INTERNAL STATE LANGUAGE AND THEORY OF MIND DEVELOPMENT IN
CHILDREN WITH AUTISM SPECTRUM DISORDER

by

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ABSTRACT

This study investigated the Internal State (IS) language input of parents, IS language use by children, and children's performance on perspective taking and false belief Theory of Mind (ToM) tasks. Two groups of participants were included: children with Autism Spectrum Disorder (ASD) ($N = 12$, M chronological age = 7; 4, M language age = 6;0) and typically-developing (TD) children ($N = 13$, M chronological age = 6;0, M language age= 6;5), matched on language age. Independent means samples t-tests showed that the transcripts of the two groups of parents or the two groups of children did not differ in regards to total number of words, utterances, or mean length of utterance. ANOVAs were used to test for differences in IS language category or elaboration in the two groups (ASD, TD), in parents and children. For the parent data, no statistically significant differences emerged. For the analysis of child talk the ANOVA revealed that the main effect of group approached significance, with a trend towards TD children using more IS language than children with ASD. ANOVAs were also used to test for differences in ToM task performance (perspective-taking, false belief) in the two groups of children; TD children performed significantly better on ToM Tasks overall than the children with ASD. Partial correlations found that for the TD group, there were no significant correlations between the parent's or the child's use of IS language with the child's performance on ToM tasks when chronological age was controlled for. For the ASD group, after controlling for chronological age and language age, the parent's use of elaborated affect terms was significantly positively correlated with their child's performance score on perspective-taking tasks, and the parent's use of elaborated cognitive terms was significantly negatively correlated with their child's performance on false-belief tasks. Also for the ASD group, the child's use of simple affect terms was significantly positively correlated with their performance on false belief tasks after controlling for chronological age and language age. Findings are discussed in relation to prior research and clinical implications.

LIST OF ABBREVIATIONS AND SYMBOLS USED

IS	Internal State
TOM	Theory of Mind
ASD	Autism Spectrum Disorders
AS	Asperger Syndrome
HFA	High Functioning Autism
PDD-NOS	Pervasive Developmental Disorder not otherwise specified
DD	Developmental delay
MLD	Moderate learning difficulty
DS	Down syndrome
SLI	Specific language impairment
TD	Typically-developing
CA	Chronological age
MA	Mental age
LA	Language age
IQ	Intelligence quotient
M	Mean
SD	Standard deviation
SE	Standard error
R	Range
MLU	Mean length of utterance
MR	Mental rotation
VPT	Visual perspective-taking
DT	Desires perspective-taking
FB	False belief
ANOVA	Analysis of variance
SALT	Systematic analysis of language transcripts
VMA	Verbal mental age
M	Mother
F	Father
PPVT	Peabody picture vocabulary test
EVP	Expressive vocabulary test
OWLS	Oral and written language scales
MCDI	MacArthur Communicative Developmental Inventory
RDLS	Reynell developmental language scales
TROG	Test for reception of grammar
BPVS	British picture vocabulary scale
CTOTIS	Child talk, total internal state language
SS	Simple sensory
ES	Elaborated sensory
SA	Simple affect
EA	Elaborated affect
SC	Simple cognitive
EC	Elaborated cognitive
r	Correlation
p	Significance

CHAPTER 1: INTRODUCTION

"Minds differ; this is the point of communicating" (Nelson, Skwerer, Goldman, Henseler, Presler and Walkenfield, 2003, p.25). The ability to use language as a tool to communicate is of paramount importance in effectively navigating our social world. We must all at times be mind readers in order to understand actions and to predict the behaviour of others. As humans, our internal states are just that: inaccessible to those around us, and are therefore conveyed to others through our behavior and through communication, both verbal and nonverbal. Internal state (IS) language refers to explicit talk about perceptions, thoughts, beliefs and feelings. Children learn IS language through their interaction with others in their environment. Theory of Mind (ToM) is the knowledge that other people have these internal states, and knowledge that another's internal states may differ from our own. ToM allows a child to interpret a person's behaviour and make sense of why people act and respond to others and to their environment the way they do.

Nelson and colleagues describe social interaction as a "complex transactional process of entering into a community of minds" (Nelson et al, 2003, p.24). Transactional refers to the "reciprocal, bidirectional influence of the communication environment, the responsiveness of communicative partners, and the child's own developing communicative competence" (Wetherby, Warren & Reichle, 1998, p. 2). In essence, a child's communication attempts influence and are influenced by their parent's communicative input. The language used by a parent to communicate with the child will thus change alongside the child's own developing communicative capacities. This

dynamic, interactive exchange provides the context for the child's development of both IS language and ToM. It is this perspective of acquisition that is examined in the current study.

This study investigates issues related to the social understanding of children with Autism Spectrum Disorders (ASD). In particular, the aims of this study were four-fold. First the IS language input of parents to children with Autism Spectrum Disorders (ASD) was compared to that of parents to typically developing (TD) children. Second, the IS language use of children with ASD was compared to that of TD children. Third, the relationship between IS language use of parents and their children was analyzed, for TD and ASD groups separately. Finally, the relationship between parental IS language input or children's IS language use and performance on a series of ToM tasks was examined for groups with either ASD or typical development.

The following background for this study will provide a brief overview of ASD followed by a review of the research on ToM development in TD children and children with ASD. Next, the development of IS language use by children with TD or ASD will be presented, followed by a discussion of the relationship between ToM and IS language. Finally, findings on parental IS language input to children with TD or ASD will be overviewed, in addition to a discussion of the relationship between a child's IS language use and ToM development.

Autism Spectrum Disorders (ASD)

ASD is an umbrella term for three related disorders: Autistic Disorder, Asperger's Disorder, and Pervasive Developmental Disorder Not Otherwise Specified (including

Atypical Autism). According to the Diagnostic and Statistical Manual of Mental

Disorder (DSM IV-TR; APA, 2000), Autistic Disorder is characterized by a) a qualitative

impairment in social interaction and in communication; b) restricted repetitive and

stereotyped patterns of behavior, interests and activities; and c) an onset of delays or

abnormal functioning in at least one of social interaction, language used in social

communication, or symbolic/imaginative play prior to the age of 3. Asperger's Disorder

also involves a qualitative impairment in social interaction; restricted and stereotyped

patterns of behaviour, interests and activities; significant impairment in social,

occupational or other areas of functioning; but no clinically significant delay in language,

cognition or adaptive behaviour. Finally, Pervasive Developmental Disorder Not

Otherwise Specified (including Atypical Autism) is a diagnosis used when there is

impairment in social interaction, communication, and/or stereotyped behaviors and

interests, but the presentation of symptoms does not reach diagnostic criteria for Autistic

Disorder or Asperger's Disorder.

   Language abilities in children with Autism Spectrum Disorders (ASD) range from

normal, to delayed, to essentially nonverbal. Atypical speech and language features are

often observed, including repetition of stereotypic utterances or echolalia; irregular

prosodic features (pitch, intonation); pronoun reversals; and difficulty with the initiation

and maintenance of conversations with others (Hadwin, Baron-Cohen, Howlin and Hill,

1997). As will be discussed later, aspects of IS language are also a challenge for children

with ASD. ToM development has been labeled by some as a core impairment in children

with ASD. Researchers have linked deficits in ToM to impaired meta-representational

capacity, which may lead to the atypical social and communicative behaviours observed in this population (Steele, Joseph & Tager-Flusberg, 2003; Leslie, 1987).

Theory of Mind Development in Children with Typical Development

ToM is a broad construct that reflects many skills and areas of knowledge acquired over time and through experience (Jenkins & Astington, 2000; Keenan, 2003). Certain abilities developed in infancy are proposed to provide a basis for ToM, including imitation of facial gestures and vocalizations, joint attention, social referencing, intentional communication, and symbolic and pretend play. By approximately 18 months of age, TD toddlers display ToM by demonstrating a beginning understanding of the desires of others, as illustrated in a study by Repacholi & Gopnik (1997). In their study, infants were able to accurately give a parent the parent's preferred snack (cracker or broccoli), regardless of the child's own preference. TD children at 24 months begin to actively show perspective-taking skills, and begin to pass Level 1 visual perspective-taking tasks in which the child demonstrates an understanding that what they see may differ from what another sees in the same situation, or "what we see is different" (Moll & Tomasello, 2006, p. 603). By approximately 5 to 6 years of age, TD children also show more advanced visual perspective-taking skills, and begin to reliably pass Level 2 visual perspective-taking tasks such as Piaget's Three Mountain Task, or appearance versus reality tasks (Flavell et al., 1986). Passing this type of visual perspective-taking task indicates that a child knows that they may see the same thing someone else sees at the same time but from a different perspective, so it is seen differently; that is, "how we see it is different" (Moll & Tomasello, 2006, p. 603).

False-belief understanding begins to emerge between the ages of 3 and 5 years for TD children. First and second-order false-belief tasks have been used to test for the knowledge that people's thoughts can differ about the same situation. First-order false-belief tasks involve inferring a person's mental state, while second-order false-belief tasks involve embedded mental state understanding, or the ability to infer one person's mental state about another person's mental state. The passing of first-order false-belief tasks is considered a critical milestone in ToM development and is sometimes referred to as the "litmus test for assessing children's understanding of the mind" (Slaughter & Repacholi, 2003). In order for a child to pass a first-order false-belief task, they must understand that a person can have a belief about something that does not reflect reality. A person's incorrect, or false belief about a situation, will guide their behaviour in that situation. Wellman, Cross and Watson (2001) completed a meta-analysis of 178 research studies involving first-order false-belief tasks, including collectively thousands of TD children across multiple countries. They assessed the proportion of correct responses to first-order false-belief questions across a range of task variables such as the type of task, who the protagonist was in the task (person with the false belief), the target objects used, the type of questions asked, the salience of the protagonist's mental state, etc. They found a strong effect for age, regardless of the task variable examined, in that most 3 year olds failed the task, but most 4 1/2 year olds passed.

A study by Wimmer and Perner (1983) provides an example of the often-used "change of location" first-order false-belief task. In this task, a boy, Maxi, puts his chocolate bar in a kitchen cupboard, and leaves the room. While he is gone and cannot see, his mother moves the chocolate to a drawer. When Maxi returns, children are asked

where Maxi will look for his chocolate bar (tapping knowledge of Maxi's false belief about where the chocolate bar currently is). Generally, most 4- to 5- year-olds will say that Maxi will look in the cupboard rather than in the drawer, since that is where he left the chocolate and he is unaware that his Mother moved it. Three-year year-olds however will usually say that Maxi will look in the drawer, even if they are able to tell you where Maxi had put the chocolate originally. Another often-used first-order false-belief task is the "Sally-Anne False-Belief Task" (Baron-Cohen, 1985), also a change of location task. Various questions are asked based on a puppet show with two dolls: Sally puts a marble in a basket then leaves; Anne transfers the marble into a box and hides it; Sally returns for her marble. The questions posed to the child after watching the task include: Naming ("Which doll is which?"), Belief ("Where will Sally look for her marble?"), Reality ("Where is the marble really?") and Memory (Where was the marble in the beginning?"). The goal for the child, again, is to accurately infer the protagonist's mental states that guide their behaviour; in essence, what the protagonist thought/believed/felt that made them act in a different way than the child would have acted, having knowledge about the true events that occurred and therefore a different understanding of the events than that of the protagonist who is operating on a false-belief. For the current study, both perspective-taking and first-order false-belief tasks are used.

The consistency of performance of TD children on first-order false-belief tasks, across different countries and different task variations (Wellman, Cross and Watson, 2001) suggests that maturation plays an important role in ToM development. In addition to maturation, general cognitive, social and language abilities may also potentially contribute to a child's theory of mind. Scaffolding of language by parents, in particular,

is of importance to the present study in that the IS language input received by children from their parents is hypothesized to help support ToM development.

Theory of Mind Development in Children with Autism Spectrum Disorders

The term 'mind- blindness' was used by Baron-Cohen (1995) to describe ToM deficits observed in children with ASD. Even in infancy, children with ASD show impairment in their acquisition of the basic skills that support ToM development. For example, by 12 months they demonstrate difficulties with joint attention, understanding intentionality in others, using proto-declarative communicative gestures such as pointing, and engaging in imitation and play (Symons, Peterson, Slaughter, Roche, and Doyle, 2005). Most children with ASD show impairment or delay on tests of ToM, in particular false-belief tasks.

In false-belief tasks, researchers have found that children with ASD do not easily shift perspective between what someone else might think and what they themselves know (e.g., Baron-Cohen, Leslie & Frith, 1985; Baron-Cohen, Leslie & Frith, 1986.) Many researchers have investigated false belief difficulties in children with ASD. One example is that of Baron-Cohen et al. (1985). These authors compared children with ASD (*M* chronological age (CA), ASD = 11; 11) to children with Down syndrome (DS) (*M* CA, DS = 10; 11) and TD children (*M* CA = 4; 5) on the Sally-Anne False-Belief Task. The 20 children with ASD were matched to 14 children with DS based on CA which resulted in the children with ASD having higher mean mental ages (MAs) on both verbal (5; 5) and non-verbal cognitive scales (9; 3) than either the group of children with DS or TD. This was done to test the author's hypothesis that ToM was a specific deficit in children with ASD, largely independent of intellectual disability. Children in all three groups

answered the Naming, Reality and Memory questions on the false-belief task accurately. However the group with ASD showed specific difficulty with the Belief question ("Where will Sally look for her marble?"), pointing most often to where the marble really was. Eighty percent (16/20) of the children with ASD failed the false-belief task and their failure rate was much higher than in the comparison groups (DS or TD), despite the fact that the ASD children's mean mental age was higher than both control groups. Since the children with ASD were able to correctly answer the control questions, their failure to pass the task was not attributed to linguistic, memory or attentional problems but to a specific difficulty with false-belief ToM.

The universality of the ToM deficit in ASD, however, is a matter of some debate (e.g., Happe, 1994; Rajendran and Mitchell, 2007).   In the above study, for example, 20% of the children with ASD passed the false-belief task. As Happe (1994) stated, such findings are problematic for the ToM core deficit hypothesis of autism. A meta-analysis by Happe (1994) revealed that children with ASD who do pass first-order false-belief tasks pass these at later ages than typically developing children. Happe (1994) found that on average a verbal MA of 9 years was required; and that no child with ASD passed a first-order false-belief task before having an MA of 5.5 years. Indeed, verbal MA highly predicted whether or not a child with ASD was able to pass a false-belief task. Findings such as these suggest a delay, rather than a complete inability to develop ToM in individuals with ASD.

