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The Role of Attachment and Language in Analogical Reasoning

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The University of Southern Mississippi

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Abstract of a Dissertation
Submitted To the Graduate School
of the University of Southern Mississippi
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ABSTRACT

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IN ANALOGICAL REASONING

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The present study examined the relationships between attachment and analogical reasoning within two domains: social reasoning and physical reasoning. Verbal reasoning was assessed as a possible mediator of these relationships. This study was conducted with 67 typically-developed children between the ages of nine to 11 years of age who were recruited from The University of Southern Mississippi's student population and from schools in Hattiesburg, MS and Ocean Springs, MS. Attachment security was assessed using the Kerns Security Scale (Kerns, Klepac, & Cole, 1996), and verbal reasoning was assessed with the Weschler Intelligence Scale for Children-3rd edition (Weschler, 1991). Analogical reasoning within social and physical domains was assessed using analogous match-to-sample tasks. To assess social reasoning, the participants were required to reason about others' emotions such as happiness, sadness, fear, and anger. To assess physical reasoning, they were required to reason about physical tasks that others were engaged in, such as sports, cooking, art, and school activities.

The results revealed that verbal reasoning was significantly related to social reasoning, while the relationship between verbal reasoning and physical reasoning approached significance. Attachment was not significantly related to any of the other variables in this study.

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CHAPTER I

INTRODUCTION

How do human beings become "mind readers" and seemingly use this ability, known as theory of mind, to predict what someone is going to do next? Does a poor attachment style towards a primary caregiver hinder the development of social reasoning skills, such as an ability to "read minds" or, rather, of more general cognitive abilities? The present study seeks to address these questions by focusing on a measure of attachment security and its relationship to analogical reasoning generally, and social reasoning specifically. Theory of mind, which allows people to understand other individual's beliefs and emotions, has been a widely studied aspect of social reasoning. The current study will assess the ability to recognize and reason about others' emotions; one critical aspect of the human theory of mind system.

Vygotsky (1978) and later, Tomasello (1999) focus on the complex relationships between a child's social environment and the development of social cognitive skills and more general cognitive abilities, which open the door to cultural learning, such as language and social skills. The ability to develop and maintain an advanced culture may be one key component of human cognition that distinguishes us from all other species (Tomasello, 1999, 2001). The current study focuses on the particular set of skills that allows humans to interact with other members of their culture. More specifically, of interest is whether the benefits of developing a strong attachment to caregivers, an early social experience, might be limited to facilitating the development of social reasoning, which encompasses a broad suite of skills – only one facet of which is theory of mind, or

may have even farther reaching benefits with regards to a broader range of cognitive abilities, such as analogical reasoning.

These questions have been addressed in the study of children with autism (Charman & Baron-Cohen, 1992; Leekman & Perner, 1991; Leslie & Thaiss, 1992; Zaitchik, 1990), but the relationship between attachment and analogical reasoning within social and physical reasoning domains in typically-developed children has not been explicitly examined. Furthermore, previous research has suggested intriguing differences in performance on social and physical reasoning tasks in typically developing children (Zaitchik, 1990).

There are clear reasons to assume a relationship might exist among attachment, verbal reasoning, and social/physical reasoning. First of all, attachment may be related to the development of social reasoning, as children with autism spectrum disorder (ASD) are generally impaired in forming attachments to others, and show deficits in reasoning about the mental states of others (Sobel, Capps, & Gopnik, 2005). Children with this range of disabilities also show deficits in language skills (Tomasello, 1999). Verbal reasoning may also be assumed to be related to attachment, as children who are more securely attached may be more socially engaged, and thus more communicative (more will be discussed). However, the impairments of children with ASD may also be more widespread to include general cognitive deficits such as impairments in executive function and dual representation (Hill, 2004), rather than being restricted to the social domain (Scott & Baron-Cohen, 1996; White & Roberson-Nay, 2009). It is possible that sharing perspectives with others leads to more widespread facilitative effects in the development of early cognitive abilities, such as early advances in dual representation,

analogical reasoning etc., perhaps mediated through advances in language. Understanding how these complex capacities are related in typically developing children may help inform where development 'fails' in disorders such as autism. Prior research has been mixed with regards to the links between attachment and abilities such as social reasoning and verbal reasoning, which are indirectly related to our main question of interest, as will be reviewed below. Thus, there is a need for further investigation.

There are reasons to presume a relationship between attachment and emerging theory of mind in children whose development is typical in both aspects. By nine months of age, children have an emerging ability to monitor gaze and to alternate gaze between a social partner and an object or event, which gives them the opportunity to begin to understand intentions and share attention with their conspecifics (Adamson & Bakeman, 1985; Carpenter, Nagell, & Tomasello, 1998; Tomasello, 1999, 2001). These behaviors and understandings reflect joint attention, which is the first step in the development of theory of mind. Presumably, typically-developing children are more likely than those with autism or autistic spectrum disorder to develop secure attachments. In having a secure attachment, there may be more opportunities to interact with a caregiver, so in turn, there are more opportunities to develop joint attention skills. van Ijzendoorn et al. (2007) found that children with autism were more likely to have insecure attachments, while typically developing children were more likely to have secure attachments. The authors therefore questioned whether children with autism might have a biological predisposition for insecure attachment. In other words, children with autism may have a difficult time developing a secure attachment even if their parents make an attempt at trying to facilitate its development. Insecure attachments in children with autism may

cause problems processing social stimuli, which in turn, may cause deficits in joint attention. But, even within typically developing children, there is a range of both attachment (Ainsworth, Blehar, Waters, and Wall, 1978; Blehar, Lieberman, Ainsworth, 1977) and theory of mind development (Hughes, Happe, Taylor, Jaffee, Caspi, & Moffitt, 2005).

Culture places these social cognitive skills of joint attention and theory of mind in a much broader context, so one should address the importance of culture and how young generations learn about their culture through a specific set of social-cognitive skills. Cultural transmission is a recent evolutionary phenomenon that allows organisms to save time and effort in learning skills and making improvements on already established social practices because it exploits the existing knowledge and skills of conspecifics (Tomasello, 1999, 2001). Cultural transmission is evident in the following examples: rat pups eating only the food their mothers give them, young chimpanzees learning how to use tools from the adults around them, and human children gaining linguistic skills and conventions from the adults around them. Unlike other species, humans have a unique-mode of cultural transmission known as cumulative cultural evolution that reflects how fast human beings accumulate modifications (also known as cultural histories) over time. For example, the way humans have used hammers has changed dramatically throughout human history because of all of the modifications and improvements that have been made in the use of a hammer. Human beings accumulate these modifications because they have powerful cultural learning processes or skills to support them.

An important and powerful aspect of human cultural learning is social cognition, which includes the ability of individual organisms to understand conspecifics as beings

like themselves (Tomasello, 1999). This capacity allows an individual to put themselves in the "other person's shoes," or take the perspective of another, so they can learn from the other person as well as through the other person, which is what makes the transmission of culture so rapid. Moreover, they are able to understand that the other person has intentions and mental states like their own. Individuals learn about their culture from others through the process of imitation and active instruction by adults. First, if an individual is using a hammer, the other person that is observing will need to understand the situations that a hammer is used in for that particular culture. The individual observing the use of the hammer will also probably need to understand the intentions of the person using the hammer such that he or she probably did not intend for it to be used to kill animals or humans (it is not part of their culture). Imitation is reflected in the whole process of observing another individual and then replicating that particular behavior, which is how components of a culture are passed on through generations.

Unfortunately, those with autism and autistic spectrum disorders are not able to understand that other people have intentions and mental states like the self (Sobel et al., 2005; Tomasello, Carpenter, Call, Behne, & Moll, 2005). Specifically, this is reflected in the fact that they are unlikely to initiate bids for joint attention with others by declaratively pointing to or showing objects (Baron-Cohen, 1989; Charman et al., 1997; Mundy & Willoughby, 1996), nor are they likely to respond to others' bids for joint attention (Leekman et al., 1997). Thus, they are also unable to engage in skills of cultural learning. For instance, they may have difficulty understanding a person's intentions when they are using a hammer or some other object.

Development of Cultural Learning Skills

By nine months of age, typically-developing children have an emerging ability to monitor gaze and to alternate gaze between a social partner and an object or event, which gives them the opportunity to begin to understand intentions and share attention with their conspecifics (Adamson & Bakeman, 1985; Carpenter et al., 1998; Tomasello, 1999, 2001). These emerging behaviors and understanding of intentions reflect joint or shared attention, which is the first step in the development of theory of mind. Joint attention is a social-cognitive skill that allows people to identify with other humans and to understand them as intentional agents, like the self, through the use of pre-linguistic communicative acts to help coordinate attention between a social partner and an object or event. More specifically, joint attention can be classified as dyadic-between self and other agent-or triadic-between self, another agent, and an object. Triadic interactions should involve an early understanding of mental states in order to coordinate attention between self, other, and the object. Joint attention is used to characterize an entire set of skills, interactions, and behaviors such as gaze following (flexibly and reliably looking where another person looks), joint engagement (engaging adults in extended periods of social interaction mediated by an object), social referencing (using others as reference points in social interactions), and imitative learning (acting on objects in the ways that others do). Because most of these joint attentional behaviors emerge simultaneously in development and rely on the understanding of others as perceiving, behaving, and goal-directed beings, it strongly suggests that these behaviors are not isolated cognitive modules or learned behavioral sequences but, rather, reflect the children's emerging understanding of other persons as intentional agents. The emerging understanding of others as intentional agents

at nine months seems to come from an infant's understanding of other persons as "like me" at an early age, and the fact that children also have new understanding of their own intentional actions. For example, an infant will begin to see other humans as "like themselves," so any new understanding of their own functioning will give them a new understanding of others' functioning as well (Meltzoff, 2007; Tomasello, 1999). According to Tomasello, "the child simply sees or imagines the goal-state the other person is intending to achieve in much the same way that she would imagine it for herself, and she then just sees the other person's behavior as directed toward the goal in much the same way that she sees her own" (1999, p.76).

Other people are a part of a child's social environment or human cultural environment that they grow up in, which sets the stage for their cognitive development (Tomasello, 1999). The people in the child's social environment live in a certain way in that they may eat a particular set of foods, live in a certain type of living arrangement, and engage in particular rituals and activities throughout the day. This means that the child will experience and be exposed to certain languages or environments that range in degree of stimuation, which in turn affects their cognitive development and how they interact and learn from others. If they are not exposed to these things, it could be quite devastating to a child because they need this information to thrive in their cultural environment. The adult transfers this information or cultural knowledge by either directly instructing the child or by the process of scaffolding, which is when an adult may witness a child struggling with a skill and attempt to provide hints or draw attention to aspects of it that the child may be missing, in order to make the task easier. When a child can solve a problem with the assistance of an adult, it suggests that the child has skills that are not

yet matured but are in the process of maturation. Vygotsky (1978, p.86) termed "the distance between a child's actual development level as determined by independent problem solving and level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" the zone of proximal development. In general, the zone of proximal development is indicative of a child's capability to learn under a teacher or parent's guidance. The other people in a child's environment, and the child's relationships with those others, are thus very important to a child's learning and cognitive development.

The Influence of Social Cognitive Skills on Language Development

If children can take advantage of these social-cognitive skills, such as joint attention and understanding others as intentional agents, it opens a window for them into the cultural world which can result in the creation of unique forms of cognitive representation and theory of mind (Moore & Dunham, 1995; Tomasello, 1999). For example, children use their cultural learning skills such as joint attention in order to acquire linguistic and other communicative symbols (Tomasello, 1992, 1999). In order to acquire these symbols and language in general, a child must first be able to engage in joint attention. The child must also live in a world that has structured social activities that are understandable, which aids in the development of language. Routine activities that take place between two individuals can assist a child in coming to understand and discern how an object and activity work and function and they can ultimately represent the actions as intentional and goal-directed. For example, an adult may sit down with a child and roll a red ball back and forth between her and the child on a regular basis, so therefore, the child may come to understand her own goal of rolling the ball to the adult

and the adult's goal of rolling the ball back to her. The adult must then use a novel linguistic symbol that refers to the object they are paying attention to in a way that a child can understand as relevant to this activity such as a verbalization of the term "pass the ball." In order to learn a new word, or phrase, such as "pass the ball," the child must be able to use the new word or symbol toward the adult in the same way and purpose in which the adult used it toward him or her. Over time, children become more skillful at joint attention and understanding the adult's communicative intent in a variety of novel situations, so they continue to learn new words and build their vocabulary. As studies show, engagement in joint attention is associated with a larger vocabulary or language ability (Carpenter et al., 1998; Tomasello & Todd, 1983), although the positive effects of joint attention on language development decrease after about 15 months of age (Carpenter et al., 1998).

