2012; Ohashi et al., 2012) and no difference in expressive and receptive language either in children aged 24 – 52 months (Ohashi et al., 2012) or children aged 36 – 78 months (Hambly and Fombonne, 2012). In an unpublished study, Yang (2011) also found comparable performances between the two groups on global structure, local structure, and the use of evaluative devices in storytelling narratives. In addition to research in other areas of language development, a study from China that focused on the pragmatic aspects of language also found no significant difference between monolingual and bilingual children with ASD (Reetzke et al., 2015). Similar to the present study, Reetzke et al. (2015) used scores from the CCC-2 to measure pragmatic

abilities. However, the participants in their study were younger (monolingual mean age = 60 months, bilingual mean age = 61 months) than the participants in this study (monolingual mean age = 104 months, bilingual mean age = 103 months), and all of their participants spoke Chinese languages, while participants in this study had a mixture of language backgrounds. Despite differences in the participants' age and language background, the present study and the study by Reetzke et al. (2015) both found no differences in pragmatic skills between monolingual and bilingual children with ASD.

4.2 Comparison between Typically-Developing Children and Children with ASD

4.2.1 Comparison on Pragmatic Measures

Results from the pragmatic measures of the ERRNI transcript in the current study is consistent with findings from previous research. In a study comparing ten children with ASD (age 12;1), ten typically-developing children (age 7;9), and ten children with intellectual disabilities (age 11;3) on a storytelling task, researchers found that the group of children with ASD did not produce any causal statements at all (Tager-Flusberg, 1995) This is a striking contrast to the group of typically-developing children and the group of children with intellectual disabilities, who produced nine and ten causal statements, respectively (Tager-Flusberg, 1995). Similarly, the participants in the current study also did not produce many causal statements. The mean percentage of causal statements per utterance in the monolingual group was 1.85%, and the mean percentage in the bilingual group was 2.85%. In the monolingual group, only 3 out of 18 participants produced causal statements; the remaining 15 monolingual participants did not produce any causal statements at all. In the bilingual group, 5 out of 18 participants produced causal statements, and the remaining 13 participants did not produce any causal statements at all. This shows that the vast majority of participants in both groups did not use any causal

statements, and even within the participants who did use causal statements, they only produced one to three causal statements each.

Another finding from the study by Tager-Flusberg (1995) was that children with ASD produced shorter and less complex narratives compared to children with intellectual disabilities and typically-developing children. This finding is also apparent in the participants of the current study, as evident through their Story Content standard scores. The Story Content standard scores reflect how many main ideas the participants were able to convey in their narratives. The mean Story Content standard score was 81.35 for the monolingual group, and 78.39 for the bilingual group. The mean score for both groups deviate greater than one standard deviation from the mean of 100, indicating that when compared to the general population, the participants in this study have greater difficulties producing complex narratives that include main ideas from the story.

Children with ASD have been shown to make fewer references to characters' emotional and cognitive states compared to typically-developing children (Siller et al., 2014). In the study by Siller et al. (2014), the group of children with ASD (mean age 86 months) produced a mean of 1.65 emotional descriptors and a mean of 2.13 cognitive descriptors, while the group of typically-developing children (mean age 82 months) produced a mean of 3.87 emotional descriptors and a mean of 3.32 cognitive descriptors. Although the participants in the current study are slightly older, the number of emotional and cognitive descriptors is still low for both the monolingual and bilingual group. Four out of 18 monolingual participants produced a range of 1 to 2 emotional descriptors each, and only 1 out of 18 bilingual participant produced an emotional descriptor. The remaining thirty-one participants did not produce any emotional descriptors at all. There was a higher number of monolingual participants who produced

cognitive descriptors (i.e., 8 out of 18 participants), but each of them only produced one descriptor. In the bilingual group, only three participants produced cognitive descriptors, with each of them also producing one descriptor only. Consistent with the study by Siller et al. (2014), the participants in both groups of this study produced few references to characters' emotional and cognitive state.