Baron-Cohen (1989) studied ASD performance on a more difficult second-order false-belief task ("I think she thinks he thinks), and found that 90% of TD children (*M* CA: 7.5), 60% of DS children (*M* expressive mental age (MA): 7.5; *M* receptive MA:

4.7) but 0% of the children with ASD (*M* expressive verbal MA: 12.2; *M* receptive MA: 7.8) were successful in passing this test. Bowler (1992) also found that the majority of a sample of young adults with Asperger's Syndrome could not pass a second-order false-belief task. Happe (1995) studied second-order false-belief task performance in a group of individuals with ASD. The ASD group included 6 who could not pass any ToM tasks; 6 who passed 1st-order ToM and 6 who had passed 2nd-order ToM tasks. In this study (Happe, 1995) the control group consisted of 26 TD children (*M* CA 8;6), all of whom passed the first- and second-order tasks; 13 adults with intellectual disabilities, 11 of whom passed the first and second-order tasks (2 had not scored perfectly on the first-order tasks but had performed well across the battery; *M* CA 19;4); and 10 TD adults (*M* CA 20;5). Happe (1995) found that even those individuals with ASD who were able to pass second-order false-belief tasks were unable to provide "appropriate" (correct) mental state explanations for non-literal utterances made by characters in the "Strange Stories Task". The Strange Stories Task involves accurately identifying a character's underlying intention in non-literally true comments (Happe, 1995). The authors found this despite also finding that these same individuals with ASD were producing equivalent numbers of mental state justifications or answers to questions asked about why someone behaved the way they did in a story during the assessment.

Studies have shown that Level 1 visual perspective-taking (VPT) is intact in children with ASD (e.g., Baron-Cohen, 1989; Leslie & Frith, 1988). Hamilton, Brindley and Frith (2009) studied Level 2 VPT in children with ASD. They compared performance on a level 2 VPT task, a control mental rotation task, and a battery of other ToM tests (misleading contents false belief, diverse beliefs and desires, knowledge access, etc). For

the VPT task and the mental rotation (MR) tasks, an object with distinctly colored sides was placed on a turntable and a response card was placed in front of the child. For the MR control task, the toy was covered with an opaque flowerpot and turned around. The child then had to select what picture of the object they would see on the response card if the pot was lifted. For the VPT task, a small doll was placed at the table with the child in different places, and after turning the object the child would have to select on the response card what the doll would see, given the doll's perspective. Twenty-three children with ASD (*M* CA = 8;0, *M* Verbal MA = 4;4) and 60 TD children participated. The 60 TD children were separated into three groups based on their verbal MA (as assessed by the *British Picture Vocabulary Scale*; Dunn, Dunn, Whetton, & Burley, 1997). The lowest group of 23 TD children were matched to the ASD group on verbal MA; the middle group of 23 were matched to the ASD group on performance on the mental rotation control task, and the highest group of 14 were matched to the ASD group on CA. The tasks were administered to the ASD group, and the two lowest TD groups (the older group of TD children would have hit ceiling on the tasks so they were not tested). The authors found that the children with ASD performed significantly worse than either TD group on the ToM tasks. They also found that the ASD group was impaired, in comparison to the TD groups, on the Level 2 VPT tasks but not on the control MR task. Finally, the authors found that Level 2 VPT performance was significantly related to ability on the other ToM tasks for the ASD group. The authors argued that their findings demonstrated that children with ASD have particular difficulty with the "decoupling of mental states from reality" (p. 43).

Performance on ToM tasks has also been compared in children with ASD labeled as high functioning. Brent, Rios, Happe and Charman (2004) tested 20 children with ASD (13 children with a diagnosis of autism, 7 with AS), all with an IQ greater than 70 (*M*= 99.8 on the *Wechsler Intelligence Scales for Children-III-UK* (Wechsler, 1992) or the *Kaufman Assessment Battery for Children* (Kaufman and Kaufman, 1983) and language-age matched TD controls on a series of advanced ToM tasks. The ASD group, labeled as high functioning (both children with autism and AS combined as one clinical group) had a mean LA of 8;3, and the TD group's mean LA was 8;10. The groups all scored close to ceiling on a series of first-order false belief tasks such as the Sally-Ann Task (Baron-Cohen et al., 1985). Several advanced ToM tasks used in the study included the Strange Stories Task (described above), the Cartoons Task, which involves understanding the internal states of characters to answer why a cartoon is funny (adapted from Happe et al., 1999); and the children's version of the Eyes Task where photos of faces are shown and the child must label facial emotion expressions to describe what the person is feeling or thinking (Baron-Cohen et al., 2001). The authors found that the ASD participants were impaired relative to LA-matched TD controls on the Strange Stories and Eyes advanced ToM tasks, but performed equally to TD controls on the Cartoons task. The authors explained the high performance on the Cartoons task by suggesting that the children may have an understanding of conventional humor. However the more advanced understanding of cognitive states required to perform well on the Strange Stories task and the understanding of affective states required to perform well of the Eyes Task made it more difficult for the high-functioning ASD group than for the LA-matched TD.

Paynter and Peterson (2010) assessed ToM and related it to vocabulary and grammar skills in children with AS (24), High-functioning Autism (19) and CA-matched TD controls (20). Vocabulary skills were measured via the *Peabody Picture Vocabulary Test* (Dunn & Dunn, 1997); grammatical/syntactical skills were measured via the *Test for Reception of Grammar* (Bishop, 2003); and non-verbal MA was measured using the *Raven's Progressive Matrices Test* (Raven, 1989). The ToM task battery included 5 false-belief tasks (2 change of location tasks, 2 misleading contents tasks, and one more-advanced false-belief task, the Belief-Emotion task, requiring the prediction of an emotional state after a puppet's false-belief realization). The authors found that, after controlling for CA, non-verbal MA and verbal MA, the children with AS developed false-belief understanding earlier than the HFA group, and did not differ from the CA-matched TD group in terms of ToM performance. The authors therefore argued that delayed language may be the symptom on the autism spectrum that is most closely linked to ToM difficulties. However they cautioned that younger children with AS (preschoolers) may not be comparable to their TD peers.

These studies suggest that children with HFA have more difficulty with ToM tasks than children with AS. By the age of 8 years, children with AS are not impaired in their ToM abilities in comparison to TD children, whereas children with HFA still show a marked impairment in ToM.

Thus, delays in ToM development have been show to be evident in individuals with ASD relative to both CA and LA matched controls. However, as children with ASD mature they do develop ToM skills, although they still demonstrate a delay on more complex tasks. As well, language ability seems to constrain ToM development, such that

children with ASD who do not have language difficulties may also be less delayed in

ToM. IS language is one aspect of language that has been shown to impact the

development of ToM.

Internal State Language Development in Children with Typical Development

As discussed by Bretherton and Beeghly (1982), internal states are abstract

constructs often with no concrete or easily observable referent. Thus, language that is

used to describe abstract cognitive, emotional or perceptual states takes time to learn.

Cognitive IS terms (e.g. know, wonder) may be particularly difficult to acquire,

compared to emotion (happy, angry) or perception (look, smell) IS terms. This is because

actions such as knowing are less directly observable and therefore must be inferred more

from behaviors. In contrast, one is able to see/touch/hear/taste perceptions as they are

labeled and can observe features associated with a happy or angry person through facial

expressions or nonverbal behaviors. Thus, learning cognitive words such as think,

believe and know may be more dependent upon explicit examples and explanations being

given in interactions (*She **thinks** the marble is in the basket because that is where she left

it; She **believes** in the Easter Bunny without having ever seen it; she **knows** that her

friend stopped playing with her because her friend wanted to go play on the swings.)*

Internal state language has been studied in TD children by investigating the type

of IS language used, the "experiencer" of the internal state term (attributional focus) and

the explanations or elaborations of the mental states that are provided. Bretherton and

Beeghly (1982) completed an early longitudinal study of IS language in young children at

20 and 28 months of age. Mothers were given a list of IS words and asked to note which

terms their child used, in what contexts, and who the terms referred to when they were used (i.e., the attributional focus: child, parent or someone else). The authors found that mothers reported their children were using IS terms by 20 months, and the number of different IS terms used increased with age. The mean number of IS words reportedly used by children rose from 7.8 at 20 months to 37.2 at 28 months. At 28 months, most children were reported to be producing words from the following IS categories: perception (*see, hear*), physiology (*thirsty, tired*), emotion (*like, scared*), desire (*want, can*), and moral (*good, bad*). Cognitive terms (*know, remember*), however, were reported in less than 1/3 of the children. These authors also directly assessed the children's production and comprehension of IS terms at 28 months using language sampling during three tasks: play, shared-book reading, and snack. Vocabulary and IS word comprehension was also assessed using the *Peabody Picture Vocabulary Test* (Dunn & Dunn, 1981) and the *Emotion Label Recognition Test* (Bretherton and Beeghly, 1982) respectively, in addition to the use of the same parent report form described above. Language sampling revealed that at 28 months, volition (desire), physiology, and perception items were produced most often, affect and moral judgment somewhat less, and cognition terms least of all. In regards to attribution, the authors found that at 28 months the children attributed 66% of IS terms to both themselves and others; however, attributions to the self were used significantly more than were attributions to others. Further, children who were able to attribute terms to both themselves and others were able to use IS language about non-present experiences, including questions, denials and statements about past and future events. The authors found that the categories of IS language attributed to both self and other were also the categories of IS language used to

describe non-present experiences as well. These were the same categories of IS language as those obtained for total IS vocabulary (physiology, volition/ability and perception being used significantly more than affect and moral obligation; with cognitive terms being used significantly less than all the other categories). Bartsch and Wellman (1995) also state that by approximately 2 years of age, TD children were able to use desires verbs such as "want" in communication with others; however, cognitive verbs such as "think" and "know" were not used by children until approximately one year later.

In regards to elaborations, Bretherton and Beeghly (1982) found that causal elaborations (descriptions of why a particular state was experienced or how a state led to certain behaviors) were predominantly produced in regards to affective states, not perception or cognitive states, and more causal elaborations were made when children talked about their own internal states versus another's. Causal elaborations about emotions exceeded elaborations about perception, physiology and volition ability; and causal elaborations about the five senses (a subset of perception terms) and about cognitions were lowest in frequency. Causal elaborations were also made more about self attributions than about IS language attributed to others. Contrastive statements, or elaborations of internal states, begin to be used more commonly in children ages 4-5 years and above (Sabbagh and Callanan, 1998). Bartsch and Wellman (1995) argued that the use of belief terms in a contrastive way ("I thought it was a flower, but it's a pen") by children three years or older shows a developing understanding that internal states are potentially different from reality.

Meins, Fernyhough, Johnson and Lidstone (2006) also investigated the use of internal state language in a group of older TD children ages 7-9 years ($M = 8;4$) while

narrating a wordless picture book (*Frog on His Own*, Mayer, 1973; as used in the current study), and performing a Describe-A-Friend task. The picture book narrative was scored for internal state comments (references to the character's cognitive and affective states, such as beliefs, knowledge, desires, and emotions); perception comments (references to the 5 senses of the characters); attempt comments (comments about the intentions of the characters in the story); self-referential comments (comments relating to the child's own internal states); distancing comments (comments showing uncertainty about the events in the story, such as "looks like", "might"); and general description comments (plot-related). In the Describe-A-Friend task, the comments were coded as mentalistic (cognitive or affective comments); behavioral (activities, interactions, or personality characteristics); physical (physical characteristics) or general (did not fit into the above categories). The authors found that in the book narration task, at least 87% of the TD children used one or more internal state comments and 95% used at least one perception comment. In the Describe-A-Friend task, 54% used at least one mentalistic attribute. Mentalistic attributes included references to mental states or intellect (e.g. "He's a clever person") or to the friend's own or the friend's responses to the child's own emotions (e.g. "She plays with me when I'm feeling sad", or "She's always really happy", p. 187). The authors state that although there was considerable variation in the use of IS language within the group of children in both tasks, after controlling for age and verbal ability, the tendency to use IS language in both the book narration task and the Describe-A-Friend task was highly positively correlated, and most children aged 7-9 were using internal state language in both of these non-interactional tasks.

These studies show that TD children develop IS language categories early (around

the age of 20 months) and in a particular order, using perception and affect terms before

and more often than cognitive terms. They also progressively develop the ability to

attribute IS terms to themselves and then to others. In addition, the ability to elaborate on

IS terms develops later and increases in frequency over a long period. Children are first

able to elaborate about their own internal states and later about those of others', and they

continue to use IS language in different contexts as they continue to develop their

language abilities.

Internal State Language Development in Children with Autism Spectrum Disorders

Researchers have found that the development of IS language use is impaired in

children with ASD. Tager-Flusberg (1992) conducted the first study of IS language use in

6 boys with ASD, compared to 6 boys with Down syndrome matched for age and

language production, as indexed by mean length of utterance (MLU). The group with

autism ranged in age from 3; 4 – 7; 7; and in MLU from 1.66 – 4.20. Spontaneous

conversational speech samples containing 100 utterances from the 12 children were

collected over a one to two year period and were analyzed for IS language use. The

author combined the transcripts over the length of the study for each group for her

analysis. She found no significant differences between groups in the frequency of use of

desire, perception or emotion state terms; however, the children with ASD were impaired

in their ability to use attention and cognition terms. As well, the children with ASD never

elaborated cognitive terms, while 6.2% of the cognitive terms produced by the children

with DS were elaborated. In terms of attribution, both groups of children talked more

about their own perceptions, desires and cognitions than about those of other people; however, both groups of children spoke equally about their own emotions and the emotions of others. The finding of a specific difficulty with cognitive IS terms is particularly interesting, as other research has suggested that children with DS produce fewer cognitive lexical verbs than MLU-matched TD controls (Hesketh & Chapman, 1998).

In a later report, Tager-Flusberg (1995) found that, in comparison to verbal MA-matched TD children and children with intellectual disability, children with autism (mean age 12.1 years) did not differ in the proportion of internal state language used in narratives elicited using a wordless picture book, but that the children with ASD did not provide any causal elaborations to explain the internal states of others. Tager-Flusberg and Sullivan (1995) also investigated internal state language using narratives based on a wordless picture book, *Frog on His Own* (Mayer, 1973), as in the current study. In particular they were interested in the production of causal elaborations and performance on false-belief tasks. Participants included 27 students with autism or PDD-NOS (CA 6-22 years, IQ 43-92) and a control group consisting of 27 students with intellectual or learning disabilities (CA 7-27 years, IQ 52-96) and 17 TD students (CA 7-20 years) matched on language ability. Participants created narratives using the wordless picture book, then answered questions about the internal states of the characters in the book. The authors found that the groups did not differ in their frequency of use of internal state language or causal elaborations in the narrative production. However in answering the questions on the character's internal states, the participants with autism were less accurate in labeling the emotions of characters within the book and provided fewer causal

explanations for these emotions. The authors also found that the production of cognitive internal state terms was significantly related to performance on a false belief ToM task, for the participants with ASD.

Capps, Losh and Thurber (2000) also compared IS language use in the narratives of three groups of children: ASD, TD, and developmental delay (DD: individuals with intellectual disability other than Down syndrome). The groups were matched on language ability using the *Clinical Evaluation of Language Fundamentals* (Semel, Wing, & Secord, 1987). The groups with ASD and DD were also matched on mental age and IQ using the *Stanford-Binet Intelligence Scale, 4th edition* (Thorndike, Hagen, & Sattler, 1986) (ASD: CA= 12.6; LA= 6.4; IQ= 75.2, MA= 8.9). Narratives were elicited using the wordless picture book *Frog on His Own* (Mayer, 1973) as in the current study. The authors coded for elaborations, defined as the evaluation or the interpretation of events, for example the use of statements to describe the motivation or cause of a particular state (e.g. "The boy did that because...."). Results showed that the groups did not differ in their frequency of references to affective and cognitive states, but the ASD and DD groups both differed from the TD group in the frequency of causal elaborations about affective and cognitive states. Approximately 25% of the TD children's references to affective and cognitive states were causally elaborated in comparison to approximately 7% of those of the DS and ASD children. The narratives of the ASD and DD children were similar, in that there was a tendency to simply label rather than elaborate on internal states.