Joint attention and language are both thought to influence the development of theory of mind, although there is scant evidence indicating that joint attention is directly related to theory of mind (Charman et al., 2000; Jenkins & Astington, 1996). Language is influential in the development of theory of mind because the linguistic symbols that reflect language allow children to simultaneously perceive one situation in different ways or to have multiple simultaneous representations of one situation (Tomasello, 1999). For example, when speaking, the speaker will monitor the listener's attentional status, which means that both persons in the conversation know that there are at least two perspectives on a situation, as well as others that are symbolized in unused symbols and constructions. One aspect of theory of mind is being able to understand the perspectives of others. Furthermore, the fact that language can help an individual discover nonobvious

commonalities among objects (or inferring hidden sources of similarity among novel objects) may also allow one to gain insight about human action, which is part of theory of mind (Baldwin & Saylor, 2005). In essence, language facilitates the abstraction process necessary in the construction of theory of mind. Parents, for instance, may use mentalistic terms such as "want" (desire), "gonna" (intention), and "know" (knowledge/belief) across a variety of contexts. This gives the child the opportunity to learn what the parent means or what exactly their perspective is on the situation. The speaker, the parent, might ask a question right before snack time ("What do you want to eat? Banana or cracker?"), which gives the child the opportunity to understand the parent's perspective and what he or she means by "want" in that situation. In a different context, "want" could mean an entirely different thing. Mental states such as "want" are unobservable, so we may learn the meaning of such words by inferring it from the context in which it was said (Miller, 2006). In all, language allows an individual to determine what the intentions and desires of a person are, which is part of theory of mind. Over time, language promotes the development of a fully-developed theory of mind ability, which involves being able to explain and predict the actions of self and others. In addition to this, security of attachment may be related to the development of joint attention and language development. Individuals with secure attachments are likely to be more comfortable seeking out social interactions with others. This gives them more opportunities to engage in joint attention, which in turn may encourage the development of language because of the increased opportunities to learn new words and how they are used in different contexts (Block, 2006).

Deficits in Social-Cognitive Skills

An inability to develop normal language can be detrimental to the development of specific social-cognitive skills such as theory of mind, along with more general cognitive development (Tomasello, 1999; Vygotsky, 1978). Children with selective language impairment also have trouble with other nonlinguistic cognitive skills such as analogical reasoning and social cognition. According to Baldwin and Saylor (2005), language is both related and important to analogical reasoning because it serves as a catalyst for abstraction. They hypothesized that language allows one to "compare people's behaviors across distinct action scenarios, thereby helping to highlight commonalities, foster attention to relevant differences and promote inferences about non-obvious sources of commonality and difference" (p.124). Because language allows one to develop an understanding of abstract concepts, deficits in language may be detrimental to performance on analogical reasoning tasks. As for theory of mind, it may not develop normally in those with language impairments because they are not as skilled at understanding the communicative intent of others. Moreover, individuals with language impairments have difficulty forming and understanding abstract concepts, so they will have a difficult time understanding mental states because they too are abstractions.

As for children with autism, some fail to learn language at all- probably because they are not able to understand the communicative intent of others. According to Tomasello (1999) and Jarrold, Boucher, and Smith (1993), those with autism typically also have trouble with symbolic play and have poor language abilities. Tomasello suggested that these children's difficulty in understanding others as intentional agents may lead to deficits in their symbolic skills, which in turn may create difficulties in the

development of theory of mind. Alternatively, it is possible that difficulties in symbolic skills create difficulties in forming representations of others as intentional agents, not the other way around. Children with autism tend to approach things in the same way and with the same perspective time after time. This inflexibility may be due to their inability to understand the perspectives and intentions of others. One study in particular by Morgan, Maybery, and Durkin (2003) showed that, in fact, those with autism spectrum disorders do have difficulty with both their language skills and in engaging in joint attention behaviors. Thus, the poor development of joint attention behaviors may be related to poor understanding of others as intentional agents, along with the poor development of language skills. This research indicates links between language, joint attention, and the development of abstraction, which could all plausibly relate to theory of mind. These same components may be linked in typically-developing children as well.

As mentioned above, theory of mind seems to be poorly developed in both those with autism and those with some language impairments. It seems to be lacking in nonhuman primates as well, although this has become a contentious issue as of late (Call, Hare, Carpenter, & Tomasello, 2004; Penn & Povinelli, 2007; Povinelli & Vonk, 2003, 2004; Suddendorf & Whiten, 2001; Tomasello, Call, & Hare, 2003). Nonhuman primates are intentional, causal agents, but they may not understand the world in causal and intentional terms (Tomasello, 1999; Tomasello et al., 2006). There are several studies that provide evidence that nonhuman primates do not possess a theory of mind. For instance, Povinelli, Nelson, and Boysen (1990) and Woodruff and Premack (1979) showed that nonhuman primates do not bring a knowledge of others' intentionality and causality to their experiments, although after scores of trials they eventually learned to

respond in a manner that was consistent with being able to do so. There are also social behaviors that nonhuman primates do not perform, which would indicate that they do not have a theory of mind. For instance, they do not point to outside objects for others, hold objects up to show them to others, try to bring others to a location to observe something, offer objects to others by holding them out, or intentionally teach others new behaviors (Tomasello et al., 2005). These actions are not engaged in presumably because nonhuman primates lack an understanding of the conspecific's underlying internal mental states that could be affected and manipulated. However, more recent studies from the same laboratory and others, have suggested that apes may have an appreciation for some elements of the theory of mind system such as seeing (Hare, Call, Agnetta, & Tomasello, 2000; Hare, Call & Tomasello, 2001, 2006, but see Penn & Povinelli, 2007; Povinelli & Vonk, 2004). Because theory of mind may be unique to humans, humans are uniquely able to create and modify unique cognitive products such as math and language – symbols that can be used to communicate with and instruct others. So, a central question has been – what is special about human development that allows for the emergence of this ability?

Authors such as Tomasello (1999) and Vygotsky (1978) have proposed that the development of joint attention and gaze sharing may be unique to human rearing. Eventually, theory of mind, or the ability to understand other people's intentions, develops through these sorts of dyadic interactions. Attachment and human rearing may foster the development of theory of mind. Again, when children are more securely attached, they may have more opportunities to interact with their caregiver, and thus, more opportunities to engage in joint attention and gaze sharing. As will be discussed,

language, specifically as measured in the form of verbal reasoning, may have a role in the relationship between attachment and reasoning processes.

As mentioned earlier, language is influential to the development of higher psychological processes, so the absence of human-like language in non-humans may explain why nonhuman primates are not able to develop a full-blown theory of mind and make improvements on already established institutions (Vygotsky, 1978). In other words, they are not able to go beyond their simple tool use and develop a complex culture like humans can. According to Vygotsky (1978), language has an organizing function that "penetrates the process of tool use and produces fundamentally new forms of behavior" (p. 24). When solving problems for instance, a child that can use speech is able to achieve a much broader range of activity because they can apply as tools objects that are not in their direct visual field as well as those that are. Speech gives the child the ability to *plan* how to solve the problem. For example, they can think about other tools they can get from other places in order to solve the problem. Whereas children can use speech to plan how they will solve a problem, apes are not able to use speech and appear to be more spontaneous and impulsive in solving a problem. Language seems to free the individual from the direct visual field and to go beyond that. It allows an individual to think abstractly and to predict if certain objects or behaviors may be useful in the solving of a problem.

Thus, language may have implications for theory of mind and analogical reasoning, because both abilities seem to require that one can think in the abstract - beyond the immediate experience. Theory of mind, for instance, requires the ability to put oneself in the other person's shoes and to think about what they might do in a particular

situation. Furthermore, analogical reasoning involves reasoning about relations or the transfer of information from a known system to a relatively unknown system (Vosniadou, 1995). In other words, an individual applies a known relationship between two things to a new problem or a new situation. In both situations, language allows someone the ability to go beyond what is directly visible and to think abstractly. It allows someone the ability to *predict* and to think ahead. Attachment, an early social experience, could influence the development of language, which in turn, could influence both theory of mind and analogical reasoning. Moreover, attachment could affect development independently of language ability. There has been a wealth of research investigating how attachment may bolster the development of theory of mind, but there has been a paucity of research exploring the relationship between attachment and analogical reasoning. The hypothesized relationship between attachment and analogical reasoning will be discussed further below, but it is possible that attachment may also affect the development of analogical reasoning through language (or attachment may affect the development of analogical reasoning directly and independently of language). The proposed research seeks to explore whether or not attachment may bolster the development of analogical reasoning, regardless of whether the reasoning is within the physical or social domain, or whether its facilitative effects are limited to within the social domain.

Attachment Theory

In order to appreciate the predicted relationships between a child's early attachment to their primary caregiver and their continuing cognitive development, it is critical to first review the main theories of attachment. Recent attachment theory seems to begin with John Bowlby's work, which indicates that children need a close and

continuous relationship with a primary caregiver in order to flourish (Bowlby, 1973; Feeney & Noller, 1996). For Bowlby, attachment behavior is defined as "any form of behavior that results in a person attaining or retaining proximity to some other differentiated and preferred individual, usually conceived as stronger and or/wiser" (1973, p. 292). Infants engage in specific behaviors such as sucking, clinging, smiling, and crying that promote protective responses from the adult caregiver, which also promotes a binding relationship between the infant and the caregiver. According to Bowlby, the goal of attachment behaviors is to establish and maintain contact with the attachment figure, while the goal of the attached person is to feel and maintain security.

Bowlby (1973) also discussed how attachment functions to maintain a balance between exploratory behavior and proximity seeking behavior while considering how accessible the attachment figure is and the possibility of dangers in the environment. For example, if an infant feels like separation from their attachment figure is a threat to their well-being, he or she will try to remain close to that person (a secure base) because that person is thought to be a safe haven or a source of comfort to the infant. This behavior suggests that use of the caregiver as a secure base will appear more frequently when the infant is in a situation of perceived threat such as a stranger getting very close to an infant. For example, an infant who is wary of a stranger may try to go hug mother and to get close to her, which should reduce the wariness. According to Bowlby, withdrawal behaviors from a fear-eliciting stimulus are well-organized by the age of 12 months because the infant's cognitive equipment has developed enough to take into account relevant objects and situations that are absent and present. If the infant does not feel threatened, the infant will be likely to engage in exploratory behavior rather than

attachment behavior towards the caregiver. Exploratory behavior may also be the result of a secure attachment with the attachment figure who has encouraged the child to be self-reliant and autonomous, but is also reliably available and accessible when the infant needs it. In all, Bowlby suggested that proximity seeking, secure base, and safe haven are the three defining features and functions of an attachment relationship.

Bowlby (1973) addressed individual differences in attachment that are reflected in some key propositions of attachment theory. The first proposition suggests that a person will be less prone to fear if an individual is confident in the availability of the attachment figure when it is desired. The second proposition suggests that confidence, or a lack of it, in the attachment figure builds up slowly during infancy, childhood, and adolescence. In addition to this, these expectations about the availability of the attachment figure appear to remain and persist throughout the rest of one's life. The last proposition suggests that actual expectations that one has about the accessibility and responsiveness of attachment figures that developed during the younger years are likely to reflect the actual experiences one had. All of these expectations about the attachment figure are incorporated into inner working models of attachment. Specifically, a key feature of these workings models is the attachment figure itself, where they may be found, and how they may be expected to respond if the infant or child turns to them for support. These working models are relatively stable over time and reflect memories and beliefs from a person's early experiences of caregiving that continue on into new relationships.

Although Bowlby (1973) discussed individual differences, Ainsworth was the first to engage in detailed studies of individual differences in attachment styles. These attachment styles are assessed using the Strange Situation, which is when the mother and

the infant are placed in an unfamiliar and threatening room (Ainsworth et al., 1978). After a few minutes, a stranger enters the room and then the mother leaves. Another few minutes pass, and the mother returns and the stranger leaves. At this point, the mother makes an attempt to engage the infants with toys and then leaves the infant in the room alone again. The infants' behaviors are observed throughout the entire situation both when the caregiver and stranger leave and return to the room in order to determine the infant's attachment style. The particular patterns of distress and avoidant behaviors toward the parental caregiver and the stranger along with more positive behaviors such as being comforted easily when the parent or caregiver returns are indicative of a specific attachment style.

Ainsworth conducted naturalistic observations of mother-infant interactions using the Strange Situation Procedure. Based on these observations, Ainsworth and colleagues (1978) suggested that organized patterns of infant behavior can be used to identify different styles of infant-mother attachment. This resulted in three particular styles of attachment: insecurely attached-avoidant (Group A), securely attached (Group B), and insecurely attached-resistant or anxious-ambivalent (Group C). A fourth attachment style, disorganized attachment emerged later. These patterns of behavior are associated with the amount of interaction between mother and infant and how sensitive and responsive the mother is to the infant's needs. There are particular behaviors associated with each attachment style. For instance, Group A children tend to be indifferent as evident in their responses of defensiveness and avoidance of close contact when the mother comes and goes; Group B children are sociable and exploratory when the mother leaves and happy to see the mother when she returns; while Group C children respond with anxious

behaviors such as crying and appear ambivalent towards the mother when she returns after a brief separation, sometimes displaying anger towards the mother. Children who evidence disorganized attachment often appear to be contradictory in their actions toward their attachment figure, and generally appear confused.

There are also associated patterns of caregiving related to each attachment style. Group A parents tend to be rejecting and rigid and averse to contact or may be overly intrusive, while Group B parents are likely to be available and responsive. Group C parents are insensitive and intrusive or inconsistent in their availability and attention. Children who are classified under disorganized attachment often come from family environments and parents that are less than ideal and sometimes even abusive or neglectful, or may have been abused themselves as children.

Although some of the early work on attachment classified children into discrete categories of attachment styles, later research has developed continuous scales of attachment such as the Security Scale (Kerns et al., 1996) that is used in the present study. Thus, rather than classifying children into discrete categories, they are assessed on their degree of attachment ranging from insecure to secure. Readers further interested in categorical versus continuous nature of attachment classifications (and the debate surrounding this issue) should consult Fraley and Spieker (2003) and accompanying rejoinders by many prominent attachment researchers including J. Cassidy, A. Sroufe, E. Waters and T.Beauchaine, and M. Cummings.

Generally, it is important to understand the theories of attachment in order to understand the next discussion on the relationship between attachment and social reasoning. As the research will show, there does seem to be mixed findings on this

relationship, and there may be variables that mediate this relationship. Attachment may be directly related to theory of mind because more securely attached children have more opportunities for interaction with a caregiver, so there are also more opportunities to develop joint attention and theory of mind.