Difficulty with answering follow-up questions to stories has been noted in children with ASD compared to children with Down's syndrome (Loveland et al. 1990). In the study by Loveland et al. (1990), the group of 16 children with ASD (mean age 162 months) produced significantly more bizarre material in their responses to factual and inferential follow-up questions than a group of 16 children with Down's syndrome (mean age 159 months). Although the current study did not specifically examine the percentage of bizarre material in the participants' response to follow-up questions, the mean of the ERRNI comprehension question standard score suggests that the participants have difficulties with answering comprehension questions compared to the general population. The monolingual group achieved a mean of 86.08, and the bilingual group achieved a mean of 88.47; both groups' mean standard score on the ERRNI comprehension questions are at the lower end of the typical range, indicating that answering comprehension questions to stories may be an area of difficulty for these participants.

Results from the CCC-2 indicated that both the monolingual and bilingual participants have difficulty with the pragmatic aspect of language, which is expected in children with ASD since pragmatics is a major deficit for this population. On all four subscales measuring pragmatic aspects of language, both groups of participants scored at least one standard deviation below the mean. Furthermore, the participants' SIDI scores also resembled the children with ASD in the CCC-2 normative sample. Within the normative sample, most children with ASD (i.e., 64.52 %)

scored between -10 to 10 on the SIDI, and 27.42% scored -11 or less. Compared to children with Specific Language Impairment and Pragmatic Language Impairment, there is a much higher percentage of children with ASD scoring -11 or less (Bishop, 2006). Similarly, in the current study, the majority of participants scored between -10 to 10 on the SIDI (i.e., 68.18% of the monolinguals, 63.63% of the bilinguals). Although the majority of the participants scored within the typical range of -10 to 10 on the SIDI, a significant number of participants scored -11 or less, which is expected in children with ASD. In the monolingual group, 31.81% of the participants scored -11 or less on the SIDI, with their scores ranging from -11 to -29. Likewise, in the bilingual group, 36.36% of the participants had a score of -11 or less on the SIDI – their scores ranged from -11 to -22. The proportion of children obtaining a low SIDI score (i.e., -11 or less) to children obtaining a typical SIDI score (i.e., -10 to 10) is similar between the participants in the current study and the children with ASD in the CCC-2 normative sample. This shows that the level of pragmatic difficulties faced by the participants in the current study is comparable with the general population of children with ASD.

4.2.2 Comparison on Structural Language

Although the focus of this study is on the pragmatic aspect of language, variables from the CCC-2 examining structural language abilities also support findings from previous research. Structural language has been found to be a challenge for all children with ASD (Boucher, 2012), and this is reflected in the current study when examining the participants' performance on the CCC-2 subscales measuring structural language. There are four subscales in the CCC-2 measuring structural language, and the mean score on these four subscales for both the monolingual and bilingual groups were below the mean of 10. In particular, the monolingual group scored one standard deviation below the mean for three of the four subscales (i.e., Scales

B to D). This supports the finding that children with ASD struggle with structural language and perform below average on these measures.

4.3 Pragmatic Skills in Monolingual and Bilingual Typically-Developing Children and Children with ASD

In the typically-developing population, research has found that bilinguals have an advantage in theory of mind compared to their monolingual peers (Goetz, 2003; Nguyen & Astington, 2014). One theory hypothesizes that pragmatic challenges arise from deficiencies in theory of mind (Martin & McDonald, 2003). Following this theory, a bilingual advantage in theory of mind should result in bilingual children having better pragmatic skills. This was supported by a longitudinal study on children with ASD, which found that, when compared to IQ and language scores, scores on a measure of theory of mind were the best predictor of the children's pragmatic skills (Tager-Flusberg, 2003). Consistent with the indication that bilingual children may have better pragmatic skills, research has also found that bilingual children use more evaluative clauses in narratives (Chen & Yan, 2011).