In summary, individuals with ASD have strengths and weaknesses in IS language use. The frequency of usage of mental state terms (IS language) and the ability to attribute these terms to themselves or others is comparable to DD or DS controls matched

on language ability, however, individuals with DS have also been shown to have difficulty producing cognitive terms relative to TD controls. Individuals with ASD also experience difficulty in their ability to elaborate on internal states, particularly cognitive states. As discussed in the following sections, the ability to elaborate on internal states is related to ToM development.

Relationship between Theory of Mind and Internal State Language in Children with Typical Development

Researchers have investigated how ToM may be related to language in general and to IS language specifically. Looking at language abilities in general, Astington and Jenkins (1999) assessed 3 year-old TD children at three points (beginning, middle and end) over a 7-month period during their nursery school year. Measures of language ability (as measured by the *Test of Early Language Development*, Hresko et al, 1981) and ToM (three tasks: change-in-location false-belief task, unexpected-contents false-belief task, and an appearance-versus-reality task) were obtained over the three time periods. They found a unidirectional relationship, where early general language ability predicted later positive performance on ToM tasks, controlling for earlier theory of mind; whereas earlier theory of mind did not predict later language ability (controlling for earlier language ability). The authors posited that children use language as a symbolic framework to understand a person's mind, including thoughts and beliefs.

Olineck and Poulin-Dubois (2007) conducted a longitudinal study investigating whether infants' internal state language use was related to ToM development. In the first assessment, 26 14-month-old and 30 18-month-old infants completed an imitation task

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and their parents completed the *MacArthur Short Form Vocabulary Checklist: Level II Form A* (Fenson et al., 2000) to assess concurrent vocabulary ability. Twenty-six of the parents of these infants (*M* CA of the infants = 32 months, SD = 0.43) also completed a questionnaire about their child's internal state language production. Finally, 31 infants children (*M* CA = 50.05 months, SD = 4.37, range = 45.26 - 55.43 months) returned for a follow-up assessment, which included an evaluation of the children's receptive vocabulary abilities via the *Peabody Picture Vocabulary Test* (PPVT; Dunn & Dunn, 1997) and completion of an IS language use parent questionnaire. At this follow-up assessment around the age of 50 months, ToM development was also assessed, using a ToM Scale that involved presenting five interactive stories to the children then asking questions regarding the child's children's internal states and those of the characters in the stories. A false-belief task (misleading-contents) and interactive game measuring intention understanding were also administered. The authors found that, not only did the children's use of internal state language at 32 months predict their performance on the false-belief task at 50 months, but the children who produced more IS language at 32 months also scored higher on the ToM Scale, and that this predictive relationship was not driven by overall language abilities as measured by the PPVT, but IS language specifically, further illustrating the importance of IS language to ToM development.

Training studies have also been used to study the relationship between IS language and ToM in TD children. Lohmann and Tomasello (2003) studied 138 TD children (3;0 to 3; 3 years) randomly assigned to one of four training groups. In each training group, children were shown 16 objects, 12 of which had a deceptive element such as a flower that was actually a writing pen, and 4 of which did not. Training in each

of the groups involved the experimenter referencing the deceptive object with the child in different ways. Sentential complements and internal state language were used to varying degrees across the training conditions. Sentential complements occur when a sentence takes a full clause as its object complement (e.g. John **thinks** *Sally is at school*; Sally **knows** *John is going to school*). The <u>full training group</u> discussed the deceptive component of the object using mental state verbs such as "**think**" or "**know**", along with a discussion of the child's and a puppet's false belief about the object, using sentential complement constructions. In the <u>sentential complement-only training group</u> the deceptive component of object was not highlighted for the child, but the examiner talked about the object using internal state words and sentential complements. In the <u>discourse-only training group</u> the deceptive component of the object was discussed with the child, but without the use of internal state nouns and verbs or sentential complement constructions. Finally, in the <u>no-language training group</u> the deceptive aspects of the object were identified, but only with the phrases "*look*" and "*but now look!*" to show the appearance versus reality distinction. The authors tested the effect of these training programs on false-belief task performance post-test. ToM was measured using false-belief tasks prior to training (misleading contents task) and after training (an appearance versus reality task, a change of location task and a misleading contents task). The authors found that the use of internal state language to discuss deceptive objects, and the use of sentential complements to discuss deceptive objects, both separately facilitated progress on false-belief task performance. The <u>full training group</u> where both of these were incorporated resulted in the greatest gains in false belief performance. In other words, training on language about internal states positively contributed to these children's ability

to complete ToM false-belief tasks, especially when used in sentential complement constructions.

Symons, Peterson, Slaughter, Roche and Doyle (2005) also examined the relationship between TD children's internal state language use and ToM. IS language was elicited in response to the *Separation Anxiety Test* (Slough, Goyette, & Greenberg, 1988) which involves 6 pictures of separation situations and the child is asked about the feelings of the children in the pictures, what the child in the picture was likely to do next, and how the participant would feel if they were the child in the picture. This test was administered at two time points separated by one year. At Time 1 the children had a mean age of 57 months (SD = 6.7 months), and at Time 2 the children had a mean age of 70 months (SD = 6.6 months). A battery of false-belief tasks including 6 unexpected identity and contents tasks, 5 changed-location false belief tasks, and 2 emotion false-belief tasks were also administered at Time 1 and Time 2. Internal state language used by children was coded for cognitive (e.g., thoughts, knowledge), affect-desire (e.g., wants, needs, desires), affect (e.g., emotions such as happiness or sadness) and behavioral states (e.g., action verbs). At Time 1, 10% of the child's talk was about cognitive and desire internal states, and 34% was about affect states, At Time 2, 6% of the child's talk was about cognitive and desire states, and 36% were about affect states. The authors found that the TD children's total mental state language used at Time 1 significantly positively predicted their emotion false belief task performance at Time 2. As well, at Time 2 their cognitive and desire mental state language was positively related to emotion false belief understanding and overall ToM task performance. The authors reported that the IS

language-ToM relationships obtained were not affected by variations in the participants' age, receptive language skills or socio-economic status.

Finally, in a study mentioned above by Meins et al. (2006), the authors analyzed the relationship between IS language use in two non-interactional tasks (narrating a wordless storybook and a Describe-A-Friend task) and concurrent ToM development in older TD children in comparison to the previously mentioned studies (TD 7 to 9 year olds). The authors found no association between the children's performance on the Strange Stories ToM task and their proportional use of IS language on either task. They did find however that for this group of 7-9 year olds ToM understanding was linked to general verbal ability and verbosity (length of narrative), and that the use of IS language generalized across contexts in children. The authors argued that IS language use in non-interactional contexts "taps into different underlying capacities to those that determine ToM performance" (p. 193).

In summary, general language ability predicts later ToM in young TD children. However, studies of the relationship between IS language and ToM have variable results. For younger children (ages 3;0-5;10) a unidirectional, predictive relationship has been found where early general language ability (and specifically a child's use of IS language in some research; Olineck and Poulin-Dubois, 2007, and training on IS language such as sentential complement constructions; Lohmann and Tomasello, 2003) predicted later positive performance on ToM tasks (Astington and Jenkins, 1999; Symons, Peterson, Slaughter, Roche and Doyle, 2005). The contexts in which IS language was examined and relationships found in these studies of younger TD children included standardized tests of language abilities, IS language use parental questionnaires, training on using IS

language and sentential complements to discuss internal states in ToM tasks, and asking children about internal states depicted in pictures. For older children (7-9 years old), research has not found an association between concurrent TD children's performance on a ToM task (Strange Stories task) and their proportional use of IS language on non-interactional tasks such as narrating a wordless storybook or in describing a friend; however, it has been found that ToM understanding is linked to general verbal ability and verbosity (length of narrative) for these older TD children. Therefore, although IS language use has been linked to ToM development in young TD children in previous research, it is important to also recognize that context (or task in research) and age of children may play a role in whether or not relationships between ToM and IS language are found, as illustrated above. Other factors such as individual differences in IS language use, and whether ToM or IS language use can be related to internal state understanding in social contexts (such as during interactional contexts such as play at school) must also be taken into account in the analysis or application of research findings.

Relationship between Theory of Mind and Internal State Language in Children with Autism Spectrum Disorders

Researchers have also investigated how ToM may be related to language in general and to IS language specifically for children with ASD as well. Steele et al. (2003) studied the relationship between language in general and ToM development in 57 children with ASD aged 4-14 years. A battery of ToM tasks and two measures of receptive and expressive vocabulary from the *Peabody Picture Vocabulary Test* (PPVT-III, Dunn & Dunn, 1997) and the *Expressive Vocabulary Test* (EVT: Williams, 1997)

were given at two time periods, collected one year apart. The authors found that the children with ASD showed significant gains in ToM over the one-year period, and that early vocabulary ability predicted ToM gains. Therefore, the authors argued that language plays a causal role in the development of ToM understanding in children with ASD.

Fisher, Happe and Dunn (2005) also investigated the relationship between general language and ToM development in children with ASD. The participants in their study included 58 children with ASD and 118 children with moderate learning difficulties (MLD, i.e., developmental delay). Verbal MA was assessed using the *British Picture Vocabulary Scale 2nd Edition* (BPVS II; Dunn, Dunn, Whetton, & Burley, 1999) and the *Test for Reception of Grammar* (TROG; Bishop, 1989) and ToM was assessed using two false-belief tasks (change of location and misleading contents). There were no significant differences between the groups on the two language measures (BPVS: ASD *M*: 7;2, MLD *M*: 7;5, TROG: ASD *M*: 6;05, MLD *M*: 6;07), but the groups did differ significantly on CA (ASD *M*: 10.74; MLD *M*: 12.13). The authors found that performance on false-belief tasks and language abilities was more strongly related in the ASD group than in the MLD group; and that, although vocabulary significantly predicted false-belief performance for the group with ASD, that grammar predicted false-belief performance over and above vocabulary for this group. The authors concluded that language may "provide the structure for understanding representational understanding" (p. 416) in children with ASD.

Ziatas, Durkin and Pratt (1998), interested in the relationship between IS language and ToM, examined whether ToM task performance was related to belief term use in

children with Autism, Specific Language Impairment (SLI), Asperger Syndrome (AS) and TD children. The participants included 12 children with autism matched by sex, CA and VMA to 12 children with SLI and by sex and VMA to 12 TD children. The 12 children with AS were matched by sex, CA and VMA to 12 children with SLI and by sex and VMA to 12 TD children. The *Peabody Picture Vocabulary Test* (PPVT: Dunn & Dunn, 1981) was used to match on language age and the *Test of Reception of Grammar* (TROG: Bishop, 1989) was used to ensure that all participants had the grammatical understanding of at least a 4-year old (*M* VMA on the PPVT: ASD = 5;9, matched to SLI=6;1 and TD 6;3; AS=6;4, matched to SLI=6;5 and TD 7;0). Three ToM tasks were administered. These included the Sally-Ann task (change of location false belief task: Baron-Cohen at al., 1985); a belief term comprehension task (based on a task devised by Moore et al. (1989), where the child is required to understand differences in levels of certainty between *know*, *think*, and *guess* when answering questions on where an object was hidden and what the puppet states, e.g. puppet 1 stating "I think the Smartie is in the red box" versus Puppet 2 stating "I know the Smartie is in the blue box"); and a belief term expression task (where the child had a turn controlling the puppets to help the experimenter find the Smartie that the child could then have, using the terms *think*, *guess*, and *know*). The authors found that the group of children with autism performed significantly poorer than the other groups (AS, SLI and TD) on the false-belief and belief term comprehension and expression tasks. They argued that their findings support the notion that ToM development and internal state language development (specifically belief term development) is associated, as only the group of children with autism who performed poorly on the false-belief tasks also failed to demonstrate development of

belief terms, whereas the children with AS or SLI passed the false belief tasks and had

higher mean scores on the belief term comprehension and expression tasks. The authors

caution that a causal relationship was not demonstrated.

Finally, Hadwin, Baron-Cohen, Howlin and Hill (1997) assessed whether

teaching children with ASD ToM abilities (emotion and belief perspective-taking and

understanding) resulted in an increase in the use of IS language. Thirty children with

ASD were randomly placed into 1 of 3 intervention groups (mean age was 9; 2 for all 3

groups): understanding emotions, beliefs and pretend play. Intervention was conducted

daily for 8 sessions. The understanding emotions group was taught to recognize external

cues for emotions such as facial expressions and that emotions can have internal causes

such as desires and beliefs. In the beliefs group, children were taught perspective-taking

and that people's beliefs may differ from their own. Finally, children in the pretend-play

group were taught object substitution (pretending an object is something that it is not) and

the use of imaginary objects (pretending an object is there when it is not) in play. IS

language was assessed before and after the training, by having the children tell a story

based on a picture book. The story telling was analyzed for the number of emotion,

perception and cognition words used. The authors found that the children with autism

were taught to successfully perform on the emotion and belief tasks in the intervention

groups but this did not result in an increase in the use of mental state words in any

treatment condition. Thus, teaching ToM had no positive impact on IS language use in

these children. The authors explained their findings by suggesting that the children with

ASD may not have had a deep conceptual understanding of the internal states; that their

passing on ToM tasks may not be related to their communication abilities; or that children with ASD may be unable to generalize internal state understanding across tasks.

In summary, for children with autism, research has found that language (such as internal state language development, and both grammar and vocabulary abilities) is associated with the development of ToM as measured by performance on ToM false-belief tasks. Teaching ToM has not been shown to positively impact internal state language use in individuals with ASD, although the dose of the treatment was small. Studies have not investigated the impact of teaching internal state language on ToM development. Research must also further investigate the relationship between performance on ToM tasks and the child's social and communication abilities and ability to transfer knowledge about internal states across contexts.

Parental Input and TD Children's Internal State Language and Theory of Mind

Children are exposed to IS language through interactions with their parents. Therefore, how parents' talk about internal states to their children is likely to impact their children's use of IS language and development of ToM. Ruffman et al (2002) investigated the relationship between the mental state talk of mothers, and the mental state talk of their typically-developing children, and the children's performance on ToM tasks. Eighty-two TD children were tested at three time points: mean ages for these three time points were 3; 1 years, 3; 4 years, and 4; 4 years. Picture descriptions were coded for the number and type of IS terms used. Three ToM tasks (false-belief translocation, desire-emotion and emotion-situations tasks) were also administered. The authors found that individual mothers were consistently either high or low users of IS language across

the three time points. Overall IS language use did not increase over time for the mothers or the children. The mother's mean number of IS language utterances were 18.26 (SD = 13.3), 35.22 (SD=21.78) and 32.32 (SD=20.88); the child's were 2.10 (SD=3.71), 4.32 (SD = 6.10) and 3.94 (SD = 4.05, respectively, for the three time points. Mothers' frequency of desire utterances went from 3.46 (SD=3.46) to 2.5 (SD=2.34) from the first to third time point, while their use of cognitive utterances went from 8.22 (SD=7.27) to 15.69 (SD=11.59). Both the mothers and their children talked more about desires than cognitive states early on, but later talked more about cognitive states than affect states. Early mother IS talk was found to predict later child IS talk, but early child IS talk did not predict later mother IS talk. In particular, mothers' talk about affect (desires) was more highly correlated with child's later talk about cognitive states than was mothers' early talk about cognitive states, suggesting that children learn about beliefs via talk about affect. The authors also found a predictive relationship between mothers' IS language and children's ToM. Specifically, mother's earlier IS talk predicted children's later ToM development, independent of the children's earlier ToM and language skills. Causal talk about internal states was found to be most beneficial to the development of ToM, rather than the frequency of any single category of IS talk.