Attachment and Social Reasoning

The first aim of this study is to examine the relationship between attachment quality and social reasoning. Attachment quality and an aspect of social reasoning, theory of mind, both have strong implications for psychological well-being, especially for social competence and positive social relationships (Bosacki & Astington, 1999; Cassidy Kirsch, Scolton, & Parke, 1996). There is evidence from previous studies showing a positive association between higher levels of theory of mind ability in young children and the quality of attachment (Fonagy, Redfern, & Charman, 1997; Fonagy, Steele, Steele, & Holder, 1997; Meins, Fernyhough, Russell, & Clark-Carter, 1998), so the current study will attempt to replicate these findings with a slightly older group of children. Less work has been conducted to determine whether existing attachment with parents continues to contribute to an understanding of mental states or higher order mental state attribution in older children, past the age at which theory of mind first emerges, so the present study will make an important contribution in this section of the literature. Furthermore, the ability to perceive and reason about analogies between mental states has not been explicitly related to attachment previously.

According to Humfress, O'Connor, Slaughter, Target, and Fonagy (2002), there are several reasons why there is an overlap between theory of mind and attachment quality. First, the significant association may actually be an artifact, which would result

from the fact that both of these measures are mediated by a third variable, such as verbal intelligence. It is possible that attachment may be related to verbal intelligence because those with more secure attachments are likely to be more comfortable seeking out social interactions with others, which in turn may encourage the development of verbal reasoning because of the increased opportunities to learn new words and how they are used in different contexts (Block, 2006). Second, there are studies showing the social interaction origins of both theory of mind ability and attachment quality. Specifically, some aspects of social interaction that were shown to be predictive of better performance on theory of mind tasks and attachment quality were sensitive caregiving and parental openness to and encouragement of affect expression in the child (Bretherton, 1990; Bretherton & Beeghly, 1982; Brown, Donelan-McCall & Dunn, 1996). In all, attachment may be related to theory of mind because of third variables such as verbal intelligence and social interaction.

Social reasoning and attachment quality may overlap simply because they are part of the same developmental processes. For instance, Bowlby (1973) suggested that a child's ability to attribute independent thoughts and feelings to self and others signaled the fourth stage in the nature of the child-parent attachment relationship. In this stage, the child learns that the mother-figure can be perceived as an independent object. Sooner or later in this stage of development, the child is able to infer something of his mother's set-goals and something of the plans she is using to accomplish them. In addition, individual differences in parental sensitivity and, as a consequence, child-parent attachment quality, would influence a child's ability to develop an understanding of the caregiver's perspective. Specifically, secure attachments facilitate a formation of organized mental

representations of the attachment relationship that a child can use to predict the attachment figure's behavior. Thus, this resembles what we know of as theory of mind, where the child learns to understand the other person's perspective, allowing the child to understand and predict behaviors of others. Thus, attachment can facilitate the development of theory of mind and other aspects of social reasoning independently of the advancement of language skills.

Thus there are several different hypotheses concerning the possible relationship between attachment and social reasoning; (a) A more secure attachment leads to greater social reasoning through enhanced language or verbal abilities, i.e. verbal reasoning mediates the relationship between attachment and social reasoning, (b) a more secure attachment directly facilitates greater social reasoning through the types of interactions shared between the child and caregiver, i.e., gaze sharing, joint attention etc., (c) social reasoning may appear to be enhanced in children with more secure attachments because better attachment actually leads to enhanced cognition more broadly than merely within the social domain, that is, sharing a close intimate bond with another may lead one to an earlier metarepresentational capacity that leads to enhanced dual representation and analogical reasoning abilities – therefore we would see children with more secure attachments showing superior social reasoniong, but also greater analogical reasoning skills in the physical reasoning tasks as well (more on this later), and (d) there may be no relationship between attachment and social reasoning.

Meins et al. (1998) examined the longitudinal development of symbolic and mentalising abilities in 33 children whose security of attachment was assessed in infancy. Their main hypothesis was that mothers of securely attached children would be more

likely to treat their children as individuals with minds, which would in turn influence the child's ability to engage with other people on a mental level in that they can understand other people's mental orientations to the world and the beliefs and desires that motivate their behavior. The specific hypotheses were as follows: (a) securely attached children would show a greater ability to include the verbal suggestions of an experimenter into their pretend play (Study One); (b) Within the securely attached group, the mothers' greater tendency to treat their children as mental agents would be reflected in their sensitivity to their children's current level of functioning and their tendency to describe their children using mental characteristics (Study Two); and (c) securely attached children would perform better than insecurely attached children on tasks requiring an understanding of other minds (Studies Three and Four).

As for the measures used in the study by Meins and her colleagues (1998), attachment security was assessed at 11 or 13 months using the Strange Situation procedure developed by Mary Ainsworth. In the first study, symbolic play was assessed at 31 months using two representational toys, a toy car and a female doll, and a selection of junk objects such as a toilet roll inner tube and a piece of aluminum foil. There was an introductory play session, which was followed by two types of structured play, an elicited and an instructed condition. In Study Two, maternal tutoring sensitivity was measured using a box construction task, which involved building a box identical to a model that had already been assembled. The mothers' inclination to describe their children using mental characteristics was measured using a short interview asking the mother to simply describe their child. In Study Three, theory of mind ability was assessed using an unexpected transfer task. In this particular task, the child was introduced to a soft toy called Charlie

the Crocodile and was told that his favorite food was chocolate. The child witnessed the chocolate being put in one of two small cardboard boxes, one being white and the other red. The child was then told that Charlie was hiding his chocolate to keep it safe while he went for a swim. Charlie was removed from the table, and the experimenter described how they were going to play a trick on Charlie by taking the chocolate out of the box and then place it in the other box with the lids of both boxes being closed. The experimenter then told the child that Charlie was about to come back from this swim, so the child was asked where Charlie would look for the chocolate. In the final study, the experimenters used a false belief and emotion task to assess the young children's ability to understand not only a character's current belief, but also to integrate this information with previous knowledge about the character's preferences and desires in order to predict an emotional response.

The results of the study by Meins and her colleagues (1998) showed that securely attached children in infancy were able to add the verbal suggestions of an experimenter into their play sequences at 31 months. In addition to this, mothers of securely attached children were more likely to use sensitive tutoring strategies on a collaborative task with their children who were three years of age at the time. Mothers of securely attached children were also found to be more likely than mothers of insecurely attached children to describe their children in terms of their mental characteristics. Another important result was that securely attached children were more likely to pass the unexpected transfer task at age four. As for the developmental pathways that may link security of attachment with later symbolic and mentalising abilities, the authors of this study found that children's initial security of attachment was a strong predictor of performance on the unexpected

transfer task at age four, which, together with the mother's tendency to describe their children in mentalising terms, in turn predicted performance on the advanced mentalising task at age five. The authors suggest that mother-centered variables such as a mother's sensitivity and consistency in caregiving are aspects of a secure attachment that may have an influence on a child's ability to engage with another person on a mental level. So the finding that a secure attachment is predictive of later mentalising ability may be due to the fact that securely attached children are better able to recognize and act on alternative perspectives of another person.

Consistent with the findings of Meins and her colleagues (1998), Humfress et al. (2002) also found a positive relationship between attachment and theory of mind (mentalising ability) in 70 early adolescents (mean age 12.6 years). In addition to this, they examined the extent to which this relationship is potentially due to other variables, namely verbal ability and parenting quality. This conclusion is consistent with the first hypothesis in that the role of attachment in theory of mind development may be mediated through language ability. Furthermore, sensitive caregiving and parental openness to and encouragement of affect expression (parenting quality) have been found to be associated with better theory of mind performance and secure attachment (Bretherton, 1990; Bretherton & Beeghly, 1982).

In order to assess mentalising ability, Humfress and his colleagues (2002) assigned ratings to children's attribution of mental states to characters in several vignettes that are based on a subset of stories developed by Happe (1994). Specifically, there were ten stories selected in which the subject had to infer pretence, lying, joking, telling a white lie, etc. Child-parent attachment was measured using the Child Attachment

Interview, which is a 19-question, semi-structured interview that assesses the children's mental representations of attachment figures and significant others. Attachment quality is indicated by an Overall Coherence Scale, which is a continuous scale and reflects the quality of the child's representations of the attachment figure throughout the interview. Verbal intelligence was measured using the Vocabulary subscale of the Weschler Intelligence Scales for Children-III UK edition. Parenting quality was assessed by examining scores on three dimensions important to parenting: Warmth/Support, Conflict/Negativity, and Monitoring/Inductive Control.

Humfress and his colleagues (2002) found a significant association between mentalising and attachment coherence in early adolescence (r = .35; attachment coherence explained 12% of the variance in mentalising ability in their sample). This relationship was partially mediated by verbal intelligence, although parenting quality was found not to have an effect on this relationship. The authors suggested that this connection between attachment and theory of mind is not limited to young children, as they found this relationship in early adolescence as well, which according to them, can be explained by the role of parenting sensitivity that promotes the capacity of the child to be aware of, label, and understand thoughts of feelings of self and other. A child's understanding of one's own intentionality is thought to transfer to the actions and reactions of others, so then children begin to view themselves and others as intentional agents.

In contrast to the above studies, the last few studies discussed found a stronger role for variables other than attachment that impact theory of mind development. For instance, stronger weight was given to other variables such as maternal sensitivity and

elaborative discourse. Symons and Clark (2000) examined the hypothesis that various features of early mother-child relationships in infancy contribute to the development of social understanding and theory of mind by the end of the preschool period. The authors of this study examined their hypothesis with forty-six mothers and their children (20 girls, 26 boys) who they followed from birth. The children were observed when they were two years of age and again at around five years of age. Aspects of the mother-child relationship that were assessed were as follows: maternal emotional distress (self-report measures that focused on maternal depressive symptoms, state and trait anxiety, parental stress, coping behavior, and social support), depression (used the Centre for Epidemiological Studies Depression Scale), situational and dispositional anxiety (measured using the State-Trait Anxiety Inventory Y), stress specific to the parent-child relationship (assessed using the Parenting Stress Index-Form 6), coping resources (Coping Inventory for Stressful Situations), social support, attachment security and maternal sensitivity (assessed using two complementary q-sort measures), and maternal behavior (measured using the Maternal Behavior Q-Sort).

Social understanding and theory of mind ability were assessed using three sets of false belief tasks (Symons & Clark, 2000). There were six object identity tasks where children are sequentially given six objects whose real identity or logical contents of a container differed from their apparent identities or actual contents. Two object location tasks were also developed from Wimmer and Perner's (1983) unexpected transfer task. In these two tasks acted out with DUPLO and LEGO materials, a central character (e.g., Sarah) hides an object such as a toy radio and leaves the room. A foil (e.g., a monkey) relocates the object, and the character returns to the scene. The children were then given

the character and were asked a set of questions such as “Show me what Sarah will do next” and “Where will Sarah look for the toy radio?” In addition to these tasks, there were three caregiver location tasks that were modeled after the object location tasks, had the same format, and were acted out using LEGO characters and materials. The only difference is that the caregiver tasks used searches for a parent-character rather than an object, and situations therefore included the separation of a child-character from their parent in home, beach, and clothing store change room settings. Mother-characters were used to activate attachment behavior.

The results of Symons and Clark’s study (2000) showed that object location task performance was related to a concurrent home-based observational measure of attachment security (r = .30). In contrast to their hypothesis, attachment security and maternal sensitivity at age two did not predict object location task performance. Another finding was that sensitive parenting and maternal emotional distress in infancy were predictive of caregiver location performance at age five. Even though sensitive parenting is closely associated with attachment, the current study’s data points to a generalized measure of sensitive parenting as being more predictive of theory of mind performance than antecedent or concurrent attachment security. Maternal sensitivity is an aspect of the mother-child relationship and reflects the mother’s parental warmth and acceptance, availability for interactions, and appropriate responsiveness within social interchange. Moreover, it also involves the mother being available for interactions, cognizant of the child needs, and meeting these needs in a timely manner. The authors suggested that this maternal sensitivity may be important to theory of mind acquisition because children who have experienced responsive relationships are more likely to view relationships in these

terms and be empathetic to the perspective to others. Despite the finding that maternal sensitivity was a stronger predictor than attachment security of theory of mind performance, the authors suggested that the attachment measure they used may lose important distinctions between insecure-avoidant and insecure-resistant infants because the attachment measure provides only a single quantitative measure on a security dimension.

Also, it may be important to recognize that maternal warmth and sensitivity may not be completely independent of attachment security. Lohaus, Keller, Ball, Voelker, & Elbin (2004), discuss how the literature is mixed with regards to the relationship between sensitivity and attachment. Thus, Lohaus and his colleagues set out to investigate the relationship between maternal sensitivity and attachment. They found that an assessment of attachment of the participants at 12 months of age was not predicted by the sensitivity ratings at three months. This finding suggests that there may be other factors other than sensitivity that influence the development of attachment, although this does not necessarily mean that sensitivity is completely independent of the development of attachment.

Ontai and Thompson (2008) studied the relationships among attachment, mother-child discourse, and theory of mind in 76 four-year-old children (36 males) with a mean age of 4.48 years. The authors hypothesized that attachment would have a direct association with theory of mind, but that mother-child discourse could interact with attachment security in the prediction of theory of mind performance. They also examined whether or not the mother's use of mental state terms in conversations had an influence on theory of mind performance. In the study, theory of mind was assessed using four

tasks: one standard unexpected location task, one requiring the child to attribute an emotion to a story character holding a false belief, one unexpected location task involving the mother as the character, and one emotion attribution task involving the mother as the character. In the unexpected location task, children were told to predict where a story character would look and why after his/her candy bar was moved to a new location without his or her knowledge. In the emotion-attribution task, children were told to predict and explain how a character would feel before and after finding the contents of their favorite drink were switched with another drink. For the caregiver theory of mind tasks, they were modeled after the emotion-attribution task using mothers as the main characters and the child as the protagonist.