Contrary to research findings in the typically-developing population, the present study did not find a bilingual advantage in pragmatic skills. One explanation for this is that the two groups of participants in this study may have had similar theory of mind abilities; if this was the case, one would expect their pragmatic skills to also be similar. Unfortunately, this study could not investigate the link between theory of mind skills and pragmatic abilities because the database used for the study did not assess participants on theory of mind tasks.

A second explanation is that the participants in this study may have had similar theory of mind abilities because they were so closely matched. Each bilingual participant was closely matched to a monolingual participant based on nonverbal IQ scores. By closely matching

participants on this variable, any cognitive advantage that may exist in the general population of bilingual children with ASD might have been masked. In the literature comparing monolingual and bilingual children in the typically-developing population, participants are often matched on age and language abilities, but it is uncommon to match on nonverbal IQ. By not matching on nonverbal IQ, cognitive advantages that may occur as a result of bilingualism may become more apparent. In future studies on children with ASD, it would be worth examining whether data obtained from bilingual participants matched to monolingual participants on age and language skills only - but not on nonverbal IQ - would demonstrate different outcomes.

Another explanation that may account for the lack of a bilingual advantage in pragmatics is that the bilingual participants in this study were only assessed in one language for the narrative production task. As previous research has shown, it is important to consider the language used when assessing bilingual children, as they could perform differently depending on the language in which they are tested (Gutiérrez-Clellen, 2002). For example, a study that examined storytelling narratives in Spanish-English typically-developing bilingual children found that they produced more attempts and initiating events in Spanish narratives compared to English (Fiestas & Peña, 2004). Furthermore, an unpublished study by Yang (2011) found that both English-Mandarin bilingual children with ASD and English-Mandarin typically-developing bilinguals used more evaluative devices when producing narratives in Mandarin compared to English. It is possible that, if the present study had examined narrative productions from both languages spoken by the bilingual participants and compared them with those of monolingual speakers, the bilingual group might have outperformed the monolinguals on some measures, such as the use of evaluative devices.

4.4 Limitations

In addition to the small sample size, another limitation to this study is that the transcriptions of the ERRNI narratives could not be checked for reliability. Some narratives were transcribed by Pathways researchers, while others were transcribed by the author of this study. However, it is important to note that all transcribers were graduate students studying speech-language pathology who had extensive training in the transcription process; thus, it is likely that the transcriptions were both accurate and uniform.

Information on the language background of the children was based on parent report only. This can be problematic, especially for information regarding the bilingual participants, because this is not an objective measurement of their language proficiency in each of the languages they speak. To ensure that the bilingual participants in this study are in fact proficient in at least two languages, the criteria for choosing bilingual participants was set to be more rigorous. Based on parent report, none of the bilingual participants were exposed to one language only beyond the age of 2;0, indicating that they have all been exposed to at least two languages at a very young age. To increase the confidence in bilingual participants' language proficiency, future longitudinal studies can formally assess bilingual children's language abilities in both languages.

As discussed in the previous section, another limitation of this study is that bilingual participants were assessed in only one language for the storytelling task. Because the Pathways database only assessed each participant in either English or French, it was not possible to examine narratives in other languages for the bilingual participants.

4.5 Summary

In summary, monolingual and bilingual children with ASD performed similarly on all measures of pragmatic skills in this study. The dependent variables included scores from the