Symons, Peterson, Slaughter, Roche and Doyle (2005) used a joint book reading and story-telling task to also examine the relationship between ToM and IS talk in mothers and their TD children. In their first study, they examined parent-child communication during a joint book reading task and measured ToM development in 51 children ranging from 60 to 85 months. The children completed a battery of false-belief ToM tasks (6 unexpected identity and contents tasks, 5 changed-location false belief

tasks, and 2 emotion false-belief tasks). The authors coded the mothers' and children's utterances during the joint book-reading as either mental, behavioral or physical states. Mentalistic language (IS cognitive language) accounted for 28% of the parent's talk and 10% of the child's talk during the shared book-readings. Symons et al. found that more character mental state comments made by mothers (attributing the IS term to an "other", often the character in the book) during the joint book reading was positively related to children's performance on false-belief tasks. The authors suggested that a developmental sequence may occur in which IS language input from parents leads to the child's own use of IS language, which in turn leads to ToM development.

Taumoepeau and Ruffman (2006, 2008) also looked at the relationship between parental IS input and children's ToM in TD children. Data was collected at three time points (15 months, 24 months and 33 months). Mothers described pictures to their children and the child's language and mental state vocabulary was tested using the *MacArthur Communicative Development Inventory* (MCDI: Words and Gestures checklist, Fenson et al., 1993) and the *Reynell Developmental Language Scales III* (RDLS; Edwards et al., 1997). Two ToM tasks were also administered to the children: an "Emotion Situation Task" (cartoon vignettes were presented where a protagonist's emotion was first named then children selected the photo that matched how the protagonist feels) and a "Body Emotion Task" (photos of a person showing either happiness or sadness via body position were shown and children were asked to point to either a happy or sad face). Mothers were administered an emotion-labeling task as well in which they matched verbal emotion expressions to pictures and vice versa. The authors found that mothers' talk about desires decreased from Time 1 to Time 2 and talk about

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desires and emotions remained consistent across Time 2 and 3. Talk about cognitive states however increased across all three time points. Further, maternal talk about cognitive, desire and emotion at 24 months was found to be predictive of children's performance on ToM emotion tasks at 33 months. These authors therefore argued that mother's mental state talk was the vehicle through which children learned ToM.

Taumoepeau and Ruffman (2006, 2008) were also interested in studying whether mothers' IS talk predicted later IS talk in their children. Taumoepeau and Ruffman (2006) found that mother's talk about their child's desires at 15 months positively predicted the child's talk about their own desires at 24 months of age. Taumoepeau & Ruffman (2008) later reported that mother's talk about the cognitive states of others at 24 months positively predicted the child's talk about mental states at 33 months. Further, mothers' talk about others' cognitive states was a better predictor of the child's later cognitive state talk than mothers' talk about the child's own cognitive states. The authors posited that talking about the child's affective states early on allows the child the opportunity to link these affect IS terms with their own internal experiences. Then, once children have learned to talk about their own affect, mothers adjust their IS input to talk more about the cognitive states of others (which are more abstract). This, they suggested, is particularly and increasingly beneficial in helping the child develop ToM understanding, and demonstrates what the authors call a "systematic scaffolding process by mothers" (Taumoepeau & Ruffman, 2008, p. 300).

Slaughter, Peterson and Mackintosh (2007) reported on two studies looking at the relationship between parental IS language and ToM development in children. In their first study, 30 TD children ($M = 3;9$, $SD = 4.6$ months) and their mothers participated.

The mother's narrated a wordless picture book to their children that was coded for seven IS language categories, including simple or elaborated cognitive, affect, and perception/attention terms, as well as false-belief endings in a story. The children's ToM was tested using a change of location false-belief task (similar to the "Sally-Ann" task). In this first study the authors found that mothers' elaborations of cognitive states and references to false belief endings were both significantly positively correlated with their child's performance on the false-belief ToM task. Talk about affective and perceptual states, either simple or elaborated, however, was not correlated with false belief task performance in their children. The authors argued based on these findings that elaborative talk about internal cognitive internal states are particularly important for children's development of false belief understanding.

Together, these studies suggest that parental input positively predicts internal state language learning in TD children. Early parental IS talk, specifically elaborated talk about internal states, positively predicts both later child IS talk and children's ToM development. Parents attributing IS talk first to their children's internal states, then towards the states of others', allows children to connect and use IS language to discuss their own internal states, the internal states of others, and possibly make sense of why people may behave they way they do given these internal states thus acquiring social-cognitive understanding, or ToM.

Parental Input and the Internal State Language Use and Theory of Mind of Children with ASD

To date, only two studies have focused on parental IS language input to children with ASD or the relationship between input and children's IS language or ToM

development. Kay-Raining Bird, Cleave, Curia & Dunleavy (2008) published a case study of a young child with ASD ("CD": CA= 3; 7, LA= 9-12 month range). The researchers analyzed all parental talk directed to the child over a three-day period in terms of IS language. Input to the child with ASD was on average 176 utterances per hour and 33% of the mother's (M) utterances and 25% of the father's (F) utterances contained IS terms (sensory: M: 38%, F: 32%; desire/volition/ability: M: 24%, F: 28%; judgment: M: 11%, F: 14%; emotion: M: 15%, F: 9%; and cognitive: M: 4%, F: 10%). IS talk was almost always about the child's internal states, except when cognitive terms were used, for which the mother frequently referenced her own cognitive states. The IS talk of CD's parents was judged to be similar to that of previously published descriptions of TD children of the same developmental age. However, the authors argued that typical input may not be sufficient to overcome the unique IS language and ToM deficits of children with ASD.

Slaughter et al. (2007) also studied parental IS language input to children with ASD, in their second study. Two groups of children were included, ASD and TD, to investigate possible differences in IS language input or differences in the association between IS language input and ToM. The participants were 24 TD children (3; 1 years to 6; 9 years) and 24 children with ASD (4; 3 years to 9; 3 years) and their mothers. The children were matched on verbal MA as assessed by the *Peabody Picture Vocabulary Test-Revised* (PPVT-R; Dunn & Dunn, 1981) and ToM was assessed using false-belief (change of location and misleading contents), desire and visual perspective-taking tasks. Mothers narrated three wordless picture books and the narratives were transcribed and coded for simple and elaborated IS language in three categories (cognition, affect,

perception). The mean frequency of mother's comments about the story characters'

affective (TD=2.71; ASD=2.37), perceptual (TD=27.33, ASD=23.96) and cognitive

(TD=4.25, ASD=5.29) mental states did not differ significantly for the two groups; length

of narratives (verbosity) was controlled for by the authors. However, mothers of children

with ASD were less likely to provide elaborations about a character's affective (TD=1.83,

ASD=0.71) and cognitive (TD=7.21, ASD=4.58) states. Importantly, partial correlations

and multiple regression analysis showed that the children's performance on perspective-

taking and false-belief tasks was significantly correlated with their mothers' frequency of

elaborated affective mental states, for the ASD group only. Therefore, for the children

with ASD, elaborative information mothers provided about mental states may have been

particularly advantageous.

In summary, based on the limited research on parental IS language input towards

children with ASD, children with ASD are receiving IS talk in similar frequency to TD

children of similar language ages, however are potentially receiving less of the elaborated

IS talk that has been shown to be correlated with and is particularly beneficial for ToM

development as measured by ToM task performance.

Research Questions

The review of the available research has found a link between IS language and

ToM development in both children with ASD and TD children. Focusing on the group of

children of interest in the current study, research has found that children with ASD have

delays in ToM development, and language ability (such as IS language) seems to

constrain their ToM development. Children with ASD are also impaired in IS language

development. Although they are able to use IS language in similar frequency and can attribute these terms to themselves or others in comparison to peers matched on language ability, they experience difficulty in their ability to elaborate on internal states, particularly cognitive states. As previously discussed, the ability to elaborate on internal states is related to ToM development. Also, teaching ToM has not been shown to positively impact internal state language use in individuals with ASD. Finally, based on the limited research on parental IS language input towards children with ASD, children with ASD are receiving IS talk in similar frequency to TD children of similar language ages; however, they appear to be receiving less of the elaborated IS talk that has been shown to be correlated with and may be particularly beneficial for ToM task performance.

Given these previous research findings, the goals of this study were then to replicate previous findings and to contribute to this growing area of research by studying internal state language input by parents, use by children, and children's ToM development in children with ASD compared to language-age matched TD children in one study. The role of attributional focus of IS language ("experiencer") was a key factor of interest in both parent and child IS talk, as was categories of IS language use (simple versus elaborated perception, affect and cognitive internal state terms). Whether and how parent's IS talk is related to their child's IS talk in children with ASD was also a key factor of interest, given the limited previous research in this area.

The purpose of the current study was then to explore the relationships between parental IS talk, child IS talk, and child ToM development by comparing the frequency and type (simple or elaborated sensory, affect or cognitive IS language terms), and

attributional focus of IS language (child, parent, child and parent or other) that children

with ASD or TD (matched for language ability) receive from their parents, and the IS

language they use themselves. As well, we aimed to explore the relationships between

parental input and child's use of IS language with children's ToM task performance on a

variety of visual perspective-taking, desires perspective-taking, and false belief tasks.

The following research questions were therefore addressed in this study:

1. Does the category (simple or elaborated; sensory, affective, or cognitive) or

    attributional focus (child, parent, child and parent, other) of IS language input differ

    for children with Autism Spectrum Disorder in comparison to children who are

    typically developing matched for language age?

2. Does the category or attributional focus of IS language use differ for children with

    Autism Spectrum Disorder in comparison to children who are typically developing,

    matched for language age?

3. Is parent's IS language input related to their children's use of IS language?

4. Is children's ToM ability related to:

    a. Parental IS language input?

    b. The children's own IS language use?

Based on previous literature, the following hypotheses were made:

1. Parents of children with ASD would be similar in overall frequency of IS language input to parents of TD children (Kay-Raining Bird et al., 2008), however they may differ in their use of elaborated IS language (Slaughter et al., 2007).

2. Children with ASD would not produce as many elaborations of internal state language, especially cognitive terms, in comparison to TD children, based on previous research showing that elaborated cognitive terms may be particularly difficult for children with ASD (Tager-Flusberg, 1995; Tager-Flusberg & Sullivan, 1995).

3. A child's IS language use would be related in type (simple and elaborated) and attribution to the IS language input being received, given the transactional nature of language development and previous research findings (Taumoepeau & Ruffman, 2008; Symons et al., 2005). That is, parents who used a higher frequency of IS language use in their narratives would have children who are more likely to include IS language in their own narratives.

4. The child's ToM performance in both groups would be positively correlated with IS language use by his/her parents and the children's own use as well.

CHAPTER 2: METHODS

Participants

Twenty-seven parent-child dyads were recruited, from 22 families. Two dyads were tested but excluded from analyses, as the children were found to not meet the language-age inclusion criteria (described below) after testing (one child scored below and 1 child scored above the criterion). The sample of 25 dyads included 12 dyads with children with ASD, and 13 dyads with TD children. Descriptive statistics for participant characteristics are presented in Table 1.

Typically-Developing (TD) Children.

Children who were TD were included in the study if they fell within a chronological age range of 3;0 to 8;11 years old. This age range was selected because it captures a critical period of development of ToM in TD children. Specifically, by the age of 4 1/2 years most children are able to pass first order False-Belief theory of mind tasks (Wellman, Cross and Watson, 2001). By including TD children both below and above the age of 4, we were able to capture children who have not yet attained this critical development and also those who have surpassed it. TD children were included if they had no diagnosed or suspected speech, language, hearing and/or learning disorders or any medical conditions that might impact their ability to learn. This was determined by asking the parent this question during the initial recruitment phone screening. As well, TD children were included if they scored no more than one standard deviation below the mean on their combined Listening Comprehension and Oral Expression score on the *Oral and Written Language Scales* (OWLS; Carrow-Woolfolk, 1995, described further below).

Children in the TD group ranged in age from 4; 10 – 7; 9 (Table 1). There were 9 boys and 4 girls. These children had a mean language age (LA) as measured by the total score on the OWLS of 6; 6.

Children with Autism Spectrum Disorders (ASD).

Participants with ASD were included if they had received a diagnosis of Autism, Asperger's Syndrome, or Atypical Autism from a qualified professional. Diagnosis was based on *the Diagnostic and Statistical Manual – 4th ed. revised*, the *Autism Diagnostic Observation Schedule* (Lord, Rutter, DiLavore, & Risi, 1989), the *Autism Diagnostic Interview-Revised* (Rutter, LeCouteur & Lord, 2003), or another reputable diagnostic instrument. Only children with ASD who had participated in research previously through the Autism Research Center (and therefore their diagnosis had been verified by an experienced clinician-scientist) were included in the study. Children with ASD were included in the study if they fell within a LA range of 3; 0 to 8; 11 years, as measured by the combined receptive and expressive score of the OWLS. Children in the ASD group ranged in age from 5; 1 - 9; 5 years (see Table 1). There were 10 boys and 2 girls in the group. These children had a mean LA of 6; 0.

The two groups of children (ASD, TD) were matched on LA (composite age-equivalent score), as demonstrated by t-test. Independent means t-tests revealed significant differences in chronological age (t(23)= 3.150, p= 0.004) and standard scores on the OWLS (t(23)= -4.671, p= 0.000) between the two groups. The groups had similar distributions in terms of the gender of parents and children.

Table 1

Participants characteristics: Means (standard deviations) and Ranges for Chronological Age (in months), Oral and Written Language Scales (OWLS) Language Age (in months), and OWLS Standard Scores; Gender of Children, Gender of Participating Parents

Participant Characteristic	TD (n=13)	ASD (n=12)
	M (*SD*), Range	*M* (*SD*), Range
Chronological Age (months)*	72.92 (11.15), 58-93	89.4 (14.89), 61-113
Language Age (months), Combined score on subtests, OWLS	78.69 (12.95), 59-107	72.4 (15.08), 49-83
OWLS Combined Subtest Standard Score*	105.53(10.36), 87-122	84.25 (12.4), 67-105
Gender of Children	Males=9, Females=4	Males=10, Females=2
Gender of Participating Parents	Males=2, Females=11	Males=1, Females=11

Note: * = Significant differences between groups at the p < 0.05 level.