The mother-child elaborative discourse was measured by asking mothers to talk to their children about a past event in which they participated together. Whenever the mother took a turn in the conversation, their turns were coded for elaborations (statement or question that moves the conversation to a new aspect of the event or adds information about an aspect), fill in the blank (provides all but a single piece of information and pauses, waiting for the child to utter that missing piece), evaluations (confirms or negates a child's previous utterance), repetitions (repeating the gist of their own previous statement), memory prompts (requesting for more information from the child without providing any additional information), and preference (questions that ask for the child's preference). A mother's elaborative score is obtained by computing the proportion of clauses in which mothers used elaboration, fill in the blank clauses, or evaluations in relation to the total of all coded clauses. Mother-child mental state discourse was measured in the context of event conversations, which were also coded for maternal use

of direct references to mental states that can be defined as references related to will, mind, imagination, interest, intellect, and so on. Attachment security was measured using the attachment q-sort, which consists of 90 descriptive statements of young children's behavior during interactions with their primary caregiver.

The results of the study by Ontai and Thompson (2008) showed that maternal elaborative discourse is a stronger predictor of children's theory of mind understanding (r = .30) than explicit maternal references to the mind. In contrast to previous research, they also found that attachment security did not independently predict theory of mind. Security of attachment also did not interact with maternal discourse variables in the prediction of theory of mind performance. The authors suggested that a lack of a positive finding may be due to the restricted range of attachment scores that may underlie the associations found in their study, along with the fact that the assessment of maternal conversational style was done using only one conversation, which may not give enough attention to the importance of secure attachment in helping children to understand negative or conflicting feelings. In addition to this result, maternal mental state references did not predict theory of mind performance. The authors suggest that the stronger predictive influence of elaborative discourse on theory of mind performance may be because of the multiple paths that it uses to provoke mental state understanding in children, beyond the explicit mental state references in maternal utterances. Elaborative discourse may be valuable in the development of theory of mind because it interacts with the child's utterances in providing paths for provoking a deeper conceptual understanding of mental states by building on the child's own conversational utterances in ways that provoke a deeper insight. Elaborative discourse may build verbal intelligence in the child,

so this study may provide evidence for verbal intelligence as a mediator of the relationship between attachment and theory of mind.

In summary, the existing data regarding the relationship between attachment and theory of mind seems to be mixed. Some studies have shown a strong direct relationship between attachment and theory of mind, whereas others have not, with some showing a stronger relationship between maternal discourse (mental state language references) or verbal ability with theory of mind. In addition to this, some studies have shown that verbal ability may partially mediate the relationship between attachment and theory of mind. The present study attempts to clear up some of these inconsistencies by examining the direct relationship between attachment and social reasoning, while also considering the possibility that language or verbal reasoning may mediate this relationship. Some of the studies that failed to find a relationship between attachment and theory of mind had a restricted range in attachment classifications, which can decrease any possibility that the two variables can be related. The current study will attempt to directly assess the extent to which verbal reasoning serves as a mediating variable in the relationship between attachment and social reasoning but will also assess social reasoning within an analogical reasoning task, and present that task in contrast with an analogous physical reasoning task – tasks which may provide assessments of cognitive skills more broadly construed. Thus, one hypothesis for the present study is that more securely attached children will perform better than more insecurely attached children on social reasoning tasks with verbal reasoning mediating this relationship.

Attachment and Broader Cognitive Abilities

The second aim of this study seeks to examine the relationship between attachment and cognitive abilities more broadly, looking at the impact of attachment on relational or analogical reasoning, and contrasting the effects on social versus physical reasoning tasks within an analogical reasoning problem. There appears to be a gap in the literature with regards to the direct relationship between attachment and analogical reasoning, so the present study can attempt to fill this gap. There are theoretical reasons to assume a relationship between attachment and a broader suite of representational abilities given the research described above and the following theoretical background. Most of the previous research has explored relationships between attachment and language, along with language and analogical reasoning, so it is logical to suppose that language may mediate the relationship between attachment and analogical reasoning.

As Tomasello (1999) and Vygotsky (1978) point out, early attachment relationships or early social experiences are important to the development of language, although joint attention may interact with attachment and exert an influence on language development as well. A study by Murray and Yingling (2000) investigated the links between attachment, home stimulation, and language development in 58 toddlers (36 medically high risk and 22 low risk) at 24 months of age. Specifically, they hypothesized that knowledge of the mother's role as a secure base and as a teacher would increase one's ability to predict language development in children. They also hypothesized that an emotionally responsive and a cognitively stimulating home environment would predict language competence. Security of attachment was measured using Ainsworth's Strange Situation (Ainsworth et al., 1978) at 21 months, while receptive and expressive language

was evaluated by a speech pathologist who used the Receptive and Expressive Emergent Language Scale. The HOME Inventory was used to assess the degree to which the mother acted as a teacher/stimulator. The results showed that attachment and the stimulating characteristics of the mother had an additive effect on language development, specifically, receptive language development. In addition to this, attachment and HOME scores were not correlated, which suggests that these two variables make independent contributions to a child's language development. Attachment security was found to significantly predict expressive language scores, while scores on the HOME Inventory did not. In all, attachment was found to account for 16% of the variance in the model.

Tomasello (1999) noted that language seems to be important to the development of analogical reasoning as evidenced by the fact that those with language impairments often express difficulties with more general cognitive abilities including analogical reasoning. A study by Bandurski and Galkowski (2004) found that both deaf children and hearing children were able to develop skills in analogical reasoning as long as they experienced early and consistent language, whether it be sign language or spoken language. This result suggests that learning language is important to the development of analogical reasoning, even if an individual cannot hear. It is those with language impairments or difficulty in learning a language that have trouble with analogical reasoning because language promotes the abstraction process that is necessary in analogical reasoning.

Baldwin and Saylor (1995) also advocated the importance of language to analogical reasoning because it promotes abstraction and highlights any non-obvious commonalities among objects and events. Evidence for this may come from a study by

Kotovosky and Gentner (1996) who tested a key claim of the knowledge-change view that learning about domain relations should increase identification of relational similarity among objects or stimuli; thus, children are better able to complete an analogical reasoning task when they have appropriate knowledge of a particular domain. They reasoned that they could test this prediction by using relational language, or labels for higher-order relations, to increase the salience of the common relational structure of the stimuli. They taught a group of four-year-olds to label and categorize the higher-order relations of symmetry and monotonicity (the stimuli were increasing or decreasing in size) and then tested them using a series of analogical reasoning tasks. They hypothesized that training on the higher-order relations would lead to increased relational performance when the children were later tested with a series of analogical reasoning tasks. This hypothesis was confirmed. The authors concluded that learning to label and categorize higher-order relations improved four-year-olds' performance in recognizing higher-order commonalities. Thus, relational language made relational patterns more salient for the children and promoted relational learning through the use of a common label that leads children to search for relational commonalities such as symmetry and monotonicity between two different situations. In essence, language allows for abstraction, which assists the child in finding any similarities among the stimuli.

Thus, the proposed study will also test the relationship between attachment and analogical reasoning with language as a possible mediator of that relationship. Even though individuals with insecure attachments do develop language, those with secure attachments are likely to be more comfortable seeking out social interactions with others, which in turn may encourage more advanced development of language because of the

increased opportunities to learn new words and how they are used in different contexts (Block, 2006). Thus, children with more secure attachments may be more likely to have advanced language or verbal reasoning skills. Additionally, language allows an individual to think about things that are not in one's direct visual field, and eventually allows one to think more abstractly. This ability to think more abstractly may allow an individual to process analogies more efficiently. Overall, we predict that securely attached children will perform better than insecurely attached children on two analogical reasoning tasks; a social and a physical reasoning task. Language should be a mediator of this relationship.

Differences in Performance on Social Reasoning and Physical Reasoning

The final aim of this study is to examine whether there are differences in performance on social reasoning tasks and physical reasoning tasks, in order to assess whether the assumed benefits of a secure attachment on a child's developing cognitive abilities are domain-specific, presumably limited to the social domain, or are more broadly construed. Social reasoning in the present study refers to tasks that involve reasoning about emotional states, whereas physical reasoning tasks involve reasoning about activity states, but do not involve the attribution of or inferences about other people's internal mental states. In the related literature, researchers generally use the term "social reasoning" to refer to tasks that involve reasoning about what others are thinking or feeling, that is involve theory of mind. We have chosen to assess cognition more broadly by designing an analogical reasoning task that can involve the attribution of mental states (in this case, specifically emotions) in one version, but allows for the creation of an analogous task that still taps into analogical reasoning, but outside of the social domain. By creating analogous tasks we have avoided confounding variables such

as verbal, non-verbal tasks, for example. Some researchers who have assessed performance on these two variables have used different types of tasks for each, some of which are more verbally oriented and others that were nonverbal, such as using photographs in place of characters or objects. As will be discussed, children with autism were able to perform better on tasks involving photographs rather than the standard false-belief tasks that are more verbal in nature (Zaitchik, 1990). Researchers such as Leslie (1987) have taken this finding to mean that children with autism generally have difficulty reasoning about psychological states and not about non-psychological states; however it is possible that it was the verbal dimension of the task, and not the mental state attribution component per se that caused the children with autism the difficulty.

For instance, Zaitchik (1990) used a false-belief task; however, he replaced a lot of the verbalizations or narrative with photographs. The standard false-belief task involves Sally first placing a marble in a basket and then going away for a walk. While Sally is away, Ann removes the marble and puts it in a box. The child, or participant in the task, is asked about where Sally put the marble in the beginning, where it is now, and where Sally will look for the marble on her return (Wimmer & Perner, 1983). Zaitchik (1990) replaced Sally with a Polaroid camera and Sally's belief is replaced by a Polaroid photograph. The marble is still placed in the basket; however, instead of Sally forming a belief about the marble in the basket, the camera forms a photograph in the basket. The photo is then placed face down on the table, and the marble is then removed from the basket and placed in the box. The child is now asked a different set of questions: Where was the marble when the photograph was taken; where is the marble now really; and where in the photograph is the marble. For typically-developing children, both the

standard false-belief task and the one using photographs are equally difficult. Most typically-developing three-year-olds will fail both tasks, while most four-year-olds pass both tasks. Despite this, there is a small but reliable effect that, if they pass only one of these tasks, it is the false belief instead of the photographs task. In contrast to this, children with autism will perform at or near the ceiling on the photographs tasks, while they fail standard false-belief tasks (Zaitchik, 1990).

Similar results have been obtained with drawings and maps (Charman & Baron-Cohen, 1992; Leekman & Perner, 1991; Leslie & Thaiss, 1992). Like photographs, drawings and maps also tend to stand for something else. So as discussed above, children with autism were able to understand the false photographs better than the false belief tasks even though the procedures, instructions, any syntactic forms of questioning used in both the false photograph and false belief tasks were almost identical. In contrast, typically developed children tend to find false belief tests at least as easy as tests of similarly false representation by a camera. Although these studies may suggest specific deficits in representations of mental states for children with ASD, most of the studies used a drawing or a photograph to stand for something else.That is, children with autism were able to perform well on tasks that involved photographs, drawings, and photographs (which stand for something else), but they were not able to do well on tasks that involved representing mental states.

According to Leslie's (1987) and Perner's (1993) metarepresentational theories, children with autism are *able* to directly represent objects, situations, and real-world scenarios, but they are not able to represent representations of representations. Declarative sentences, drawings, and beliefs that were used in the false-belief tasks and

the tasks involving photographs all stand in representational relations to their objects. To represent that relation is to metarepresent, to form a higher-order representation of a first-order representational relation. An example would be "that sentence says that X is F" or "that painting is about F." Initially, the metarepresentational theory was proposed to explain how children with autism's difficulty with theory of mind tasks are due to a generalized inability with metarepresentation, which manifests itself in social contexts as an inability to form beliefs about others' mental states-hence the difficulty with theory of mind tasks or reasoning about psychological states (Gerrans, 1998).

This account does not explain why children with autism perform better on false-photograph tasks and not as well on the standard theory of mind tasks (whereas typically developing children do better than children with autism on the standard theory of mind tasks). Leslie's (1987) explanation for this finding is that the standard false-belief tasks require more of a capacity to metarepresent psychological states that is separate from a generalized metarepresentational capacity. Thus, it would seem that children with autism are able to metarepresent or to form a higher-order representation of a first-order representational relation, but they are not able to do this with psychological states. In contrast to this, typically-developing children seem to have an advantage on the social reasoning or theory of mind tasks. This suggests a domain specific skill for reasoning about mental states that may be enhanced by language related skills.

In the present study, we investigate whether or not typically developing children have an advantage on social reasoning tasks that may be enhanced through verbal reasoning, or through the formation of more secure attachments. Because typically developed children do well on the standard false-belief task, this suggests a domain-

specific skill for reasoning about mental states that could potentially be enhanced through language skills. The present study can determine if typically developed children do poorly on the physical reasoning task (which would be akin to the false-photograph task in that it does not require reasoning about psychological states) compared to the social reasoning task – but still requires dual representation. If they were to do poorly on both types of tasks, it may suggest a problem with generalized metarepresentation or problems with analogical reasoning more broadly. These specific differences in performance may suggest the existence of two different types of reasoning, namely social and physical reasoning.