ERRNI protocol, scores from the ERRNI transcripts, and scores from the CCC-2. The ERRNI protocol examined children's ability to convey the main ideas in a storytelling task and to answer comprehension questions, some of which were inferential in nature, about the story. The ERRNI transcript scores examined the length of the transcripts, the lexical and grammatical errors in the transcript, and the children's use of causal statements, clear references and evaluative devices when telling a story. The comparable performance found on all of these measurements between the monolingual and bilingual group suggests that bilingualism may not be detrimental to the development of pragmatic skills in children with ASD. The results of this study are consistent with previous research in monolingual and bilingual children with ASD, which has not found any negative influence of bilingualism on language development (Hambly & Fombonne, 2012; Ohashi et al., 2012; Reetzke et al., 2015; Yang, 2011). However, the results are different from research on bilingualism in the typically-developing population, which has demonstrated a bilingual advantage in theory of mind. There are three possible explanations for this difference: (a) the bilingual advantage in the typically-developing population does not extend to the population of children with ASD; (b) the bilingual advantage was not apparent in this study because the participants were closely matched on nonverbal IQ scores; and/or (c) the bilingual advantage was not apparent because bilingual participants were assessed only in English.

4.6 Implications and Future Research

Since pragmatics is one of the major deficits in language development for children with ASD, it is important to investigate how it is influenced by bilingualism. Consistent with previous research, this study shows that the levels of pragmatic skills in 8.5 – 9 year-old monolingual and bilingual children with ASD are comparable. Future research is needed to compare pragmatic skills between bilingual and monolingual children with ASD at different ages and using different

measures to assess these skills. Another aspect worth examining is whether theory of mind skills are linked to pragmatic skills in children with ASD. In addition, future studies can control for language backgrounds of participants when comparing pragmatic skills, to better understand whether certain combinations of languages help support pragmatic development in children with ASD.

Apart from deepening theoretical knowledge, this area of research also has practical implications. It can help provide evidence-based information to parents of children with ASD when making decisions regarding language practices. Many families may choose to not speak their heritage language to their child with ASD in order to facilitate their child's learning of English (Yu, 2013). This view, although unsupported by research, is often promoted by professionals who give advice to families on language practices (Yu, 2013). A family's choice to refrain from speaking their home language has effects beyond a child's language competency – it also affects the family's cultural identity, the transmission of family values, and the relationships between the child and family members (Yu, 2013). By examining pragmatic skills in monolingual and bilingual children with ASD, this study helps provide evidence-based information for clinicians to share with parents of children with ASD when assisting them in the decision of whether to raise their child in a bilingual or a monolingual environment.

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Appendix

Appendix A Coding Manual

A.1 Main Tier Coding

Lexical Error Coding

[*s] Lexical error: Semantic substitutions (e.g., case for suitcase) and vague, imprecise words (e.g., stuff, here, there)

Exception: Ambiguous words used to refer to a character in the story are not marked as lexical errors. They are marked as inadequate references instead.

[*n] Neologism

Grammatical Error Coding

[*f] Substitution/ insertion error for all closed class words (e.g., prepositions, pronouns, determiners, conjunctions, etc.)

[*m] Omitted/ incorrect/ insertion of morphemes

0 Omitted closed class words in obligatory words (e.g., prepositions, conjunctions, pronouns, auxiliaries, etc.)

[+gram] Other ungrammatical sentences in which the target utterance cannot be recovered, obligatory arguments or phrases are omitted, and/or the word order is incorrect

Inconsistent use of tense marking is not coded as a grammatical error

A.2 Dependent Tier Coding

Reference Coding

%ref tier

$REF References to any character in the story, which include proper nouns, noun phrases, and pronouns.

The following characters are coded for: the boy, the boy's mom, the man on a motorcycle, the fish at home, the fish at the store, the doll, the two girls, the person at the store

:INT Introduction of a character for the first time

:INAD Inadequate introduction of a character with an ambiguous or an incorrect reference.

"he is going to buy a fish" – Introduction with pronoun

"the boy is going to buy a fish" – Introduction with definite determiners (exception: "the store owner" or "the cashier" can be introduced with definite determiners)

"the boy saw some people" – Ambiguous introduction

:ADEQ Clear introduction of a character with a noun phrase or a proper noun.

"A boy is going to buy a fish" - Introduction with indefinite determiners

"A boy and his mom are talking" – Introduction with possessives

"<u>This</u> boy is going to buy a fish" – Colloquial use of "this"

:MAI Maintenance of a character that has already been introduced. It is considered to be "maintenance" if the character is mentioned within the same C-unit, or in successive C-units.