Post assessment, families were contacted via phone or email to complete a

questionnaire to collect further demographic information. Of the 25 dyads, 14

questionnaires were completed (7 in the TD group; 7 in the ASD group). The

questionnaire was added to the research protocol post-assessment sessions. Having the

parents complete the questionnaires weeks post-assessment may account for only 14 of

the 25 questionnaires being returned. Parent's responses are reported in Table 2. A subset

of children in both TD and ASD groups were exposed to languages other than English in

their home and/or at school, and some of these children also spoke a language other than

English. A small number of parents had previously participated in language training

workshops (TD = 1, ASD = 2). In contrast to the TD group, some (but, surprisingly not

all) of the parents of children with ASD reported that their child had received services

from an SLP, resource instructor, or was in a special program outside the school. Only

parents of children with ASD reported that they had used a learned strategy when reading to their child during the study, or had a child who had participated in research studies in the past with similar tasks (however the parents could not state which tasks that their child had experienced in previous research). Also, of the 7 that returned the questionnaire in the ASD group, 4 children were reported to have participated in an early intensive intervention program for children with ASD. Finally, all but one of the parents in the TD group, and all of the parents in the ASD group, had obtained a university degree.

Table 2

Parent Questionnaire Responses

Questionnaire Item	TD n=7	ASD n=7
Child's exposure to a language other than English at home	Yes: 5	Yes: 3
Child's exposure to a language other than English at school	Yes: 4	Yes: 2
Languages spoken other than English by the Child	Yes: 5	Yes: 1
Parent participation in training programs teaching about language development	Yes: 1 (Parent is a SLP and teacher)	Yes: 2
Child received services from a Speech-Language Pathologist	Yes: 1 (articulation)	Yes: 5
Child received services from a Resource Teacher	0	Yes: 5
Child received services from a Special Program inside or outside of the school	0	Yes: 3
Parent's highest level of education	University: 6 High School: 1	University: 7 High School: 0
Specific strategies used when reading to their child	0	Yes: 1

Questionnaire Item	TD n=7	ASD n=7
Child participation in similar tasks in research studies in the past	0	3 responded "unsure" (participated in research, not sure of tasks)
Child's participation in an early intensive intervention program designed to teach children with ASD. (ASD only)	N/A	4

Note: SLP = speech-language pathologist

Recruitment and Compensation

For the ASD group, all parent and child dyads were recruited from the IWK Autism Research Center. A research assistant at the center called families who had previously agreed to be contacted for research studies. For the TD group, recruitment was done via community postings. For both groups, parents who were potential participants completed a screening questionnaire via phone or email to determine if their child would meet inclusion criteria. If accepted to participate in the study, children and their parents were invited to the Child Language Lab in the School of Human Communication Disorders, Dalhousie University, Halifax, for an approximately 1 and a half hour session. Parents also had the choice of having the session conducted in their home or at the Autism Research Center at the IWK Health Center. A consent form was reviewed and signed by parents when they came for the session, along with verbal assent from the child participant, prior to the testing. During the session the participants were offered a break at anytime, and the sessions typically lasted between 40 and 60 minutes. After the session, each child received a small gift and a certificate of thanks for participating, and parents were financially compensated $10 for their time.

General Testing Procedure

The parent-child dyads were tested individually. Three test components were completed during the session: language assessment using the OWLS, a series of ToM tasks, and a shared book-reading task. The use of a visual schedule including a final reinforcement prize was used to maintain attention and as a behavioral management strategy. Children used an ink bingo dabber to mark off each test component as it was completed.

Oral and Written Language Scales (OWLS; Carrow-Woolfolk, 1995).

The OWLS has two subtests: the Listening Comprehension Scale and the Oral Expression Scale. Therefore, there is both an expressive and a receptive component. The Listening Comprehension Scale is designed to measure the understanding of spoken language and has 3 examples and 111 total items; basal and ceiling scores are used. A verbal stimulus is read aloud, and the examinee responds by pointing (or by telling the number of the picture) to 1 of 4 pictures. In the Oral Expression Scale, there are 2 examples and a total of 96 items. Again basal and ceiling scores are used. The examiner reads aloud a verbal stimulus while simultaneously showing a picture(s). The examinee responds orally by answering a question or completing or generating a sentence. To obtain a participant's LA, the two subtest's standard scores are summed for a total language score that can then be used to compute a child's language age equivalent. Slaughter et al. (2007) used the *Peabody Picture Vocabulary Test* (*PPVT-R*; Dunn & Dunn, 1981), which only has a receptive component. Therefore, the measure used to calculate language age differed between these two studies.

Theory of Mind (ToM) Tasks.

Five ToM tasks, varying in expected difficulty, were used: 2 visual perspective-taking tasks, 1 desires-understanding task and 2 false-belief tasks. The order of presentation of the 5 tasks was individually randomized for each participant. These were the same tasks employed by Slaughter et al. (2007) and allowed direct comparison of findings between the studies.   Using a range of ToM tasks potentially allowed us to "capture more variability in the sample" for both TD children and children who have ASD (Slaughter et al., 2007, p. 847). Children were required to pass all control questions on the ToM tasks in order to receive points for accurately answering the ToM tasks. If they did not answer the control questions correctly, they were not awarded any points for the task.

Visual Perspective-Taking Tasks.

Two levels of visual perspective-taking tasks were used. The first task, a level 1 visual perspective-taking task, involved a box with four different pictures on the sides. The child was seated at a table with the examiner, his/her parent, and a toy ("dragon"), and the box was placed in the middle of the table. The examiner first showed and labeled the pictures on the four sides of the box for the child. The child was asked to turn the box so that a picture could be seen by a different person/toy seated at the table. For example, the examiner would ask the child: "Turn the box so that dragon sees the house". The child passed the task if they were able to accurately turn the box for each of the four different visual perspectives. The child was awarded 1 point for accurately turning the box for all four perspectives on this task. Therefore the score could range from 0 to 1 for

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this task.

The second visual perspective-taking task (a level 2 perspective-taking task) used a free-standing picture of a white paper fish on top of blue cellophane, so that on one side the fish was white, and on the other side the fish appears to be blue. With the child and examiner sitting across from each other at the table, the examiner asked the child what color fish he/she saw. They then switched positions at the table, and the examiner asked the child what color fish he/she saw then. The two test questions for this task followed: *"What color fish do I see over here?"* (Level 2-other) and *"What color fish did you see when you were sitting over here?"* (Level 2-self) The child was awarded 1 point for each of these two test questions, Level 2-self and Level 2-other, for a total of 2 possible points for this visual perspective-taking (VP) task. Scores for this level 2 visual perspective-taking task could range from 0 to 2.

`*Desires Perspective-Taking Task.*

For the desire perspective-taking task (DT), the examiner asked the child to state what snack they would prefer based on two pictures presented to him/her: broccoli or lollipops. The examiner then told the child that the toy (dragon) placed across from them at the table preferred the other snack. The examiner then asked the test question*: "For a snack, what would dragon want to chose?".* Two control questions were also asked, including recalling what the toy dragon's snack preference was and what the child's preference was. The child was awarded 1 point for accurately reporting the snack that the toy dragon would want as opposed to his/her own desired snack choice. The child also had to accurately answer the two control questions in order to receive the point for

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accurately reporting the snack that the toy dragon would want. Scores on the desires perspective-taking task could range from 0 to 1.

False-Belief Theory of Mind Tasks.

Two first order false belief tasks were administered. The first was a "Change of Location" task similar to the "Sally-Ann" task devised by Baron-Cohen et al. (1985), where the child must judge where someone will search for a lost item, given that person's mistaken belief. This task was acted out using a girl doll, a boy doll, a basket, a box and a marble. The girl doll put the marble in the basket and left the scene. The boy doll moved the marble from the basket to the box and left the scene. When the girl doll returns to the scene, the child was asked the false-belief question: *"Where will the girl look first for her marble?"* This was followed by two control questions: *"Where is the marble really?"* (reality control question), and *"Where did the girl put the marble in the beginning?"* (memory control question). As in Slaughter at al. (2007), this task was administered over two trials. In the first trial the marble was hidden in a closed box by the boy doll, and in the second trial the marble was hidden in the examiner's pocket by the boy doll. The child was awarded 1 point for answering the false-belief question, providing they had passed the two control questions (memory and reality) over the two trials (closed box and examiner's pocket), for a possible total score of 2 points awarded for this task (1 point awarded for each trial: closed box and examiner's pocket).

The second false-belief task was a Misleading Contents task. In this task, the child had to acknowledge another person's false belief about what was in a container when the child knew what was, in fact, in the container. The examiner showed the child a familiar

crayon box. First a confirmation question was asked: *"What do you think is inside this box?"* Then, the box was opened and inside there were birthday candles that were shown and labeled for the child. The second confirmation question was then asked: *"Now what do you think is inside this box?"* The box was closed. The examiner then asked a test question*: "When I first asked you, before we opened it, what did you think was inside the box?"* The child was awarded one point for correctly answering this test question. Next, the toy dragon appeared on the table. The child was told: *"Here comes dragon. He hasn't seen what we were playing with. What do you think dragon will think is inside the box?"* A point was then awarded if the child was able to accurately assess recognition of another person's false belief; that the dragon would think that crayons were in the box, not what the child knows to be true (birthday candles). A possible total score of 2 points was awarded for accurate performance on this task.

The points awarded for the false-belief tasks (two change of location tasks, 1 misleading contents task) were summed to a total false-belief (FB) score between 0 and 4.

Shared Book-Reading Task.

The wordless picture book *Frog on His Own* (Mayer, 1973) was used to elicit a narrative sample for the parents and then the children. This book was selected based on previous studies that have used it to elicit mental state language in children (Tager-Flusberg & Sullivan, 1995; Capps et al., 2000). Capps et al. (2000) found that this picture book contains elements of deception that can could result in the narrator describing and using cognitive and affect mental state terms, both of which were analyzed in the current

study. In Slaughter et al (2007), child IS talk was not analyzed, given the limited amount of IS talk generated during the shared book-reading. Therefore, instead of using the 3 books used to generate narratives in the Slaughter et al study, we decided to use the *Frog on His Own* book, as this book has been used successfully in the past in generating a child's narrative. We also tailored the instructions to the parent-child dyads to ensure that both the parents and the children would have an opportunity to create a narrative based on the book, so that both parents' and child's talk could be analyzed between groups. Parents and children were given the following instructions: *"Use the picture book to tell your child a story, talking about every page. Talk about the story just as you would at home. Then, your child will have a turn to tell you a story using the book."* These instructions allowed the parent to create a narrative using the book, after which the parent elicited their child's narrative using the same book. The shared book-reading task was videotaped using a Sony Handicam (DCR-SR47).

Transcription of Dyadic Interactions

The video-recorded dyadic interactions during joint book reading were orthographically transcribed using the Systematic Analysis of Language Transcripts (SALT; Miller and Chapman, 2001) transcription conventions. The narratives of the parents and their children were combined into a single transcript. Therefore, any language used by either the parent or the child throughout the entire shared-book reading task was available for analysis. Narratives were transcribed using minimal terminable units, also known as t-units. A t-unit is one independent clause with its dependent clause(s)/modifiers connected to it (Hunt, 1965). T-units were often but not always complete sentences in the narratives.

Internal State Language Coding.

Parent and child talk was coded for simple and elaborated use of three internal state language categories (sensory, affect and cognition), consistent with Slaughter et al. (2007). Attributional focus (child, parent, both child and parent or other) was also coded.

Internal State Categories.

Three categories of IS language were coded: sensory, affect (including emotion and desire terms), and cognition. Examples of each category are provided in Table 3. Sensory IS language included lexical references to sensory internal states or processes of perception (sight, hearing, touch, smell or taste). This is an early developing category of IS language. Affect IS language (including Emotion and Desire terms) included lexical references to the experience of feelings, emotions, desires or states of preference or intention states. Talk about emotion and desire has been shown to develop before talk about cognitive states in TD children (Bartsch & Wellman, 1995). Finally, Cognitive IS language was coded, which included lexical references to mental activity. Cognitive terms have been found to be the last of the three categories to develop and are the most difficult to elaborate on for TD children (Beeghly, Bretherton & Mervis, 1986) and for children with ASD (Tager-Flusberg, 1992).

Table 3

Categories of Internal State Language

Category	Criteria	Examples
Sensory	Nouns, verbs, adjectives or adverbs describing states/processes related to audition, vision, taste, tactile touch and	"The boy is <u>looking</u> for the toy."

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Category	Criteria	Examples
	olfaction.	"She tasted the cupcake." "I smelled the flower."
Affect	Nouns, verbs, adjectives or adverbs labeling emotional feelings or behaviors, states of preference, desire, or intentions	"She is happy." "You are mad." "I want a cookie."
Cognition	Nouns, verbs, adjectives or adverbs labeling mental actions, including thoughts, intellect, reasoning.	"I remember." "You are thinking about it." "The girl doesn't know." "The children are pretending."

Simple or Elaborated Uses of IS Language.

IS terms in each category were further coded as either simple or elaborated. Simple mentions of IS language did not include any additional information about the internal state. Examples of simple IS language can be found in Table 3. Other IS language terms were identified as elaborated. Elaborations were talk about an internal state that goes beyond simple reference to an affective (desire, emotion), perception, or cognitive state. Elaborations of IS terms could be causal or contrastive in nature and could involve all or part of an utterance or multiple utterances (Kay-Raining Bird et al., 2008). Thus, coding an internal state term as elaborated resulted in needing to consider utterances as well as their larger context (usually the lines of conversation before and after the target utterance). Definitions of causal or contrastive elaborations are provided below and are exemplified in Table 4.

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1. Causal: An explicit mention of antecedent events, consequences, or other kinds of explanations for the specific state. This may involve use of an explicit connective (*because*, *so*, *if*, *how*, and *why*) or utterances that refer to two causally related events or states (see examples in Table 4)

2. Contrastive: An explicit distinction or comparison made between an internal state and another state (or reality). This included the provision of additional information about an internal state that increased understandability and/or eliminated potential confusion between cognitive states (see examples in Table 4)

Table 4

Elaborations of Internal State Language Categories Examples

Category	Examples
Sensory	"He's looking under the rock *so she can find the frog.*" (causal)
	"The frog couldn't see the dog *but he could hear him barking.*" (contrastive)
Affect	"I am sad *because it is raining outside.*" (causal)
	"I like cookies *but I don't like cupcakes.*" (contrastive)
Cognition	"The boy doesn't know where to look. *The frog is hiding in the carriage.*" *(*causal)
	"She thinks it's a baby *but really it's a frog dressed up like a baby.*" (contrastive)

Attributional Focus.

Attributional focus referred to whose internal state was being referenced; that is, the "experiencer" of the IS term. This included attributions to the child, to the parent, to a

parent and a child simultaneously, or to an "other". An "other" could be any of the

characters in the book, or references to any animate being other than the parent or the

child (including the examiner or non-present persons). Attribution was of interest in the

current study because ToM involves the ability to attribute internal states to oneself and

others. Parents attribute internal states differently as their child develops: at younger ages,

parents use internal state terms to describe the child's internal states most often, and as

the child develops the parent uses terms to describe their own internal states or those of

others more often (Beeghly et al., 1986; Rudek and Haden, 2005). Attribution examples

can be viewed in Table 5 for various IS language categories.