Other studies from both the animal literature and human literature support the idea that there are two different types of intelligence or reasoning (Brauer, Kaminski, Riedel, Call & Tomasello, 2006; Cosmides, 1989; Herrmann et al., 2007, 2010; Scott & Baron-Cohen, 1996), so the present study will also attempt to test this idea as well as Leslie's (1987) theory. Scott & Baron Cohen (1996) provided evidence in support of Cosmides' (1989) theory that specific brain systems in humans may have evolved specifically to solve social and intentional (or non-social) problems. Specifically, they conducted a study with children who had autism to assess whether or not social and nonsocial intelligence are independent of each other and if the difficulty of children with autism on theory of mind tasks is due to an underlying deficit in abstract reasoning rather than specific reasoning about mental states). They found that children with autism have deficits in mental state reasoning in particular and not with general abstract reasoning.

The study by Cosmides (1989) suggests that human intelligence evolved in order to solve social problems that arise in a social context. For instance, the results of her

study showed that the performance of normal adults on tests of logical reasoning (using the Wasoncard sorting problems) is facilitated when the problems are set within a social context of exchange and deception. The participants are given four cards in the Wason Task. Each card has a p or a p' on one side and a q or a q' on the other side. They are then asked which card he or she needs to turn over to identify violations to the rule, "If p, then q." Normal adult participants do not do well on this particular task because they turn over cards that are not relevant to this rule. For example, they turn over p and q' even though these cards are not relevant to the task. On the other hand, when the participants are given social rules of the same logical complexity, such as "If a person buys alcohol, then or she must be 18 years of age," they do well at checking for violations to the rule in a more logical manner. If they see a card with a person that is under 18 for instance, they would turn it over to see if the person is drinking alcohol. They were not likely to turn over a card that showed someone who is over the age of 18 because it has no social consequences. Generally, Cosmides (1989) suggests that typical adults have a propensity to reason well when these sorts of rules from the Wason Task are given within a social context. This is support for the fact that reasoning within the social domain may be superior to that within the physical domain for most typically developed humans; both adults and children. Based on this study and other studies previously discussed (Zaitchik, 1990), this leads to the third main hypothesis of the present study, which is that typically developed individuals will perform better overall on social reasoning tasks than on physical reasoning tasks, regardless of attachment or verbal IQ.

The Present Study

In the present study, social and physical reasoning were assessed in analogous match-to-sample tasks. The only difference between the tasks was the type of stimuli presented in each task. For the social reasoning task, the participant was required to reason or make inferences about emotional states, whereas in the physical reasoning task, the participant was required to make inferences about a physical task that individuals were engaged in. Both versions of the task were designed in an attempt to ensure that the participants were not responding to particular physical features of the images used, so that the tasks were of equivalent difficulty and successful performance could not be achieved by a perceptual feature analysis alone.

The specific aim of this study is to examine the relationship between attachment and verbal reasoning and two types of reasoning: social reasoning and physical reasoning within the context of an analogical reasoning task. There are several different possible outcomes or alternative pattern of results that could be obtained from this study:

Hypothesis 1: Children who score high on attachment will perform better than children who score low on attachment on social reasoning tasks. Hypothesis 1a: Verbal reasoning will mediate the relationship between attachment and social reasoning.

Hypothesis 2: Children who score high on attachment will perform better than children who score low on attachment on both social and physical reasoning (analogical reasoning) tasks. This result would suggest a broader advantage for attachment than facilitating social reasoning alone, such that greater attachment might enhance analogical reasoning across social and physical domains. Hypothesis 2a: Verbal reasoning will mediate the relationship between attachment and analogical reasoning tasks.

Little research has examined the relationship between attachment and social reasoning in typically developing children, and the research has been mixed. Some studies have found a relationship between attachment and theory of mind, while others have not. The majority of these studies used false-belief tasks to measure theory of mind reasoning. The present study will utilize a different measure of social reasoning. Additionally, not many of the studies used verbal intelligence as a mediator, so the present study will include a measure of verbal reasoning as a mediator of the relationship between attachment and both social and physical reasoning tasks. Humfress et al. (2002) suggested that verbal intelligence may help explain the relationship between attachment and theory of mind. Tomasello (1999) also suggested that early social experiences are important to the development of language, while language is also important to the development of social reasoning such as theory of mind. Thus, the purpose of assessing language as a mediator is based on prior research (as discussed earlier) and theory. No known research has directly examined the relationship between attachment and analogical reasoning, so this aspect of the study can make a significant contribution to the literature.

The third aim of this study will assess differences in performance on social reasoning and physical reasoning tasks. In addition to allowing us to assess whether any effects of attachment and verbal reasoning were specific to social reasoning or general to analogical reasoning across both tasks, this comparison also allows us to assess Leslie's (1987) ideas about the generalized metarepresentational capacity and the metarepresentational capacity for psychological states. Leslie proposed that children with autism are missing the metarepresentational capacity for psychological states. So,

presumably, typically-developing children should do well on tasks that involve metarepresentation of psychological states, an idea that is supported by several of the studies discussed earlier (Zaitchik, 1990). These findings imply that typically-developing children should do better on social reasoning tasks in general. This brings us to Hypothesis 3: Typically developed children should perform better on a social reasoning task than on a physical reasoning task.

CHAPTER II

METHOD

Participants

We tested 67 typically-developing children who ranged in age from 8.80 to 12.60 (the mean age was 11.00). Furthermore, 32 of the participants were female and 35 of the participants were male. Based on an article by Kotovosky and Gentner (1996), who suggested that most 8-year-olds (90% or so) can reason relationally, we targeted eight-year-olds for pilot testing of the analogical reasoning tasks. Due to poor performance on the pilot tests, the target age range for the study was increased to nine to eleven years of age. The children were recruited from elementary schools, child development centers, and daycares in Hattiesburg, MS and Ocean Springs, MS. Most of our sample came from North Taconi Elementary in Ocean Springs, MS and through the University of Southern Mississippi's psychology participant pool (i.e. children of our undergraduate students). No children were excluded from the study based on gender or other criteria.

Measures/Materials

Attachment Security

The Security Scale was used to assess children's perceptions of security in parent-child relationships in middle childhood and early adolescence (Kerns et al. 1996). We typically assessed children's perceptions of security in their mother, but if the birth mother was not the primary caretaker, they were asked to answer questions about their father or stepmother, grandmother/grandfather –whoever the primary caretaker was. Items on the Security Scale tap the following in relation to specific attachment relationships: (a) the degree to which children believe that a particular attachment figure

is responsive and available; (b) the child's tendency to rely on the attachment figure in times of stress; and (c) the child's ease and interest in communicating with the attachment figure. This measure includes 15 items that are on a 4-point scale using Harter's (1982) "Some kids…other kid" format. Children are instructed to indicate which statement is more characteristic of them and then to indicate whether the statement was *really true* (1) for them or *sort of true* (4) for them. The items for the Security Scale are indicated in Appendix A. Items are scored on a 4-point scale with higher scores indicating a more secure attachment. To obtain a continuous dimension of security, scores across items are averaged.

As for the reliability of this measure, coefficient alphas for third-grade participants were .63 and .82, for mother and father, respectively, while the coefficients for sixth-grade participants were .79 and .87, for mother and father, respectively. Test-retest reliability is indicated by coefficients of .84 and .88, respectively, for two studies with 10- to 12-year-old children and a 14-day interval test-retest correlation of $r(30) = .75$. As for criterion validity, children's reports of security were related to children's ratings of self-concept, peer ratings of liking, observer ratings of interactions with friends, and mother reports of acceptance of the child (Kerns et al., 1996). Discriminant validity is also evidenced by the fact that security scores were not related to school grade point average or to children's self-perceptions of athletic competence (Kerns et al., 1996). Children from the third grade sample in the Kerns et al. (1996) study participated in a follow-up study two years later (Contreras, Kerns, Weimer, Gentzler, & Tomich, 2000; Kerns, Tomich, Aspelmeier, & Contreras, 2000). Children involved in this study completed the Separation Anxiety Test (SAT; Resnick, 1993), a projective interview that

assesses children's state of mind with respect to attachment. Security scores were found to be associated to both the ratings and classifications from the SAT. This measure was selected for the current study because it was the most age-appropriate measure that did not require extensive observation and lacked some of the difficulties associated with discrete measures of attachment (Ainsworth et al. 1978). Using a continuous measure of attachment allows for easier measurement of correlations with other continuous measures such as verbal reasoning.

Verbal Reasoning

In the present study, we assessed language skills with a measure of verbal reasoning; the verbal subscale of the Weschler Intelligence Scale for Children-3rd edition (Weschler, 1991), which is designed as a measure of a child's intellectual and cognitive ability. We used the WISC-III rather than the WISC-IV because we wished to avoid the possibility of contaminating later educational testing, given that a lot of schools currently use the WISC-IV for assessment. The subtests are common across both the WISC-III and WISC-IV, so conclusions based on either are valid for the purposes of this study, which are not diagnostic in nature. For the purposes of this study, the Verbal Comprehension Index (VCI), which is part of the WISC-III, was used to assess verbal reasoning. This scale includes four subtests: Vocabulary, Comprehension, Information, and Similarities.

Reliability of the WISC-III is evident in a number of ways, although the focus here will be on the Verbal Comprehensive Index and its related subscales. As for internal consistency, the Verbal Comprehension Index has a coefficient of .94 (Weschler, 1991). For the specific subtests that were used in our study, the average coefficients were .87 (Vocabulary), .81 (Similarities), .77 (Comprehension), and 84 (Information). These

internal consistency coefficients were the averages across all age groups (age 6-16). Test-retest reliability was assessed using intervals ranging from 12-63 days and six different age groups. Generally, the WISC-III scores possessed adequate stability across time and across age groups. For the Verbal Comprehension Index, the average corrected stability coefficient for all ages is .93. For the related subscales, the stability coefficients were .89 for Vocabulary, .81 for Similarities, .85 for Information, and .73 for Comprehension.

Construct validity in the WISC-III has been investigated through factor analyses. First of all, numerous studies have demonstrated the existence of a global intelligence construct that is significantly related to important social criteria such as academic achievement and educational attainment. Furthermore, Carroll (1989) has used hierarchical factor analysis to show the presence of g and other high order factors in the WISC-III. As for the other factors of the WISC, numerous studies have confirmed the existence of two major factors underlying the subtests of the WISC-III, Verbal and Performance. Criterion validity has also been investigated in the WISC-III. Concurrent studies have been done on the WISC-III and WPPSI (Quereshi & McIntire, 1984). For the Full Scale IQ, the correlation was .85, while the correlation for the Verbal Intelligence Scale was .86.

Basic Materials

The MTS tasks were presented on an HP Tablet tx2100us Notebook PC with a touch screen monitor. Additionally, images used for the MTS tasks were 400 X 600 pixels standardized images, downloaded from FOTOSEARCH.com. Images will be described in more detail below in the context of the Procedure. Stickers and stickerbooks

were used as reinforcements, so that after completing the WISC and security scale measures the child had a completed sticker page that he/she could take with him/her.

Procedure

All assessments/measures were set up and ready to go before the parent and the child arrived at each session. Once the parent and child arrived, they were greeted and directed to a private room where all paperwork/informed consent was completed. Before the experiment began, the parent was asked to sign a consent form for the child's participation in the study. After completing all paperwork, the parent was directed back into the waiting room or seating area. This sequence of events occurred if the study was conducted at the university. If the study was conducted at a school during school hours, the child would have brought the signed consent form back to the school. Then, the child was removed from regular activities and taken to a separate room for testing by the experimenter who worked with the teachers to ensure that the testing was minimally disruptive to the child's regular activities. Occasionally, when two testers were available, two children were brought out of their daily activities in order to complete testing at the same time.

The order in which the tasks were given was counterbalanced across all of the children. The children were told they could take a break between tasks if they needed to. Testing took place over one day for each participant, and it took approximately 40 minutes to one hour to complete all measures.

Category Match-To-Sample.

In order to assess the children's comprehension of analogies using the MTS paradigm, it is of course essential that they first understand the basic procedure we used

to test their analogical competency. We initially tested 10 children using the same task to ensure that children of this age could complete the task that we used in testing. In addition to allowing us to assess whether children understood the basic MTS procedure, this task also provided a measure of whether the children could discriminate what is being depicted in the stimuli – that is whether they ascertained the activity and emotion being depicted.

For this task, the experimenter sat next to the child who sat directly in front of a laptop tablet computer with a touch screen. During the Category MTS task, each child received a total of 24 trials that were separated into two 12 trial sessions. There were 12 trials involving matching of emotions and 12 trials involving matching of physical activities. For the emotion matching trials, there were four total emotions used (happiness, sadness, anger, fear) with each emotion category being used as a sample three times, and a different image being used each time. For example, a sample image depicting happiness was used three times as a sample, and was presented with a correct match depicting happiness (although it wase a different image than the one used in the sample), and with an exemplar from each of the other emotion categories as incorrect matches once. For instance, since happiness was used as a sample for three trials, incorrect matches depicted different emotions such as anger, surprise, and sadness. For the physical activity trials, there were four total activity categories used (cooking, art, school, and sports), with each activity being used three times as a sample – a different particular exemplar from that category each time. For example, an image depicting sports was used three times a sample, which was matched with another, but different image,

depicting sports, and paired with each of the other three activities once as the incorrect matches.