:INAD Inadequate maintenance of a character with incorrect pronouns

"<u>He</u> is going to buy a fish. <u>She</u> got some money" – According to the story, "He" and "She" should be referring to the same character; "She" is an inadequate maintenance of the character mentioned previously.

:ADEQ Clear maintenance of a character with correct pronouns or nouns

"The boy is going to buy a fish. <u>He</u> got some money."

:REINT Reintroduction of a character that was mentioned previously. This occurs when the introduction of a character is followed by utterances focused on another character, and the first character needs to be introduced again

<u>The boy</u> (introduction) wants a fish. <u>The girl</u> (introduction and focus on another character) also wants a fish. <u>He</u> (reintroduction) wants to buy one too.

Reintroduction also occurs when the speaker switches from referring to two or more characters to only one of those characters, and vice versa.

:INAD Inadequate reintroduction of a character with the use of an incorrect or ambiguous reference

"The mom and the girl are talking on the phone, and she is apologizing."

:ADEQ Clear reintroduction of a character with a correct and unambiguous reference.

"The mom and the girl are talking on the phone, and the mom is apologizing."

Evaluation Coding

%eva tier

$EVA Evaluative clauses, words or phrases which describe characters' mental or emotional states, character intentions, narrator prediction, and defeats of narrative expectations

:EMO Expressions of emotion

(e.g., happy, have fun, sad, angry, confused, worried, etc.)

"The boy is confused"

"The worried boy"

:COG Expressions of cognition

(e.g., notice, think, know, remember, believe, forget, guess, realize, imagine, sense, curious, consider, etc.)

"The boy opens the bag, thinking the fish would be inside"

:INTN Expressions of intention

(e.g., try, want, decide, hope, need, must, have to, etc.)

"The girl wanted her doll back"

"They decided to get ice cream"

:PHY Expressions of physical state

(e.g., wet, sleepy, hurt, tired, hungry, etc.)

"The boy was hungry"

"Luckily, the fish was not hurt"

:REP Reported speech

:DIR Direct quotation of the character speech

"The boy said where is my fish?"

"The boy said good bye"

:IND Indirect report of character speech

"The boy asked if anyone saw his fish"

:REPT Repetition of words or ideas for emphasis

"He walked and walked"

:CHA Description of character

"The little boy"

"The pet fish"

"The girl with the red shirt"

:ADV Adverbs and phrases indicating manner in which an action is performed

(e.g., suddenly, accidentally, finally, eventually, etc.)

"Finally, he got his fish back"

"He ran quickly to the ice cream shop"

:INT Intensifiers that reflect narrator's emphasis on some information (e.g., very, really, so, "do", only, just, whole bunch of, etc.)

"He was quite upset"

"The boy did take a long time to find his fish"

:DIS Distancing device that lessen narrator commitment to a proposition (e.g., kind of, probably, looks like, seems like, maybe, etc.)

"It seems like the mom is apologizing"

:MIND Any expression of the narrator's or a character's internal state or thought or attributes of events or circumstance to intentions, purposes or causes. Internal states can be expressed by verbs, modals, adjectives or clauses.

:NAR Narrator comments/narrator's cognition, state of mind

"But I don't understand why"

"I think the boy is sad"

Causal Statement Coding

%cau tier

$CAUS Causal statements which explain relationships between events (e.g., because, so, since, even though, though, although, yet, therefore, however, as a result, thus, etc.)

"The boy is sad because he can't find his fish"

"The boy's mom gave him money so he can buy another fish"

"The boy was sad since his fish was missing"

Sometimes "so" is used as a discourse marker at the beginning of utterances, and is not used to explain relationships between events. These instances of "so" are not coded as causal statements.

"So he went for lunch. So he met some friends. So they talked together."