Table 5

Attributional Focus Examples

Attributional Focus	Examples
Parent	Child: "You look happy."*(simple affect)* Parent: "I am thinking."*(simple cognitive)*
Child	Child: "I want a cookie."*(simple affect)* Parent: "Are you listening?"*(simple sensory)*
We = Parent + Child	Child: "We know where the frog is."(*simple cognitive*) Parent: "We liked that story, didn't we?"*(simple affect)*
Other (e.g. character in the book)	Child: "The frog was angry."*(simple affect)* Parent: "The girl didn't know."*(simple cognitive)*

Excluded from IS Language Coding.

Excluded from the coding were any internal state terms that were judged as

serving a pragmatic function rather than referencing internal states directly. This included terms that were: conversational in nature, such as "*I know", "Know what?"* or "*I see*"; functional or used to direct someone's attention to the task such as "*Hey look*"; idiomatic or used in an unanalyzed, formulaic way such as "*I don't know*" or "*dunno*".

Reliability.

Transcription reliability.

The author transcribed and coded all samples. To establish reliability, a second graduate student transcriber/coder, trained in SALT transcription conventions, was further trained in the IS language coding system. The second transcriber/coder first independently transcribed 15% (4 transcripts) of the shared-book reading videos, two from the ASD group and two from the TD group, randomly selected separately for each group. These were used to assess inter-rater agreement for two aspects of transcription: morphemes transcribed and utterance segmentation. Percent agreement was found to be high for both morphemes (94%) and utterance segmentation (83.25%).

Coding reliability.

To assess coding reliability, the second transcriber/coder used again 15% (4 transcripts) of the shared-book reading sessions that had been previously transcribed by the researcher, two randomly selected for each group separately. Percent agreement was calculated for overall coding of IS language and coding of each IS language category and type of attributional focus. A total inter-rater reliability of 81.75% was obtained for IS language coding across the four transcripts. When reliability of each category was

examined, there was high inter-rater reliability for IS language categories (Simple Sensory = 93%; Elaborated Sensory = 100%; Simple Affect = 86%; Elaborated Cognitive = 100%), except for Elaborated Affect (6 agreements, and 3 disagreements = 67%) and Simple Cognitive (14 agreements, and 13 disagreements = 52%). For the Elaborated Affect, all three disagreements were instances where the second transcriber coded the IS term as simple affect, whereas the researcher coded these three instances as elaborated affect. These three instances were discussed, and 100% agreement was reached in which the second transcriber agreed with the lead transcriber's original coding. For Simple Cognitive, all of the disagreements involved errors of omission, where the second transcriber included the term and coded it as simple cognitive, and the lead transcriber excluded the term from the analysis for one of the reasons described above (e.g., "conversational" uses of the term, etc.). Thus, the second transcriber fully agreed with the lead transcriber when the term was present and should be coded, but was less reliable in identifying terms that were present but should be excluded from analysis. As well, when differences regarding which terms should be excluded were reviewed, the second transcriber always agreed with the lead transcriber's original decisions. For attributional focus, all disagreements were completely overlapping with decisions about whether to include or exclude the word (as with the simple cognitive terms). When disagreements around excluded terms were eliminated from the calculation, overall inter-rater reliability for the IS language coding increased to 89.8%.

CHAPTER 3: RESULTS

Independent means t-tests were used to analyze whether the parent and child transcripts differed across the ASD and TD groups. ANOVAs were used to test for differences in IS language category use in both groups (ASD, TD) in parents and children and to test for differences in ToM task performance between the groups of children. Pearson product moment correlations were used to analyze the relationship between components of ToM task within each group, specifically performance on the perspective-taking tasks and the false belief tasks. Partial correlations were used to examine possible relationships between parental and child IS language use for ASD and TD groups separately; to examine possible relationships between IS language input by parents and a child's ToM score; and to examine possible relationships between IS language use by children and the child's ToM score. For all statistical analyses, a priori significance was set at $p < .05$.

Parent-Child Transcripts

The size and syntactic complexity of the transcripts was first analyzed for the following variables, all calculated using SALT: total number of utterances, total words, MLU in morphemes, and total IS language use. Descriptive statistics for parent and child talk, by group, are presented in Table 6. For both the parents and the children, the groups created very similar narratives. Independent means t-tests were used to analyze whether the parent and child transcripts differed across the ASD and TD groups. For the parent's talk there were no significant differences between groups for total utterances, total words, MLU in morphemes, or total IS language use. Similarly, there were no significant

differences between the two groups (ASD, TD) for the child's talk on the same variables. Because the transcripts differed in length across individual parents and children, analyses of IS language use controlled for length of transcripts by calculating the percentage of IS language to total words. Length could have been controlled using a different metric (i.e., number of IS language words to total utterances). However, since the majority of IS language words were simple references and not elaborated, it was felt that controlling by total words would be more appropriate.

Table 6

Parent-Child Transcripts

	TD *M* (*SD*), Range	ASD *M* (*SD*), Range
Parent Talk, Total Utterances	88.92 (26.8), 39-124	102.42(33.47), 63-157
Parent Talk, Total Words	658.77(164.09), 458-970	744.83(245.34), 338-1295
Parent Talk, Mean Length of Utterances, in Morphemes	8.79(1.93), 5.83-13.46	8.54(2.21), 5.3-11.72
Parent Talk, Mean Percentage of Total IS Language Terms	4.36 (1.52), 2.4-8.62	4.28 (1.06), 3.29-7.05
Child Talk, Total Utterances	57.69 (11.55), 37-78	63.17(24.43), 21-106
Child Talk, Total Words	367.15(111.69), 213-587	380.33(155.46), 158-639
Child Talk, Mean Length of Utterances, in Morphemes	6.73(1.29), 4.09-8.83	6.34(1.83), 3.41-9.53
Child Talk, Mean Percentage of Total IS Language Terms	2.84(1.19), 1.41-6.09	3.38(1.56), 1.77-6.99

Internal State Language: Attributional Focus.

Initially, the intent was to include attributional focus as a variable in IS language analyses. However, the "other" attribution was used almost exclusively by all speakers. Therefore, only IS language attributed to an "other" was analyzed further. Descriptive statistics on attributional focus are presented in Table 7.

Table 7

Percentage of IS Terms Attributed to the Child, Parent, Child + Parent, or Other used by Parents and Children in ASD and TD groups

Attributional Focus	TD Group		ASD Group	
	Parent Talk	Child Talk	Parent Talk	Child Talk
	M (SD)	*M (SD)*	*M (SD)*	*M (SD)*
Child	.087 (.081)	.033 (.081)	.051 (.075)	.269 (.407)
Parent	.055 (.053)	.015 (.056)	.057 (.077)	.030 (.106)
Child + Parent	.004 (.010)	.000 (.000)	.021 (.044)	.029 (.102)
Other	.541 (.254)	2.48 (.968)	.561 (.11)	2.12 (.916)

Internal State Language: Categories.

Parent and child talk was analyzed for use of IS language categories, including simple sensory, elaborated sensory, simple affect, elaborated affect, simple cognitive, and elaborated cognitive. Descriptive statistics for the percentage of total simple IS language, percentage of total elaborated IS language, percentage of total simple or elaborated sensory, affect or cognitive terms, and percentage of total IS language category to total words used in parent and child talk across the groups are presented in Table 8.

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Table 8

IS Language, Parent and Child Talk, TD and ASD

	Parent Talk		Child's Talk	
	TD M (SD)	ASD M (SD)	TD M (SD)	ASD M (SD)
Percentage of total simple IS words to total words	3.613 (1.075)	3.77 (1.00)	2.350 (1.124)	2.785 (1.150)
Percentage of total elaborated IS words to total words	.513 (.469)	.381 (.215)	.435 (.459)	.226 (.332)
Percentage of total affect words to total words	1.416 (.916)	1.197 (.428)	1.173 (.393)	.998 (.691)
Percentage of total sensory words to total words	1.358 (.486)	1.584 (.561)	1.265 (.718)	1.191 (.766)
Percentage of total cognitive words to total words	1.351 (.699)	1.372 (.611)	.346 (.375)	.821 (.844)
Percentage of IS language word to total words: Simple Sensory	1.02 (.486)	1.254 (.524)	1.21 (.715)	.975 (.553)
Percentage of IS language word to total words: Simple Affect	.966 (.534)	.983 (.483)	.792 (.409)	.869 (.691)
Percentage of IS language word to total words: Simple Cognitive	.756 (.566)	.791 (.524)	.236 (.331)	.301 (.447)
Percentage of IS language word to total words: Elaborated	.044 (.101)	.000 (.000)	.024 (.089)	.000 (.000)

Sensory				
	Parent Talk		Child's Talk	
	TD	ASD	TD	ASD
	M (SD)	M (SD)	M (SD)	M (SD)
Percentage of IS language word to total words: Elaborated Affect	.385 (.495)	.214 (.187)	.364 (.370)	.077 (.145)
Percentage of IS language word to total words: Elaborated Cognitive	.072 (.100)	.124 (.121)	.045 (.112)	.149 (.324)

Three-way mixed ANOVAs were used to test for differences in IS language category use: one for the parent data and one for the child data. For each ANOVA, there was one between-subjects factor, group (ASD, TD), and two within subjects factors, category of IS language (sensory, affect, cognitive) and elaboration (simple vs. elaborated). Since there was a significant difference in chronological age between the two groups of children (ASD, TD), chronological age was a controlling variable (covariate) for these analyses.

For the analysis of parent talk, the ANOVA revealed no significant main effects or interactions. For the analysis of child talk the ANOVA revealed that the main effect of group approached significance, with a trend towards TD children using more IS language than children with ASD (F $(1,22)$=4.14; p =.054; $\eta p2$ = .158; ASD: M = .348, SE= .047; TD: M= .491, SE= .045). No other main effects or interactions reached significance.

Theory of Mind Task Performance

Theory of Mind (ToM) was measured using three qualitatively different types of tasks: two visual perspective-taking tasks, one desires perspective-taking task, and two false-belief tasks. Since all but one participant passed the Desires Perspective-taking task, there was limited variability on this measure and this task was not included in any further analyses. Performance on the two perspective-taking tasks were summed into a single perspective-taking ToM score (maximum score = 3). For both groups, the level 1 perspective-taking task was always passed, therefore the variability in the summed score existed only as a result of the level 2 perspective-taking task in both groups. The two false-belief tasks were summed into a single false-belief ToM score (maximum score = 4). Pearson product moment correlations revealed that, for each group (ASD, TD), performance on the perspective-taking composite score was not significantly correlated with performance on the false-belief composite score (ASD: r = -.046; p = .887, TD: r = .330, p = .271). Therefore these tasks were kept separate in the following analyses. Descriptive statistics for ToM task performance can be viewed in Table 9. The TD group but not the ASD group performed close to ceiling on the perspective-taking tasks.

Table 9

Perspective Taking and False Belief ToM Task Performance by Group, Number Correct (Total Score)

	TD	ASD
	M (*SD*)	*M* (*SD*)
Perspective-Taking Total Score /3	2.92 (.27)	2.41 (.66)
False-Belief Score Total /4	2.38 (1.26)	1.66 (.98)

A two-way group (TD, ASD) by task (perspective taking, false belief) mixed ANOVA was used to test differences in ToM task performance, controlling for chronological age (since there was a significant difference in chronological age between groups). The dependent variable was the summed score on each of the ToM tasks. A main effect of group was found, with TD children performing significantly better on ToM Tasks overall than the children with ASD ($F(1, 22)=11.275$, $p = 0.003$; ηp2 .339). No other significant main effect or interaction was obtained.

Relationship between Parent Talk and Child Talk

To determine whether there was a relationship between the IS language use of parents and children, correlational analyses were conducted. These analyses were completed with the following measures of IS language: total simple IS language (summed percentage of each simple sensory, affect and cognitive IS talk); total elaborated IS language (summer percentage of elaborated sensory, affect and cognitive IS talk); and total sensory, affect and cognitive talk (summing the percentages of simple and elaborated IS talk for each of these three IS categories). Preliminary correlational analyses were first completed to determine whether chronological age or language age should be controlling variables for either parent or child talk. Correlations of the children's chronological age and the children's language age with parent and child IS language category use for ASD and TD groups separately were first calculated. For the TD group, significant correlations between children's chronological age and the children's IS language use were found; for the ASD group, significant correlations between chronological age and language age with both parent and child IS language was found. Therefore these confounding factors were controlled for in the subsequent

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correlational analyses. These preliminary correlational results can be found in Table 10.

Table 10

Correlations between IS Language in Parent and Child Talk and Chronological Age and Language Age for both Groups (TD, ASD)

	TD Group		ASD Group	
	Parent Talk	Child Talk	Parent Talk	Child Talk
Chronological Age	-	CTOTIS: $r =$ .587, p = .035*	SS: r = .612, p = .034*	SC: r = .656, p = .021*
Language Age	-	-	EC: r = .709; p= .010** SC: r = .561, p= .058*	EC: r = .640, p = .025*

Notes: * = significant at the 0.05 level; ** = significant at the 0.01 level; r = correlation, p = significance; CTOTIS = child talk, total IS language categories; SS = Simple Sensory, EC = Elaborated Cognitive, SC = Simple Cognitive

Prior to controlling for confounding variables, correlations were completed between parent and child variables (total simple IS terms, total elaborated IS terms, total affect, total sensory and total cognitive) for both groups separately (TD, ASD). For the ASD group, there were three significant correlations between parent's total simple IS language and the child's simple IS language (r = .631, p = .028); parent's total simple IS language and child's total sensory IS language (r = .566, p =.055), and parent's total affect IS language and child's total simple IS language (r = .632, p = .027). However, after controlling for CA and LA no significant relationships remained.

Relationship between IS Language Use and ToM Development: Parent's Talk

To investigate the relationship between ToM performance and IS language in parents and children, correlations between the raw scores on the ToM tasks and percentages of IS language categories (simple and elaborated affect, simple and elaborated sensory, simple and elaborated cognitive and total IS language use) in parent's talk were computed to allow for comparison of results with Slaughter et al. (2007). For the TD group two significant correlations were found; parent's total simple cognitive IS language was significantly negatively correlated with child's perspective-taking raw score ($r = -.556$, $p = .048$); and parent's total IS language was significantly negatively correlated with child's false belief raw score ($r = -.559$, $p = .047$). For the ASD group there were no significant correlations.

Partial correlations were then used to further examine possible relationships, controlling for chronological age in the TD group and chronological age and language age in the ASD group. Table 11 shows the resulting partial correlations for the two groups (ASD, TD).