During both the social and physical reasoning trials of the category match-to-sample task, an image appeared in the center of the monitor. The child touched the image in order for two comparison images to appear. The sample then minimized and appeared at the bottom of the screen, centered, and two new images appear aligned at the top of the screen. Then, the child's task was to select from the two comparison images the one that matched the sample in terms of depicting an image from the same category (either the same emotion or the same physical activity). Photographs were presented and paired randomly with the constraint that the correct options appeared on one side of the screen no more than three times in a row. If the child selected the correct match, a pleasant tone sounded, and the experimenter wrote down a tally mark to keep track of the ones that the child got correct (so the child could get stickers for correct answers later). The experimenter then said "that's right; great job!" If the child touched the non-match, an unpleasant buzzer sounded, and the experimenter said "that's ok, try again!" The next sample then appeared and the procedure continued until the child has completed all 24 trials (2 separate sessions of 12 trials each). At the end of the 12^{th} trial for each task, an output screen appeared which informed the experimenter of the child's level of performance. If the ten children we tested as pilot participants achieved a mean level of performance of 80% on each task, social and physical, we began recruiting participants for our study that included the main reasoning tasks. It was based on performance on this pilot testing that we initially decided to test approximately 60-100 children on the testing procedure as well, and subsequently determined that we needed to test older children than

initially believed, because the computer tasks proved too difficult for eight year old children to master.

Testing

This phase included two 24-trial sessions (24 trials each for social reasoning and physical reasoning) of relational matching. Half of the children (randomly assigned) received the social reasoning task first and half of the children received the physical reasoning task first. Both tasks followed the same basic procedure as the pilot training tasks, except that, instead of the correct comparison image being an exact match to the sample image, it was one that depicted the same analogical relationship as the sample (sameness or difference). Within each 24-trial session, there were 12 trials devoted to the analogical relationship of sameness, while the other 12 trials were devoted to the analogical relationship of difference. Same and different trials were presented in random order, with the constraint that no more than three trials of each type can be presented in a row. The experimenter did not provide any hints, guidance or assistance of any kind during Testing except to encourage the child by saying "good try, keep trying" when the child is incorrect, and to praise the child and give the child stickers when the child is correct.

Initially we gave the children a set of instructions to follow, which avoided the use of any terms such as "same" and "different" and deliberately provided little guidance as to what specifically determined the nature of the analogy between the sample and comparison images. However, very early on, it was easy to see that the the children had difficulty understanding and completing the reasoning tasks. After modification of the

instructions through working with the first few participants, these were our final set of instructions that were given to each child for both sets of reasoning tasks:

> So you will be seeing a series of pairs of photographs on the computer screen and what I want you to do is to pay attention to the pair of photos that you see at the bottom of the screen just like these ones. Now what you should do is look carefully at this pair of photos and look to see if you think these two photos are showing you two things that are different from each other or two things that are the same as each other. Then, I want you to hold the photos down like this (demonstrate) either with your finger, or this pen, whichever you prefer, until these two other pairs of photos appear at the top of the screen. Now I want you to look at these two pairs of photos and try to figure out which ONE has the same relationship between them as is shown by the pair of photos at the bottom of the screen. So, if you think the two photos in the pair at the bottom are the same as each other, then you should choose the pair of photos at the top of the screen that are the same as each other. But, if you think the two photos at the bottom are different from each other, choose the pair at the top that are different from each other. You can only choose EITHER the pair of photos on the left OR the right- you can't choose both. You choose just by touching whichever pair you think shows the same relationship between the two photos as is shown by the pair of photos in the bottom pair of photos.

It was decided that it was better to reduce frustration and floor performance by providing more guidance in the task. Participants still did not achieve ceiling level performance,

and we were still able to obtain differences in performance between the social and physical versions of the task, which still allowed us to test our critical hypotheses.

Social Reasoning

The goal of the task was to select the comparison image that matches the sample image by demonstrating the same analogical relationship between the two images depicted. For half the trials, the correct matches were similar emotions. For example, a sample stimulus depicted two different images of people experiencing the same emotion (e.g. both are sad). The correct match depicted the image that shows two different people sharing the same emotion, but a different emotion than that depicted in the sample (for example both are happy). Thus the analogical relationship between the images is one of sameness or same emotional state or shared emotional state between the two people depicted but the exact emotional state between the sample and the correct comparison image is not the same. On the other half of trials the sample stimulus depicted two different images of people experiencing different emotions, so the correct match was the image showing two different people experiencing different emotions (but emotions that are either the same or different from the sample image). Here, the analogical relationship between the two images is one of difference (two different emotional states). Correct and incorrect options occurred equally often on each side of the screen, with correct options occurring no more than three times consecutively on one side.

The images that were used in this study depicted combinations of four different mental states or emotions (fear, anger, sadness, and happiness) using 72 composite image pairs. Within the categories of emotion, the images did not simply depict facial expressions so that the images can be identified on the basis of a salient physical feature.

Rather, the people were depicted engaging in various activities in which one would have to infer the emotional outcome. For instance, within the happy set/category, images might depict someone opening a gift, eating chocolate or ice-cream, receiving a hug while smiling, buying a puppy etc. Thus, the images within a category are heterogeneous in terms of their features but the individuals depicted nonetheless share the same emotion by virtue of the activity engaged in or the behavior directed towards them. For the same emotion trials, each emotion matched with itself were utilized three times as the sample (e.g. happy/happy, sad/sad, angry/angry and surprise/surprise pairings), while the correct match were pairs of images that depict the same emotions, only these emotions would not be the same emotion that was depicted in the sample. For example, if the sample depicted two images of people who were happy, the correct match showed two images of people who were either both sad, both angry or both fearful. Therefore each same composite image pair was used once as a correct match for each of the other emotion composite pairs and three times as an incorrect match on the different trials, so that there were nine same composite image pairs for each of the four emotions, for 36 total same emotion composite images. In this way, because each same/same emotion pairing is presented nine times throughout each session, but we wished to use different images each time this emotion is presented, nine different images representing this emotion category paired with itself are necessary.

In addition, there are six composite pairs of each of the six different emotion pairings; sad/happy, sad/angry, sad/fearful, happy/angry, angry/fearful, happy/fearful, creating 36 composite different pairings total. Thus, in all, there were 72 total composite images used in this task. Each of the different composite pairings were used twice as a

sample, twice as a correct stimulus, and twice as an incorrect stimulus during a session. A different image was used each time, thus necessitating the use of six different images representing each possible "different" pairing. If sad/angry is the sample then a correct stimulus must also depict two emotions that do not match, such as fearful/happy. On half of the different trials, one of the emotions in the correct stimulus matched one of the emotions from the sample. On the other half of different trials, neither emotion in the correct stimulus matched the emotions depicted in the sample. The incorrect stimulus used the 'same' emotion composite images described above. Again, on half the trials, that emotion was the same as one of the emotions depicted in the sample. On the other half of trials that emotion was not the same as either one of the emotions depicted in the sample.

Physical Reasoning

The physical reasoning task also involved the match-to-sample paradigm described above, following the same procedure as described for the social reasoning task, and the same counterbalancing of stimuli as described, but using different stimuli. In this task, the images depicted cooking, sports, art, and school activities rather than emotions, such that the child was required to reason about the physical relationship between the people depicted in the stimuli rather than the emotions that they are feeling. For half of the trials (twelve trials), the correct matches were similar activities. For example, a sample stimulus depicted two different images of people experiencing the same activity (e.g., both are cooking). The correct match was the image that shows two different people sharing the same activity, but a different activity than that depicted in the sample (for example both are engaging in sports). Thus the analogical relationship between the images is one of sameness or same physical activity between the two people depicted but

the exact physical activity between the sample and the correct comparison image is not the same. On the other half of trials the sample stimulus depicted two different images of people experiencing different activities, so the correct match was the image showing two different people experiencing different activities (but activities that are either the same or different from the sample image). Here, the analogical relationship between the two images is one of difference (two different physical activities).

The images that were used in this study depicted combinations of four different physical activities such as sports, cooking, school, and art activities by using 72 composite image pairs. For the same physical activity trials, each physical activity matched with itself was utilized three times as the sample (e.g., cooking/cooking, sports/sports, school/school, and art/art pairings), while the correct match were pairs of images that depict the same physical activity, but these activities were the same activity that was depicted in the sample. For example, if the sample depicts two images of people who are engaging in sports, the correct match showed two images of people who are either both cooking, both engaging in some of art activity, or both engaging in a school-related activity. Therefore each same composite image pair were used once as a correct match for each of the other physical activity composite pairs and three times as an incorrect match on the different trials, so that there was nine same composite image pairs for each of the four physical activities, for 36 total same physical activity composite images. In this way, because each same/same activity pairing is presented nine times throughout each session, we wished to use different images each time this activity was presented. Thus, nine different images representing this activity category paired with itself was necessary.

In addition, there were six composite pairs of each of the six different physical activity pairings; cooking/art, cooking/school, cooking/sports, art/school, school/sports, art/sports, creating 36 composite different pairings total. Thus, in all, there were 72 total composite images used in this task. Each of the different composite pairings was used twice as a sample, twice as a correct stimulus, and twice as an incorrect stimulus during a session. A different image was used each time, thus it necessitated the use of six different images representing each possible "different" pairing. If sports/cooking is the sample then a correct stimulus must also depict two activities that do not match such as school/art. On half the different trials, one of the activities in the correct stimulus did not match one of the activities from the sample. On the other half of different trials, neither physical activity in the correct stimulus matched the physical activity depicted in the sample. The incorrect stimulus used the same physical activity composite images described above. Again, on half the trials, that physical activity was the same as one of the physical activity depicted in the sample. On the other half of trials that physical activity was not the same as one of the physical activities depicted in the sample.

As with the social reasoning task, it is important to note that within the categories, the images used were not homogenous on any particular feature or object. For instance, within the activity of cooking, images could include people cutting up fruit, rolling dough, stirring pasta, stir frying meat, barbecuing etc. None of the images would be of exactly the same activity, but all would belong to the same general category, such that the child would have to be reasoning about an abstract category and not a single perceptual or physical feature contained within the images.

CHAPTER III

RESULTS

Descriptive Statistics

The means and standard deviations of each construct are presented in Table 1. As shown in the table, the mean for attachment was 3.17. Scores on this scale can range from one to four, so this mean of 3.17 suggests that most of the participants were reporting high levels of attachment. Additionally, the standard deviation was very low at .54. The scores on this measure ranged from 1.53 to 4.00. The low standard deviation could be a potential issue due to the restricted range of this variable, so it is possible that attachment may not associate with any of the other variables. Additionally, the skewness of this variable was pretty high at -1.20. This, again, suggests that most of the children were scoring high on this variable. Thus, to best deal with the issue of negative skew, we transformed this variable by using the square root and log. Transforming attachment using the log made no difference over transforming it using the square root, so we used only the square root of all attachment scores in all analyses reported below.

Table 1

Means and Standard Deviations of Constructs

Variables	M	SD
		.
Attachment	3.17	54
Verbal Reasoning	101.18	13.94
Social Reasoning	68.22	21.13
Physical Reasoning	76.24	17.13

The mean for verbal reasoning was 101.18, while the standard deviation was 13.94. In a standardization sample of 2,200 who ranged in age from six to 16, the mean for this scale was a 100 (Weschler, 1991). Thus, our participants seem to be comparable to the standardization sample. The standard deviation was also high at 13.94, which suggests that we have a range of scores on this variable. The standard deviation of our participants was comparable to the standard deviation of the standardization sample, which was 15.

The mean percentage correct for our participants on the social reasoning task was 68.22, while the standard deviation was 21.13. The mean percentage correct for the physical reasoning task was 76.24 correct, while the standard deviation was 17.13. The highest percentage that can be obtained is 100%, so our participants seemed to score relatively high on these measures, although the variance suggests that we obtained a wide range of scores for each type of reasoning task. Both of the social and physical reasoning tasks have not been used before, so there is no normative sample to compare these results to.

The intercorrelations among all of the variables are presented in Table 2. Note that attachment has been transformed using the square root. As Table 2 indicates, there is a significant positive relationship between social and physical reasoning ($r = .55$, $p < .01$). The relationship between verbal reasoning and social reasoning approached significance ($r = .23$, $p = .06$). Interestingly, attachment was not correlated significantly with verbal reasoning, nor was it related to social and physical reasoning.

Table 2

Bivariate Correlations among Attachment (Transformed), Language, Social and Physical Reasoning

Variables	1	2	3	4
Attachment	-	.02	.11	.13
Language		-	.23	.19
Social Reasoning			-	.55**
Physical Reasoning				-

Hypothesis Testing

The proposed model is depicted in Figure 1 below.. Before any analysis was done, the 15 items from the Security Scale were randomly assigned into three parcels with five questions within each of the parcels. Additionally, three subscales (Similarities, Vocabulary, and Comprehension) from the Verbal Comprehension Index were used as indicators of verbal reasoning. Thus, there were two latent variables and three observed variables.