Table 11
Partial Correlations Between Child ToM Scores and IS Language use by Category used by Parents, for each Group (ASD, TD)

		TD		ASD	
Parent's Input of IS Language by Category		Perspective-Taking Score	False Belief Score	Perspective-Taking Score	False Belief Score
EA	r	.196	-.510	.771	-.052
	p	.541	.090	.009**	.887
SA	r	.508	-.314	-.293	.232
	p	.092	.320	.410	.518
ES	r	-.021	.221		
	p	.948	.489	-	-
SS	r	-.069	-.310	-.363	.327
	p	.831	.326	.302	.356

		TD		ASD	
Parent's Input of IS Language by Category		Perspective-Taking Score	False Belief Score	Perspective-Taking Score	False Belief Score
EC	r	.207	.307	-.253	-.768
	p	.520	.331	.481	.009**
SC	r	.126	-.001	-.323	-.410
	p	.696	.997	.363	.239

Notes: EA = Elaborated Affect, SA = Simple Affect, ES = Elaborated Sensory, SS = Simple Sensory, EC = Elaborated Cognitive, SC = Simple Cognitive, : * = significant at the 0.05 level; ** = significant at the 0.01 level; *r* = correlation, *p* = significance

For the TD group, no significant correlations between parental IS category use and the child's perspective-taking or false-belief scores remained once chronological age was partialled out. For the ASD group, two significant results emerged after controlling for chronological age and language age: the parent's use of elaborated affect terms was significantly positively correlated with their child's performance score on perspective-taking tasks ($r= .771$, $n=12$, $p= .009$) and the parent's use of elaborated cognitive terms was significantly negatively correlated with their child's performance on false-belief tasks ($r=-.768$, $n=12$, $p= .009$).

Relationship between IS Language Use and ToM Development: Child's Talk

Initially correlations between the raw scores on the ToM tasks and percentage of IS language categories (simple and elaborated affect, simple and elaborated sensory, simple and elaborated cognitive and total IS language use) in child's talk were computed. For the TD group there were no significant correlations. For the ASD group one significant correlation was found; child's total simple affect IS language was significantly positively correlated with their false belief raw score ($r = .609$, $p = .035$).

Partial correlations were then used to further examine possible relationships between IS language use by children and the child's ToM score. Again, we analyzed the two groups separately (ASD, TD) and controlled as above. Table 12 shows the resulting partial correlations.

Table 12

Partial Correlations by Group (ASD, TD) Between Child ToM Scores and IS Language Use by Category used by Children

		TD		ASD	
Child's Use of IS Language by Category		Perspective-Taking Score	False Belief Score	Perspective-Taking Score	False Belief Score
EA	*r*	.287	-.132	.412	-.364
	p	.365	.683	.237	.301
SA	*r*	-.256	-.356	-.082	.698
	p	.422	.256	.822	.025*
ES	*r*	.245	.363		
	p	.443	.246	-	-
SS	*r*	-.021	-.346	.120	-.069
	p	.948	.270	.742	.850
EC	*r*	.192	.504	.476	.275
	p	.549	.095	.164	.442
SC	*r*	.091	.426	-.429	-.189
	p	.779	.167	.216	.602

Notes: EA = Elaborated Affect, SA = Simple Affect, ES = Elaborated Sensory, SS = Simple Sensory, EC = Elaborated Cognitive, SC = Simple Cognitive, Correlation = *r*, significance = *p*, *= significant at the *p*< .05 level, ** = significant at the p< .001 level.

For the TD group, there were still no significant correlations between the child's use of IS language category and the child's performance on either perspective-taking or false belief tasks after controlling for chronological age. For the ASD group, child's use of simple affect terms continued to be significantly positively correlated with their performance on false belief tasks, after controlling for language age and chronological age (*r*= .698, *p*=.025).

CHAPTER 4: DISCUSSION

The purpose of the current study was to investigate IS language input by parents, IS language use by children produced during a wordless storybook narration, and ToM development in children with ASD, in comparison to language-age matched TD controls. This study also aimed to also explore the relationships between parental input and child's use of IS language, and the relationships between parent or child IS language use and children's ToM task performance. The narratives created by the parents and their children will first be discussed, followed by the use of IS language in these narratives, including attributional focus of IS terms and the categories of IS language used. Next the relationships between the parent's IS language input and the children's use will be discussed. Group differences between the children's performance on a series of ToM tasks will then be explored, and the relationships between the children's performance on the ToM tasks and their parent's IS language input along with their own IS language use will be discussed. Finally, the limitations of the current study and clinical implications will be outlined.

Narrative Corpuses

Narratives were generated in the current study using the wordless picture book *Frog on His Own* (Mayer, 1973). This book has been used in previous research (Tager-Flusberg & Sullivan, 1995; Capps et al., 2000) to study IS language. Parents first told their child a story using the book; then their child had a turn to tell them a story using the book. All the talk produced during both narrative retellings was analyzed.

For the narratives created by the parents, no significant group differences in

MLU, total utterances, or total words were found; that is, the narratives created by parents of children with TD or ASD were similar in length and syntactic complexity. Given that the children in our study were matched for language age, this may explain the similarities found.   Slaughter et al. (2007) also found no statistically significant differences in parent narrative sample length between groups (TD, ASD). In Slaughter et al. (2007), groups (TD, ASD) were matched on language age, as in the present study, although they used a different measure of language (PPVT-R, Dunn & Dunn, 1981). The group LAs were quite similar for the two studies, especially for the groups with ASD. In the current study, the TD participants had a mean LA of 6;5 and mean CA of 6;0; the ASD group had a mean LA of 6;0; mean CA of 7;4. In Slaughter et al. (2007), the TD mean LA was 5; 5 and mean CA was 4; 7; the ASD group mean LA was 6; 2 and mean CA was 6; 7. Thus, the present study replicated the finding of Slaughter et al. (2007) that parents of children with ASD talk about books an equal amount and using similar MLUs as parents of children with typical development. At least for children with LAs of five to seven years, it would appear that parents of ASD and TD children with ASD or TD base the length and complexity of their narratives on the language abilities of their children.

In the present study the narratives were considerably shorter than in the Slaughter et al. (2007) study. Parents in the present study produced narratives with a mean total number of words of 744 for the ASD group (*SD* = 245), and 658 for the TD group (*SD* = 164). In Slaughter et al. (2007), the mean total words produced was 1622 (*SD* = 570) for the TD group, and 1454 (*SD* = 578) for the ASD group.) These differences in length across studies can be attributed to two methodological differences: Slaughter et al.'s parents were asked to read 3 books to their children while the parents in the present study

read one; and the parents in the present study were asked to have their child create a narrative using the same book after the parents had done so. Both of these differences would likely reduce the narrative lengths in the current study relative to Slaughter et al. (2007).

The two groups of children in this study also produced narratives of similar length and syntactic complexity. No significant differences in MLU, total utterances, or total words were found. This, again, may not be surprising given that the two groups were matched on language ability and that the matching measure of language (OWLS) included both receptive and expressive components. It does suggest, however, that children with ASD have narrative skills (at least at the micro-narrative level) that are comparable to their overall language abilities.

The group of children with ASD in the current study had relatively good language skills. The similarity between groups replicates and extends to a younger sample past research showing that high-functioning children with ASD have comparable storybook narrative lengths and range of complex syntactic devices to their language-age (TD and DD controls) and MA (DD controls) matched peers (ASD: CA= 12.6; LA= 6.4; IQ= 75.2, MA= 8.9; Losh & Capps, 2003). Similarly, Tager-Flusberg and Sullivan (1995) found no differences in total number of words, different words, or syntactic complexity (length and lexical cohesion devices) in narratives of children with autism, children with intellectual impairment and TD children matched on language age (participants with ASD ranged from 6-22 years of age; 7-20 years old for the TD group and 7-27 years old for the group of individuals with intellectual impairment).

Attributional Focus

In this study, the experiencer of the internal state was analyzed. As it turned out, for both the parents' and the children's narratives, the experiencer of IS talk was almost always a character in the wordless picture book. It is interesting that the "other" category predominated in both parents' and children's talk, regardless of whether they were in the TD or ASD group. In regards to parent's talk, this is contrary to findings of a previous study of a child with lower language level (Kay-Raining Bird et al., 2008) in which parents talked most often about their child's thoughts, perceptions and feelings rather than another's. Nonetheless, parents did speak about others' internal states some of the time, even to this young child with ASD. Taumoepeau and Ruffman (2008) report that early in children's development, around the age of 1 to 2 years, parents attribute IS language primarily to their child (especially affect talk) but later (from 2 years on) they increasingly attribute internal states to others, especially cognitive internal states. These authors argue that talking first about a child's affective states allows the child the opportunity to link IS terms with their own salient, internal experiences, such as satisfying their immediate desires and goals. Then, once children have learned to attribute IS terms to themselves, talking more often about others' internal states helps the child's ToM development by scaffolding their knowledge of others' minds. Given the older language ages of the children in the present study (TD LA 6; 5, ASD LA 6; 0), we would expect that "other" attributions of IS language would be used at least some of the time by parents of both groups in their talk to their children. Even so, it is particularly noteworthy that the parents of children with ASD were producing many 'other' attributions when telling stories to their children, as this would presumably support their

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child's development of ToM.

The shared book context undoubtedly contributed to the predominant use of the "other" attributional focus. In studies such as Kay-Raining Bird et al. (2008) and Bretherton & Beeghly (1982), IS language was examined in multiple contexts, including daily routines, play activities, book reading and meals, giving the parent's multiple opportunities to attribute IS terms to a variety of experiencers. As well, the frequency of attributions to others changed with context, with the highest proportion found in the book reading activity. In the present study a single task, shared reading of a wordless picture book, was used. It therefore makes sense that the experiencers of IS language discussed would often be the characters in the story and therefore that other attributions would be high.

It is somewhat more surprising that the children with ASD also attributed most of their IS language to "others", especially given the ToM difficulties of this population and since Tager-Flusberg (1992) found that children with ASD (matched on CA and LA to children with DS: ASD group ranged from 3; 4 - 7; 7) talked more about their own perceptions, desires and cognitions than those of other people (although they did speak equally about their own emotions and the emotions of others). The ASD group however did not use self-attributions more often than the DS group: both groups spoke equally about their own internal states and the internal states of others. In the Tager-Flusberg (1992) study as well, the elicited speech samples were in the context of play/conversational activities versus the current shared book-reading activity. Therefore, as discussed previously, a conversational context would increase the opportunities for talking about the participant's own thoughts and feelings and decrease the opportunities

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for talking about others' thoughts and feelings, relative to the present study context of shared book-reading. Also, given that the parents created narratives first and the children followed with a narrative about the same book, the children may have benefited from the parent model and imitated the other-attributions of their parents in the current study. Regardless, it is important to note that the children with ASD in the current study as a group were able to talk about the internal states of others, showing thereby the capacity for a level of ToM understanding.

Parental Internal State Language Input: Categories and Elaborations

In the comparison of parent IS language use across groups no significant main effects or interactions were found in levels of elaboration and categories. Thus, parents of both groups were talking relatively equally about simple and elaborated categories and about affective, perceptual or cognitive categories. Given that the children in both groups were matched on language age, this might account for the similarities in parental internal state talk. Parents seem to be adjusting their IS talk to the language abilities of this relatively older sample of children and providing a relatively rich array of IS language input.

There were differences between the findings of parental use of IS language in the present study and previous research. Beeghly, Bretherton and Mervis (1986) found cognitive terms were used less frequently than affective and perceptual terms and that very few elaborations were produced in input to two year olds. Kay-Raining Bird et al. (2008) reported a similar pattern of IS category input to one child with ASD. However, these children were in a much earlier stage of language development than in the present

study, so the differences would be expected.

Also in contrast to the present study, Slaughter et al. (2007) found that simple mentions of IS terms in the parental input were used more often than elaborations of those terms in their TD group, except, interestingly, for cognitive terms where the order was reversed. In contrast to the present study as well, Slaughter et al. (2007) found that the mothers of children with ASD produced fewer elaborated cognitive and affect terms in their narratives than the mother's of TD children, matched for language age. A possible explanation may be that the books used in Slaughter et al. (2007) and the current study differed. Therefore, it could be that the content of the books themselves may be driving these differences in IS language category use. The book used in the current study, *Frog on His Own* (Mayer, 1973), often visually represents emotional reactions of characters to events, giving parents many opportunities to talk about IS language (e.g., frog *happy* to explore on his own, etc.) and to elaborate on them. In comparison, Slaughter et al. (2007) used three "Carl" books, which depict a mother unaware of adventures her infant and dog have while she is not home. Therefore these books may provide more opportunities to talk about cognitive terms and false beliefs, which TD parents seemed to take more advantage of than parents of children with ASD.

In addition the way in which Slaughter et al. (2007) coded elaborations differed from the current study and possibly contributed to differences in IS language findings. Similar to the current study Slaughter et al. coded an IS term as elaborated if it included causal or contrastive content. However "explanatory information" was also included as an elaboration by Slaughter et al.; explanatory elaborations were clausal complements required by cognitive terms to make a complete sentence. These were not counted as

elaborations in the current study unless they were also contrastive or causal in content. For example, "He remembers <u>that he has not done the bedroom yet</u>" (p. 843, Slaughter et al., 2007) would *not* have been coded as elaborated in the current study, but in Slaughter et al. it would have been. Therefore, this difference in operational definitions of what designates a term as being elaborated no doubt contributed to the differences in findings across studies, especially in the proportion of cognitive term elaborations.

Internal State Language Use by Children: Categories and Elaborations

Statistical analysis of the IS language of the children revealed no significant main effect for category of IS language use. However, the main effect of group approached significance with a trend for the TD children to use more IS language overall than the children with ASD. The trend towards increased use of IS language overall for TD children suggests that using IS language in general to discuss internal states, rather than specific categories of IS language, is difficult for children with ASD. This finding differs from findings by Tager-Flusberg that cognitive IS talk and elaborations may be particularly impaired in children with ASD, and alternatively suggests that it may be that all IS language is problematic for children with ASD. The combination of no parental differences in IS talk in the face of deficits in IS language use by children with ASD suggests that perhaps the children with ASD might benefit from a somewhat modified input as Kay-Raining Bird et al. (2008) suggested, including the increased use of IS terms in general, and elaborated IS terms specifically.

Parent-Child IS Language Relationships

We had hypothesized that a child's IS language use would be related to the IS language input being received, given the transactional nature of IS language interactions. Prior to controlling for CA and LA, significant correlations existed between parent and child IS talk for the ASD group, but no significant correlations were found for the TD group. However, once controlling for CA and LA in the ASD group these relationships did not exist. Therefore the hypothesis for parent input and child talk being related was not supported; for either the TD or the ASD group as no category of parent IS language use was significantly correlated with any category of IS language use in their children once chronological age and language age were controlled for. This is not to say that there were no similarities between the narratives of parents and children. The overall patterns of IS language use were quite similar in parents and children. Indeed, it would be unlikely that parental talk would look completely different from child talk about IS language.

There has been limited previous research that has directly assessed the IS language input of parents of children with ASD and their children's current use of IS language. In previous research with TD children, early parental IS talk was found to predict later child IS talk. Also, trends in category use between the parent-child dyads have also been seen to exist, such as early talk about affect and later talk about cognitions. What the results from the current study seem to indicate, however, is that both groups of parents do not appear to be using the on-line IS language productions of their children to frame their own talk about internal states. Interestingly (as will be discussed below) it seems as though the parents of children with ASD in the current study are

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focusing more on what they think their child knows about the thoughts, feelings and perceptions of others (implicit understanding), not what the child says (explicit use).

Theory of Mind Performance

Since most TD children pass false-belief tasks at approximately 4 1/2 years (Wellman, Cross and Watson, 2001), while most children with ASD do not until closer to 9 years of age (Happe, 1995), it was expected that the children with ASD in the present study (CA 7;4, LA 6;0) would perform less well than the children with TD on the ToM tasks that were administered. As expected, and consistent with previous research (e.g., Happe, 1995; Slaughter et al., 2007), the TD group performed significantly better on the ToM tasks than did the children with ASD. Also as expected, both groups in the current study scored better on perspective-taking than false-belief tasks. Indeed, the TD group performed at ceiling on the perspective-taking tasks. Perspective-taking tasks tend to be easier for both TD children (Moll & Tomasello, 2006) and children with ASD and tend to be passed at younger ages (Baron-Cohen, 1989; Leslie & Frith, 1988), in comparison to false belief tasks.

Parents' IS Language -ToM Relationships

The relationship between ToM and IS language use by parents and children was also assessed. For the TD group, no significant correlations between parental IS category use and their children's perspective-taking or false-belief ToM scores were obtained, after controlling for chronological age. This is in contrast to the findings of Slaughter et al. (2007) who found a significant correlation for her TD sample between parents' use of elaborated cognitive terms and their child's false-belief ToM scores. A likely

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explanation of the difference in findings across studies is that the TD group was performing at ceiling on the perspective-taking tasks in the current sample and therefore the lack of variability in this measure reduced the ability to observe significant relationships that may have existed.

For the ASD group, after controlling for chronological age and language age, the parents' elaboration of affect terms was significantly positively correlated with their child's performance score on perspective-taking ToM tasks. Thus, parents elaborated more often about the emotions of characters in the story when their children had higher scores on visual perspective taking ToM tasks. Slaughter et al. (2007) also found a significant relationship between parental elaboration of affective terms and the perspective-taking scores of children with ASD. To account for the correlation they found between affect and perspective-taking task performance Slaughter et al. argued that children with ASD who are characterized by both language and social problems may find affect easier to understand than cognition, potentially due to externally available cues such as facial expressions. A link between parental elaborations of affective terms and children's perspective-taking ToM performance on an emotion situation task has been shown in younger TD children as well (Taumoepeau & Ruffman, 2006). Taumoepeau and Ruffman (2006) suggest this relationship may indicate a "mechanism by which children's emerging *implicit* understanding about mental life is made *explicit*", and that this "mechanism can be conceptualized within the zone of proximal development such that mother's use of specific types of mental state language at critical points in the child's development bootstraps the child's social understanding" (p. 478). If this is the case, then the present finding of such a relationship in the ASD children suggests that the parents of

these children are providing IS language input in keeping with their children's ToM understanding and in a manner that will scaffold their learning.

A more difficult finding to interpret was that, for the ASD group, the parent's use of elaborated cognitive terms was significantly <u>negatively</u> correlated with their child's performance on false-belief tasks after controlling for chronological age and language age. Thus in our study, when a child with ASD had a lower score on the false belief tasks, the mothers elaborated more about the story characters' cognitive states. A possible explanation for this negative correlation is that parents of children with ASD may be sensitive to their child's emerging knowledge of false beliefs, and therefore increase the frequency of their talk about others' cognitive states to increase opportunities to systematically scaffold this teaching. Alternatively, the negative correlation may result because parents may feel the need to elaborate more on difficult areas of internal state understanding (cognitions) in order to help their child to understand these abstract concepts. Also possible is that the negative correlation found was spurious and a chance result of multiple analyses that were used to examine this IS-ToM relationship, although this seems unlikely given the p-value obtained (.001).

Combined, these findings suggest that parents of children with ASD are tailoring their talk, specifically the frequency of their elaborations, to what their child knows about affective and cognitive internal states. These children with ASD were better at perspective-taking than false-beliefs which led parents to act differently in response to each skill in their language input towards their child (in this study being their created narrative). This shows an implicit and intuitive understanding of ToM by parents, possibly based on the child's behavior rather than what the child is able to say. Such fine-

tuning would, of course, be beneficial for children with ASD by facilitating their development of an understanding of why people feel and act the way they do. The fact that we do not see the same relationships between IS language and ToM in the typically developing children may reflect their higher ToM skills and the reduced need for specific input in this area.

Child's IS Language-Tom Relationships

In investigating the relationship between the child's IS language use and their concurrent ToM understanding, no significant correlations between child's ToM and IS language were found for the TD group, in part likely due again to their near ceiling performance on the perspective-taking ToM tasks leading to reduced variability. However, for the group with ASD, the child's use of simple affect terms was significantly positively correlated with their performance on false-belief tasks even after controlling for language age and chronological age. This is in contrast to Capps et al. (2000) who found that, for children with ASD of similar LA yet older in CA (ASD: *M* LA =6; 4; *M* CA = 12; 6), performance on false-belief tasks was *negatively* correlated with references to character's affective states. In the Capps et al. (2000) study the researchers used the same book as in the current story to elicit narratives from the children and similar false-belief tasks (misleading contents and "Sally-Ann" task). The authors argued that their "surprising" (p. 202) finding of a negative correlation may be the result of the tendency of the children with ASD to label the emotions of characters rather than describing the story plot and *why* these internal states may be occurring. However, the children with ASD in the current study were able to create narratives similar in length and syntactic

complexity to the TD group, and their narratives seemed to include descriptions of the actions and story plot, in a manner similar to their TD peers (although this was not systematically analyzed). Thus, the simple listing of emotions did not appear to be a strategy used by the children with ASD in the present study and cannot account for the findings. Instead, the differences may be because the children in the current study are higher functioning (LA closer to CA) and have better ToM skills. Similarly Capps et al (2003) found that for higher-functioning individuals with ASD, that verbal IQ (or verbal mental age) and theory of mind were not associated with narrative abilities; whereas this relationship between theory of mind, verbal IQ and narrative competence has been observed in previous research with individuals with ASD with mental retardation (Capps et al, 2000; Tager-Flusberg & Sullivan, 1995). Therefore, as argued by Capps et al. (2003), it may be that for children with ASD there is a spectrum of ability in regards to emotional understanding, knowledge and skills that affect narrative abilities and that the relationship between language abilities and ToM is dynamic.

The fact that talk about emotions and desires was related to false-belief rather than perspective-taking ToM performance for the children with ASD in the present study may be due to the nature of the ToM tasks selected for the study. A correlation between perspective-taking and the use of affective terms might not have been found had different perspective-taking tasks been used. Nonetheless, the obtained relationship between affective state use and false-belief ToM is consistent with results reported by Bartsch and Wellman (1995). These authors argued that affect (in particular elaborated affect talk) may be particularly beneficial in false belief understanding because talk about affect is salient or often in the "here and now" of the child, in the form of desires and emotions.

By using IS terms to talk about the child's desires and emotions, children may then learn about how to label their own affect and also then the affect of others, and how these internal states may guide behavior. Since children are then attending to the affective internal states of themselves and others, this attention may facilitate a later (and more advanced) understanding about other types of internal states they may have, such as cognitive states (thoughts and beliefs), and then later, the cognitions of others' (which, like affect, may guide their behavior).

Limitations

As in all studies characteristics of the group of participants impacts the ability to generalize findings to a larger population. The group of children with ASD had a mean LA of 6; 0 years, CA of 7; 4, and only two of the twelve scored more than two standard deviations below the mean on the OWLS. As well, they were able to produce narratives about the Frog Story presented to them, comparable to same language-age peers in length and syntactic complexity. Therefore the findings of this study can only be generalized to other children with ASD who have a relatively high language and comparable CAs. In addition, matching on language age using a combined receptive and expressive score on the OWLS must also be considered when examining potential limitations in matching subjects and in comparing the results of this study with the results of other studies. Slaughter et al. (2007) matched on language age based on the *Peabody Picture Vocabulary Test-Revised* (PPVT-R; Dunn & Dunn, 1981), a test only obtaining a receptive language score. Therefore, different language measures were used in these two studies however the results were compared in the analysis.

The current study had a relatively small sample size. There were 12 children with ASD, and 13 TD children. This small sample size may also have contributed to a lack of detections of significant differences or correlations in the analyses.   For the analysis of child talk, the ANOVA revealed a main effect of group approaching significance, with a trend towards TD children using more IS language than children with ASD (F $(1,22)$=4.138; p =. 054; ηp2 = .158). Therefore, the effect size was small (less than .2). The IS language category by group interaction approached significance as well (F $(5,18)$=2.429, p = 0.075; $ηp^2$ =. 403), and this would be classified as a small-medium effect size. A two-way group (TD, ASD) by task (perspective taking, false belief) mixed ANOVA was used to test differences in ToM task performance, controlling for chronological age (since there was a significant difference in chronological age between groups). A main effect of group was found, with TD children performing significantly better on ToM Tasks overall than the children with ASD (F $(1, 22)$=11.275, p = 0.003; $ηp^2$ = .339)**,** also a small to medium effect size. These effect sizes suggest that there was adequate power or close to adequate power to detect meaningful differences but that a slightly larger sample would have made the findings more robust.

In addition to the small sample size, there was also a small amount of IS talk in the narratives in both groups. Future studies looking at IS language could include different contexts to elicit IS language, such as in picture description, in communications with others in social settings, or during structured play and daily routines. In regards to attribution or the experiencer of the IS term, there was not enough of the "self" attributional category to further analyze. Therefore in future studies where the different contexts such as those listed above are used, researchers will be able to elicit "self" talk

in multiple contexts and compare patterns of attributional focus, or patterns of talk about the "self" vs "others".

Overlap in the families across dyads may be another limitation in this study. The twenty-seven parent-child dyads were recruited from 22 families. Thus, several parents told a story to two different children in the study. In the TD group, there were 12 families (2 children had a story told by the same parent), and in the ASD group, there were 10 families (two sets of siblings (4 children in total) had the story told by the same parent). This overlap would presumably have affected the experience of the parents on the task as well as the variability of the samples. It also impacts the statistics used as narratives were a within subjects factor for several parents but were treated as a between subjects factor in the statistical analysis. One way to deal with this would be to exclude the second narrative of parents (along with that of the child they interacted with). This of course would reduce sample sizes in the study and therefore the power of the analyses.

Another possible limitation was that both fathers and mothers participated in the study. Originally, mothers and their children were recruited for the study. However, for 1 ASD parent dyad and 2 TD parents, the fathers arrived for the testing procedure instead. When asked about their attendance (since mothers had originally been recruited) and their experience sharing books in the home with their children, all three fathers stated that they often engaged in this type of activity with their child. (It is unknown the extent to which the mothers who participated in the study engage in shared book-reading activities in the home.) It may be that parents differ in their narrative styles, based on how frequently they engage in shared book-readings with their child. Future studies should ask this question of all participants. As well, fathers' IS language input to children has been found

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to be different from mothers'. LaBounty, Wellman, Olson, Lagattuta, and Liu (2008)

investigated the influences of both fathers' versus mothers' conversational input on 3; 5

to 5; 5 year old children's emotional understanding and ToM. The authors found that

"mothers and fathers differed in their use of IS language and that these differences had

important implications for children's social understanding" (p.13). It is possible that

differences between fathers and mothers IS talk may have existed in the current study as

well. Future research must therefore control for having both fathers and mothers

participate in the same group. However, importantly in our study, fathers and mothers

were judged as being equally comfortable with the shared book-reading task, and their

narratives were subjectively judged as similar in regards to IS language use and overall

narrative skills such as plot development.

The ceiling performance on the perspective taking tasks for the TD children is

also a limitation in the current study. Having a broader range of ToM tasks would have

aided in the analysis of internal state language and ToM relationships. Specifically,

including second-order false-belief tasks may have allowed further relationships to be

revealed, should they exist.

Finally, only 14 of the 25 parents returned the demographic questionnaire.

Demographic information about all of the families would have, of course, been ideal for

group descriptions and interpretation of results in the current study. Nonetheless, there a

comparable number of parents of children with TD and ASD completed the forms and

there is no reason to believe that those who did would be substantially different from

those who did not. In particular, knowing whether parents had participated in programs

that teach about language facilitation would have been important in that those participants

may be using techniques or strategies they have learned during their narrations.

Currently, it is impossible to tell whether the behaviors observed in parents were natural

or taught or a combination of both.

Clinical Implications

The children with ASD in this study were capable of generating narratives that

included internal state language about others. Therefore, at least for children with ASD of

comparable ages and language ages, wordless picture books serve as a fruitful context

helping children with ASD understand the reasons why people feel, think and perceive

and therefore behave the way they do. For developmentally younger children, personal

narratives might be more appropriate.

While the microstructure (length and syntactic complexity) of the narratives of the

children with ASD were similar to their TD LA-matched peers, IS language was not. A

trend for less IS talk in general, fewer elaborations, and fewer simple uses of cognitive

and perception terms for children with ASD in this study was found. This would suggest

that these types of IS language all may be important to focus on in intervention. This

highlights the importance of incorporating explicit teaching about internal state language

in practice.

The frequency of elaborated affect terms in parent's talk was significantly

positively correlated with performance on perspective-taking ToM tasks, for children

with ASD. Thus, teaching parents how to incorporate more elaborations into their

narratives when talking to children with ASD may be particularly useful in teaching a

ToM.

Finally, it is important to recognize that parents in this study were sensitive to their children and modified their talk relative to their child's ToM. This ability to fine-tune to a child's needs should be recognized in clinical contexts. Perhaps the findings of this study suggest that increasing the frequency rather than changing the type of IS talk would be best focus of intervention.

Conclusion

The current study has contributed to the growing body of research on children with ASD, development of theory of mind and internal state language development. Unlike previous studies, the current study design enabled the IS language of parents and children and children's ToM to be investigated in the same individuals. Thus, relationships between all these factors could be analyzed.

Only one context was used to elicit IS language in the current study, the shared book-reading task. The use of a variety of contexts for studying language use by parents and children (free play activity between parent and child, peer interaction, narrative creation using more than one book or picture sequence, etc), would have increased the opportunities to use different attributions and may have led to variation in the types of IS language used. For example, the children may have used more elaborations if they were talking about their own emotions, perceptions and cognitions than when talking about another's. Future studies should investigate the impact of context on IS language in children with ASD.

One important finding of the current is that parents of children with ASD appear to tailor their IS talk to their children based on their child's ToM ability, rather than their

child's on-line or explicit production of internal state talk. Thus, they seem to be focusing upon their child's competence, assessed presumably across multiple interactions, rather than their child's immediate performance.

Another important finding is that the children with ASD in this study were able to create narratives similar in length and syntactic complexity to their language-age matched peers, but different in terms of IS language use. The trends showed that the groups seemed to differ in that the ASD children produced fewer elaborated affect terms as well as fewer simple perception and cognitive terms than the TD group. These findings provide guidance for intervention for children with ASD of the same language and chronological ages. It is important to note that different patterns of strengths and weaknesses have been observed at other developmental levels.

A third finding of interest is that these children with ASD demonstrated an ability to talk about others' feelings and senses in the context of shared book-reading, even though they were still developing false belief skills. The finding of a positive relationship between their talk about others emotions and their false belief abilities suggests an important link between these two abilities.

Given that this study's participants with ASD were a relatively older and higher-functioning group, future research can focus on the potential relationships between parental IS language input, children's IS language use and ToM development using different age groups, ability levels, language elicitation strategies and contexts, and theory of mind tasks, to further understand these relationships, in children with ASD at varying developmental levels. Further, training studies or longitudinal studies would

help explicate causal relationships between ToM and IS language and between parental

input and child abilities for individuals with ASD.

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