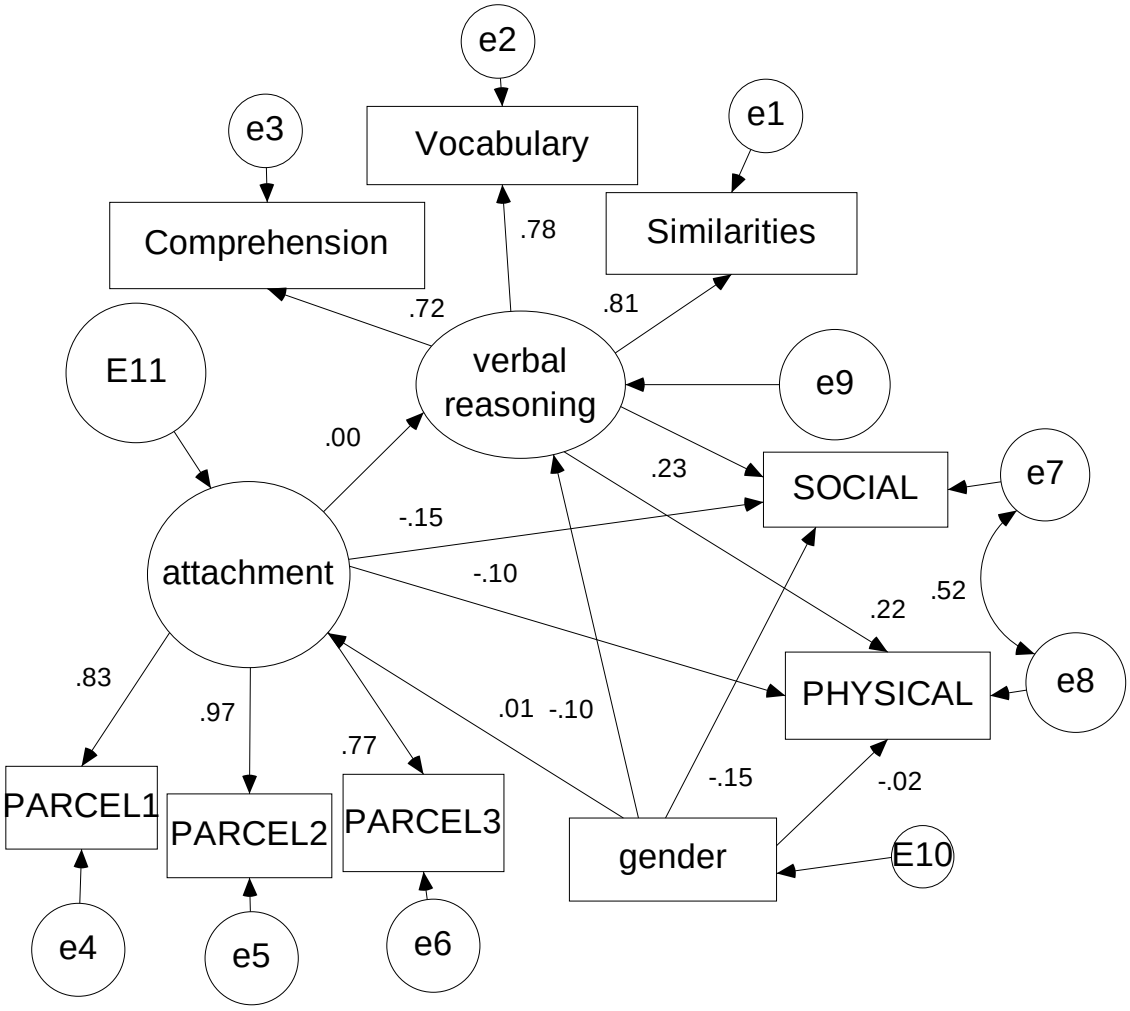

Figure 1. The Proposed Model that was Tested.

Using AMOS 5 and the maximum likelihood method, the first step is to ensure that the measurement model fits the data well. The test of this theoretical model revealed interpretable parameter estimates and adequate fit indices: χ^2 (8, N = 67) = 7.29, p = .50; CFI = 1.00; TLI = 1.00; RMSEA = .00. Upon examination of the modification indices and standardized residuals, there seemed to be no justification for making model modifications.

The next step is to determine if the structural model depicted in Figure 1 is a good fit for the data. For this model, the latent variable attachment is thought to influence verbal reasoning, which should, in turn, influence social and physical reasoning (two more observed variables). The chi square and fit indices for this model are as follows: χ^2 (17, N = 67) = 35.09, p = .00; CFI = .91 ; TLI = .86; RMSEA = .13. Additionally, the path from verbal reasoning to social reasoning was significant as indicated by a factor loading of .28, $p < .05$. The path from verbal reasoning to physical reasoning approached significance as indicated by a factor loading of .26, p = .06. Interestingly, attachment was not related to any of the other variables.

Upon examination of the modification indices, it was found that there may be some justification for making model modifications. For instance, the modification index was 17.57 for the covariance between the physical and social reasoning error terms. Because these two types of tasks are both match-to-sample analogical reasoning tasks, it would make sense to correlate the error terms. The chi square and fit indices for this new model with the error terms correlated are as follows: χ^2 (16, N = 67) = 14.878, p = .53; CFI = 1.00; TLI = 1.00; RMSEA = .00. The chi square difference test was used to compare these nested models (the original model and this new model) for significant changes in the chi square statistic. For a change in one degree of freedom (this new model lost one degree of freedom), the critical value for the chi-square distribution is 3.84. This model's chi-square did decrease significantly more than this value, so the new model would be considered a better fit than the original model. This model would also be accepted over the original model because it makes sense to correlate the error terms for physical and social reasoning, since they are similar sorts of tasks.

Since there were some model modifications that were done, it makes sense to also reexamine the significance of the relationships among the variables in the model. The path from verbal reasoning to social reasoning was close to significant as indicated by a factor loading of .25, $p = .06$. The path from verbal reasoning to physical reasoning was not close to significance as evident by a factor loading of .22, $p = .11$. Below, Table 3 depicts the standardized and unstandardized betas, along with the standard errors for these regressions.

As a last look at this structural equation model, gender was added as a variable to determine if it was associated with any of other variables. The chi square and fit statistics are as follows: χ^2 (20, N = 67) = 17.14, $p = .64$; CFI = 1.00; TLI = 1.02; RMSEA = .00.

Table 3

Bivariate Regression for Verbal Reasoning Predicting Social and Physical Reasoning

	B	*SE B*	β
Social Reasoning	2.32	1.33	.23
Physical Reasoning	1.73	1.10	.22

When examining the regression paths, gender was not significantly related to any of the other variables in the model. Overall, gender did not have much of an effect on the fit of the model as most of the fit indices are the same, and it also does not seem to be related

to any of the other variables. Thus, the previous structural equation model should be accepted over this one.

The last hypothesis that we tested was whether or not there were significant differences in performance on the social and physical reasoning tasks. There was a significant difference in performance as indicated by a two-tailed t-test, t (66) = 3.56, $p <$ .001, although this was not in the expected direction given that the participants on average performed better on the physical reasoning than on the social reasoning task. In Table 1, the mean for performance on the physical reasoning task was 76.24, while the mean for the social reasoning task was 68.22.

In addition to examining percentage correct, we also examined children's rate of responding as an additional measure of performance. A two-way repeated measures ANOVA was conducted in order to assess whether there were significant differences in reaction time on the social versus physical reasoning tasks, as a function of whether the participant responded correctly or incorrectly on the trial. There was a significant interaction between the type of task and correctness of response, F (1, 66) = 5.51, p = .02. As can be seen in Figure 2 depicted below, there were significant differences in reaction time for correct and incorrect responses only on physical reasoning tasks, F (1,66) = 9.80, $p <$ .01. On physical tasks, participants responded more slowly when incorrect (M = 14802.85 ms, SD = 1783.37), than when correct (M = 9983.88 ms, SD = 980.25). As an explanation for this result, it may be that the participants responded more quickly when they were incorrect on the social trials because they were paying more attention to absolute salient features that matched between the sample and the incorrect comparison, rather than attending to the relation between the images in each composite stimulus. For

example, if there was a happy face in the sample stimulus, they may have been drawn to the incorrect option thatt also depicted a happy face, and quickly responded that option. On the other hand, the stimuli used on the physical trials may not have contained the same kind of physical features that would have been common between images in sample and comparision images, so participants may have had to attend more slowly, in particular when they had difficulty ascertaining the correct response.

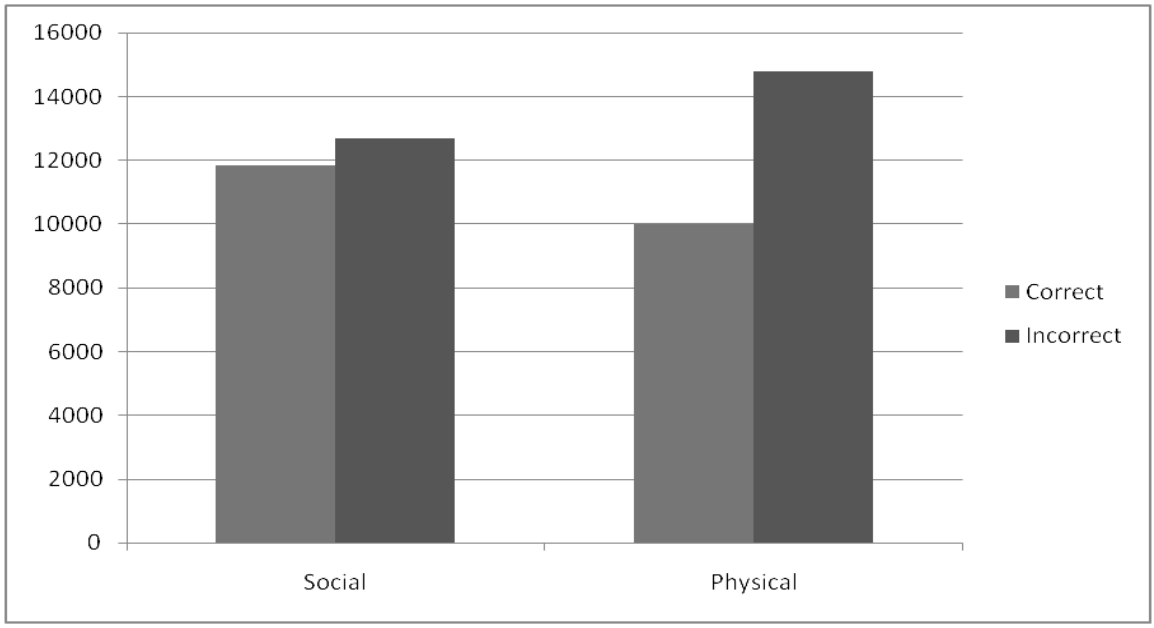

Figure 2. Average Reaction Time in Milliseconds on Correct and Incorrect Responses within the Social and Physical Reasoning Tasks

CHAPTER IV

DISCUSSION

The purpose of this study was to test whether or not verbal reasoning mediated the relationships among attachment and two types of reasoning, social and physical reasoning. Several relationships were tested. The first relationship tested was among attachment and social reasoning with language as a mediator of this relationship. The second relationship that we tested was among attachment and physical reasoning with language as a mediator. Last of all, we determined if there were any significant differences in performance among the social and physical reasoning tasks.

In contrast to our hypotheses, attachment was not related to any other variable in our model. We predicted that higher levels of attachment security would be associated with verbal reasoning and/or related to the physical and social reasoning tasks. However, the lack of significant findings could be due to the fact that the security scale was negatively skewed. In other words, most of the participants scored high on this scale, so there was not a lot of variance in the scores. This is a potential limitation to our study because the low variance in this scale could have prevented the possibility of any significant findings. Thus, it is hard to draw any firm conclusions about the contribution of attachment to any of the other variables. Because our sample did not include children who scored low on our measure of attachment, it means that ultimately we were not able to test the relationship between attachment security and the development of social and physical reasoning, because there was no variance in attachment. Put another way, we could not ultimately compare the performance of children with lower levels of attachment to those with higher levels of attachment on our dependent measures because we obtained

scores from children from only one end of the distribution. Therefore, we cannot really say where the differences might lie based on our data. If all of the children from our sample were at ceiling on this measure, we probably did not have the power to detect any differences. Future studies that obtain a more diverse sample that varies in attachment may be more likely to reveal significant patterns between these complex variables.

However, it should be noted that our results were not extremely discrepant from other published results using the same measure of attachment. First, a study by Diener, Isabella, Behunin, and Wong (2007) investigated the association among attachment, child gender, grade, and competence. Their mean for security of attachment with mothers for girls was 3.37, while the standard deviation was 0.43. Similarly, the mean for security of attachment with mothers for boys was 3.29 and the standard deviation was .45. In contrast to our own study, attachment was related to their variables of interest as attachment was significantly correlated to self-perceived peer competence and self-perceived academic competence. Kerns, Aspelmeier, Gentzler, and Grabill (2001) investigated the relationship among attachment and monitoring in middle childhood. For their third grade participants, the mean for security to mother was 3.43, while the standard deviation was 0.36. For their sixth grade participants, the mean for security to mother was 3.29 and the standard deviation was 0.42. The results revealed that monitoring did relate to attachment, but only in the 6^{th} grade. Thus, it seems that these two studies show similar descriptive statistics such as mean and standard deviation, but they obtained a relationship between attachment and one or more of their variables of interest nonetheless. In these studies, attachment was being investigated in relation to variables related to aspects of self-concept/self-esteem so it is possible that more subtle

differences in attachment security are enough to drive an effect, whereas in studies, such as ours, investigating links between attachment and the development of cognitive capacities larger differences are necessary in order for attachment to exert a significant effect on development.

Another explanation for why attachment may not be related to any of our other variables is that there is a sensitive period in which the effects of attachment exert their influence on development, and that those facilitative effects have already been exhausted on capacities that have reached their full potential before children reached the age of 11 or middle childhood. For instance, theory of mind develops around the ages of three to five, so attachment may have more or less facilitated performance on theory of mind tasks at that age range rather than the age range in the present study. Perhaps there are no more facilitative effects of a secure childhood beyond the initial development of theory of mind, joint attention and so on, so that benefits are not seen beyond early childhood, at least within the range of purely cognitive abilities being targeted in the current study.

In contrast to the Security Scale, we obtained greater variance on the measure of verbal reasoning, which was indicated by a standard deviation of 13.94. Therefore, we were able to more adequately assess the contribution of verbal reasoning independently of attachment. Verbal reasoning seemed to have a stronger influence on social reasoning, given that this relationship was close to statistical significance. This makes sense because of the relationship shown between language and theory of mind and other aspects of social reasoning. Although none of the paths from verbal reasoning to physical reasoning and social reasoning were significant, the path from verbal reasoning to social reasoning was closer to significance than the one from verbal reasoning to physical reasoning. It

may suggest the possibility of more of an influence of verbal reasoning on social reasoning performance.

Additionally, these results are consistent with the literature that focuses on the relationship between language and analogical reasoning or cognition more generally. For instance, Baldwin and Saylor (1995) also advocated the importance of language to analogical reasoning because it promotes abstraction and highlights any non-obvious commonalities among objects and events. Evidence for this may come from a study by Kotovosky and Gentner (1996) who tested a key claim of the knowledge-change view that learning about domain relations should increase identification of relational similarity among objects or stimuli; thus, children are better able to complete an analogical reasoning task when they have appropriate knowledge of a particular domain. They did, in fact, find that relational labels did increase the salience of the common relational structure of the stimuli. Generally, language may allow an individual to think more abstractly, which in turn, can help them solve analogical reasoning problems.

In contrast to our last hypothesis, on average, the participants performed better on the physical reasoning task rather than the social reasoning task. When considering the social reasoning task, it may be more difficult to reason about mental states because you have to first examine the physical characteristics readily apparent in the stimuli and then, from that, infer the underlying trait or emotion being depicted. However, with the physical reasoning task, the participant had to examine only the physical characteristics and infer the physical task; there is not any inference to be made about some invisible abstract and unobservable underlying trait. Although we attempted to equate the difficulty of both tasks so that neither task provided identical physical features between

categories, there may have been an additional level of inference in the social task for that reason. In the physical matching tasks, the sports category, for example, would have included images of people engaging in soccer, football, baseball, gymnastics, so that the activities were all different and involved different actions and objects. Thus, physically the images appeared quite distinct and the participant still needed to infer what the general category was and what the images had in common – but all of the information was readily available within those physical characteristics. Within the social matching tasks, such as the emotion category of happiness, some people may have been laughing, some smiling with mouths open, some with mouths closed, always in different scenarios, so it may have been more difficult to determine what was binding them together into the same category without inferring underlying dispositions – which requires an additional level of analysis. Of course, it is precisely such a difference that leads many to presume that humans differ from other species on the capacity to make such inferences (Penn & Povinelli, 2007; Povinelli & Vonk, 2004).

It is interesting to note that despite the fact that the participants performed better on the physical reasoning task, their reaction time was a lot slower on these tasks when they were incorrect; whereas, this was not the case on the social reasoning tasks. As noted earlier, they may be more distracted by absolute matches, rather than attending to the relation between stimuli on social trials, and thus choose quickly on both trials when they are correct and incorrect on social trials. For instance, on "happy/happy same" trials, they may be drawn to smiling faces that might appear in an incorrect happy/sad different comparison option, for example. Whereas, on physical trials, there may be less salient features that match between categories, thus forcing participants to attend to the relations,

which would slow them down the most on trials where they might ultimately be incorrect.

If our analogical reasoning tasks had been more reliant on verbal instructions, as in more traditional theory of mind tasks, like false belief tasks, it may have led to the predicted differences in our reasoning tasks. That is, we may have found better performance on the social reasoning tasks than the physical reasoning tasks. Past studies (Zaitchik, 1990) that have investigated differences between social tasks (such as theory of mind tasks) and more general cognitive tasks (false photograph tasks) have found that typically developed children performed slightly better on the theory of mind tasks than the false photograph tasks, although this difference was nonsignificant. Thus, it may be that more verbally dependent social tasks allow verbally skilled children to use their verbal skills to bolster performance in a way they could not on our primarly nonverbal social task.

Future Directions

One of the major limitations in our study was the fact that the variance on the Security Scale was quite low. Most of the participants scored high on this scale, so it was difficult to draw any firm conclusions about the relationship that attachment had with any of the other variables. An increase in sample size may increase the variance associated with scores on the Security Scale. Hopefully, by increasing sample size, there would be a greater range of attachment styles. It is possible that we may not have had a sample that was diverse in secure and insecure attachment because most of our participants came from a small, family oriented town with a fairly high SES.

Future studies could replicate the same study with a larger sample size, so hopefully there would be more variance in scores on the Security Scale. If this is the case, there may be a better potential to find a significant relationship among attachment and the other variables in this study. Furthermore, if attachment is found to be related to the other variables, language could be a mediator of those relationships. For instance, as we predicted within this study, language could be a mediator among the relationships of attachment and social/physical reasoning. In this study, language was found to be a predictor of social reasoning, so it could still potentially mediate the relationship among attachment and social reasoning if there is enough variance in the scores from the Security Scale.

Another weakness was the fact that our social reasoning task may assess theory of mind reasoning on only a cursory level. In our study, we used an analogical reasoning task to assess social reasoning. Specifically, it was a match-to-sample task, where the participants matched a sample stimulus to its correct comparison image. Emotions were used as stimuli within this task. In this task, we may not know for sure whether or not the children are truly reasoning about feelings and emotions. It may be possible that they have learned to treat a person in a particular way depending on the behaviors that another person exhibited. For example, if someone is sitting with their head down and not smiling, we may have learned to assume that this person behaves in a particular manner that differs from how one behaves when exhibiting behaviors consistent with happiness or anger, without ever reasoning about their underlying emotions. Thus it is possible to reason about the outward manifestations of underlying emotions and not the emotions themselves, and still do well in our task. However, it is assumed that children who are

attuned to the emotions of others, are also better at reading the outward signs of those emotions. Therefore, even though we may be assessing theory of mind on only a cursory level, those with better theory of mind abilities should still do better on our task than those who do not. So, while our task may be an indirect measure of theory of mind, it should correlate with other more direct measures and is still considered a social reasoning task.

Typically, theory of mind is assessed using false-belief tasks (Wimmer & Perner, 1983). In those tasks, participants are usually shown something being hidden while in the presence of a character. Then, the character leaves, and the object is moved to another location. The character comes back, and the participant is asked where he or she will look for the object. So, if the participant has theory of mind, they should understand that the character will look for the object in the place that they left it initially. False-belief tasks assess theory of mind ability more conclusively because they assess whether an individual is able to represent that another person is holding a thought, feeling, or belief that is different from his or her own. Thus, they truly show that an individual is not reasoning about just his or her own thoughts and feelings and that this individual is capable of representing dual beliefs. Future studies could use two analogous tasks, one that comes closer to assessing the concept of theory of mind and another that assesses physical reasoning or cognition more generally.

However, a strength of the present study was the choice of using two analogous tasks where one assessed social reasoning and the other assessed physical reasoning. Additionally, these types of tasks have not been used before to assess these different types of reasoning. One of the reasons the tasks were analogous for this study was to

make them comparable and not confound the contribution of language to the two different tasks. These tasks were meant to be more nonverbal in nature, so they can be used with comparative and clinical populations, along with younger children. Furthermore, because of our interest in assessing the impact of attachment and language on broader cognitive abilities, such as analogical reasoning, we needed to design a task that required children to reason about the relations between objects in both social and non-social domains. Our task was constructed to achieve this goal.

One strength of this study may be that our match-to-sample task did not require the use of language in that the children were not asked a lot of questions that they had to answer. They were initially given instructions with few prompts after that. This allows the current methodology, including all of the variables, to be conducted with other populations, such as younger children and children with certain disorders, such as children with autism and other language-delayed populations. As discussed, research has found that children with ASD do not do well on false-belief tasks, which may be due to the language comprehension that is required. Children with autism generally have some language impairments (Jarrold et al., 1999). Thus, it is possible that children with autism may be able to perform at higher levels on our match-to-sample tasks, which assess social reasoning skills, in contrast to their performance on traditional false belief tests. In the current study, it was found that verbal reasoning may affect performance more on the social reasoning tasks, so it may be that better language skills are required when it comes to social reasoning. Within the social reasoning tasks that we used, it requires the inference of an underlying emotion rather than just how emotions are manifested in the expressions of the individuals, which would be a whole lot more observable and less

abstract. Thus, when making inferences about some underlying emotion, language is needed in order to think about those things. This may be why language is required for social reasoning tasks rather that physical reasoning tasks, where you can easily oberve activities and there's no inference about some underlying trait. Furthermore, our MTS tests can also be presented to non-human populations to extend the study of comparative as well as developmental psychology, as comparisons between social and physical reasoning are of interest with other species as well. In fact, we are currently testing an adult male chimpanzee with the pilot version of our procedure and hope to extend those tests to other species as well.

Conclusion

First of all, the current study investigated the relationship among attachment and analogical reasoning, which has not been studied before. It was found that attachment did not relate to any of the other variables, but this may be due to the low variance of scores on the Security Scale. It is interesting to note that language was found to be a stronger predictor of social reasoning, but less so for physical reasoning. This may suggest that language is more important to the development of social reasoning rather than physical reasoning.

APPENDIX A

WHAT I AM LIKE WITH MY MOTHER

Instructions to Child:

This questionnaire asks about what you are like with your mother – like how you act and feel around her. Before we get to those questions, let's try a practice question. Each question talks about two kinds of kids, and we want to know which kids are most like you. Decide first whether you are more like the kids on the left side or more like the kids on the right side, then decide whether that is sort of true for you, or really true for you, and circle that phrase. For each question you will only circle one answer.

Practice Question:

	Some kids would rather play sports in their spare time.		**BUT**	Other kids would rather watch T.V.	
	Really true for me	Sort of true for me		Sort of true for me	Really true for me

1.	Some kids find it easy to trust their mom		**BUT**	Other kids are not sure if they can trust their mom.	
	Really true for me	Sort of true for me		Sort of true for me	Really true for me

2.	Some kids feel like their mom butts in a lot when they are trying to do things		**BUT**	Other kids are feel like their mom lets them do things on their own	
	Really true	Sort of		Sort of	Really true

	for me	true for me		true for me	for me
3.	Some kids find it easy to count on their mom for help		**BUT**	Other kids think it's hard to count on their mom	
	Really true for me	Sort of true for me		Sort of true for me	Really true for me
4.	Some kids think their mom spends enough time with them		**BUT**	Other kids think their mom does not spend enough time with them.	
	Really true for me	Sort of true for me		Sort of true for me	Really true for me
5.	Some kids do not really like telling their mom what they are thinking or feeling		**BUT**	Other kids do like telling their mom what they are thinking or feeling.	
	Really true for me	Sort of true for me		Sort of true for me	Really true for me
6.	Some kids do not really need their mom for much		**BUT**	Other kids need their mom for a lot of things.	
	Really true	Sort of		Sort of	Really true

	for me	true for me		true for me	for me
7.	Some kids wish they were closer to their mom		**BUT**	Other kids are happy with how close they are to their mom .	
	Really true for me	Sort of true for me		Sort of true for me	Really true for me
8.	Some kids worry that their mom does not really love them		**BUT**	Other kids are <u>really</u> sure that their mom loves them.	
	Really true for me	Sort of true for me		Sort of true for me	Really true for me
9.	Some kids feel like their mom really understands them		**BUT**	Other kids feel like their mom does not really understand them.	
	Really true for me	Sort of true for me		Sort of true for me	Really true for me
10.	Some kids are really sure their mom would not leave them		**BUT**	Other kids sometimes wonder if their mom might leave them	

	Really true for me	Sort of true for me		Sort of true for me	Really true for me
11.	Some kids worry that their mom might not be there when they need her		**BUT**	Other kids are sure their mom will be there when they need her.	

	Really true for me	Sort of true for me		Sort of true for me	Really true for me
12.	Some kids think their mom does not listen to them		**BUT**	Other kids do think their mom listens to them.	

	Really true for me	Sort of true for me		Sort of true for me	Really true for me
13.	Some kids go to their mom when they are upset		**BUT**	Other kids do not go to their mom when they are upset	

14.	Some kids wish their mom would help them more with their problems		**BUT**	Other kids think their mom helps them enough.	
	Really true for me	Sort of true for me		Sort of true for me	Really true for me
15.	Some kids feel better when their mom is around		**BUT**	Other kids do not feel better when their mom is around.	
	Really true for me	Sort of true for me		Sort of true for me	Really true for me

APPENDIX B

INSTITUTIONAL REVIEW BOARD APPROVAL FORM

THE UNIVERSITY OF SOUTHERN MISSISSIPPI

Institutional Review Board

118 College Drive #5147
Hattiesburg, MS 39406-0001
Tel: 601.266.6820
Fax: 601.266.5509
www.usm.edu/irb

HUMAN SUBJECTS PROTECTION REVIEW COMMITTEE
NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Human Subjects Protection Review Committee in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months. Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: **29100504**
PROJECT TITLE: **The Role of Parent/Child Dynamics in Cognitive Development**
PROPOSED PROJECT DATES: **10/15/09 to 09/30/10**
PROJECT TYPE: **Dissertation or Thesis**
PRINCIPAL INVESTIGATORS: **Tamra Beckman**
COLLEGE/DIVISION: **College of Education & Psychology**
DEPARTMENT: **Psychology**
FUNDING AGENCY: **N/A**
HSPRC COMMITTEE ACTION: **Full Committee Review Approval**
PERIOD OF APPROVAL: **10/29/09 to 10/28/10**

Lawrence A. Hosman
Lawrence A. Hosman, Ph.D.
HSPRC Chair

10-30-09
Date

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