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## **Attention-Deficit/Hyperactivity Disorder Symptoms as a Mediator of the Relation Between Social Perception and Social Skills and Adaptability in Preschoolers**

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ATTENTION-DEFICIT/HYPERACTIVITY DISORDER SYMPTOMS AS A  
MEDIATOR OF THE RELATION BETWEEN SOCIAL PERCEPTION AND SOCIAL  
SKILLS AND ADAPTABILITY IN PRESCHOOLERS

by

Brandi Michelle Ellis

A Thesis  
Submitted to the Graduate School  
and the Department of Psychology  
at The University of Southern Mississippi  
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for the Degree of Master of Arts

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May 2016

## ABSTRACT

### ATTENTION-DEFICIT/HYPERACTIVITY DISORDER SYMPTOMS AS A MEDIATOR OF THE RELATION BETWEEN SOCIAL PERCEPTION AND SOCIAL SKILLS AND ADAPTABILITY IN PRESCHOOLERS

by Brandi Michelle Ellis

May 2016

ADHD symptoms have been linked empirically to both social perception deficits as well as impairments in social skills and adaptability. The current study built on existing literature by examining whether social perception abilities indirectly predicted social skills and adaptability through ADHD symptoms in preschool-aged children. The sample consisted of 3 to 6-year-old children attending Head Start Programs and private preschools ( $N = 76$ ). It was expected that social perception abilities would positively relate to both social skills and adaptability. It was also expected that these relations would occur indirectly through ADHD symptoms. Specifically, social perception abilities would relate negatively to ADHD symptoms, which, in turn, would relate negatively to both social skills and adaptability. Although not all hypothesized relations in the model were supported, an indirect effect of social perception abilities on social skills and adaptability through ADHD symptoms was supported. Furthermore, for parent-report, the mediational model was most clear when attention problems were isolated as the mediator. These findings suggest that ADHD symptoms—particularly attention problems—are important to consider in the complex relation of social perception abilities and negative outcomes such as deficits in social skills and adaptability. The results also provide some support for

social perception deficits as one of the underlying factors that contribute to the social difficulties often seen in children with ADHD. Finally, these findings also highlight a point of intervention (or even prevention in young children), given that minimizing ADHD symptoms may disrupt the indirect link of social perception deficits on these negative outcomes.

## DEDICATION

This work is dedicated to my husband, my parents, and my brothers. Thank you for all of your support and encouragement throughout the years.

## ACKNOWLEDGMENTS

Special thanks goes to my Major Professor, Tammy D. Barry, and my other committee members, Dr. Sara Jordan and Dr. Brad Green, for their advice and support throughout the duration of this research.

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## CHAPTER I

### INTRODUCTION

Attention-deficit/hyperactivity disorder (ADHD) has associated features that reach beyond the symptoms of the disorder, which are primarily inattentive and hyperactive-impulsive symptoms (American Psychiatric Association, 2013). In addition to the hallmark symptoms of the disorder, individuals with ADHD often show adaptive functioning deficits, social skills deficits, and peer relationship problems (Burns & Martin, 2014; Demopoulos, Hopkins, & Davis, 2013; Dumas, 1998; Merrell & Wolfe, 1998). Most research on these constructs among individuals with ADHD focuses on having a diagnosis of ADHD (i.e., compared to other diagnoses or compared to a control group) and the outcomes of social skills deficits and adaptability deficits. However, these latter difficulties are likely to surface in children who exhibit the symptoms and characteristics of ADHD without meeting the full diagnostic criteria for the disorder. When a child does not meet the diagnostic criteria for ADHD—but obviously exhibits symptomology—it is likely that the impact upon the child’s social and adaptive functioning can be exacerbated by the absence of any intervention. Is it possible that the absence of a diagnosis gives parents and health care providers of children with ADHD symptoms the false impression that the child will not experience adaptive and/or social difficulties simply because he or she failed to meet diagnostic criteria? The answer to this question has important implications for early intervention. Thus, research establishing the relation between ADHD symptoms (among a community population) and social and adaptive functioning, particularly in very young children, is imperative. Likewise, a better understanding of the role ADHD symptoms may play in influencing these

outcomes is essential, given individual differences in social cognitive abilities (such as social perception). The current study aimed to address this issue by examining how social perception abilities relate to both social skills and adaptability directly and indirectly through ADHD symptoms.

## ADHD Symptoms, Social Skills, and Adaptability

### *Social Skills*

Significant social deficits are known to be associated with ADHD in children and adolescents. One study found that teacher-rated social skills deficits were associated with the presence of teacher-rated ADHD characteristics in kindergarten-aged children (Merrell & Wolfe 1998). In Merrell and Wolfe's study (1998), teachers rated children on social cooperation, social interaction, social independence, and total social skills. They found that differences on all the social skills scores between the group rated highly on ADHD characteristics and the non-ADHD characteristics group were statistically significant. In fact, more than half of the children rated by teachers as exhibiting ADHD symptoms in their sample also were rated as having significant social skills deficits based on a criterion of 1.5 standard deviations below the normative mean on a standardized measure of social skills in preschoolers and kindergartners (Merrell & Wolfe, 1998).

Furthermore, the negative impact of ADHD symptoms on peer relationships, even in the absence of diagnosis, has recently been examined and evidenced by studies with Taiwanese children (Kawabata, Tseng, & Gau, 2012; Tseng, Kawabata, Gau, & Crick, 2014). Both studies found that inattention and hyperactivity were associated with greater peer problems. Kawabata et al. (2012) found that inattention was related to difficulties forming and maintaining relationships with peers and that both inattention and

hyperactivity were related to difficulties in social interactions with peers. Tseng et al. (2014) found that both inattention and hyperactivity were associated with peer problems and that inattention was longitudinally related to later peer impairment. However, as Kawabata et al. (2012) points out, the cultural differences between China and Western countries somewhat complicate generalizability of these findings. Therefore, further research on the impact of ADHD symptoms on social skills and ultimately peer relationships, even in the absence of an ADHD diagnosis, is needed to determine whether the same conclusions can be drawn across various cultures. Furthermore, and important to the current study, the Kawabata et al. (2012) study found that the relation between ADHD symptoms and peer relationship problems was moderated by age, with the magnitude of the relation attenuated for younger children.

The moderating role of age in the relation between ADHD symptoms and peer relationship problems further underscores the necessity of determining whether or not a relation between ADHD symptoms and social skills exists among preschool children. If greater levels of ADHD symptoms in preschool children are associated with lower levels of social skills, this relation may indicate a need for early intervention that addresses ADHD symptoms and/or social skills and that may help to circumvent later interpersonal issues during later childhood and adolescence. Clearly, more research is needed to evaluate the relation among these variables in young children across various cultures. The current study aimed to address this issue by examining the relation between ADHD symptoms and social skills among young preschoolers drawn from a United States community sample.

### *Adaptability*

Research also indicates that children with ADHD score significantly lower than children without ADHD on measures of adaptability—which is often defined in the literature as an individual’s ability to regulate his or her cognitive, emotional, and behavioral responses to new, changing, and uncertain circumstances (Martin, Nejad, Colmar, & Liem, 2012). In a sample of junior high and high school students, Burns and Martin (2014) found that students with ADHD scored significantly lower than students without ADHD on cognitive adaptability, behavioral adaptability, and total adaptability. Despite these findings, ADHD and adaptability have not been thoroughly examined in younger, preschool children. This is an obvious gap in the literature, given the importance of the preschool years in developing adaptive functioning skills and self-regulation (Jahromi & Stifter, 2008).

The lack of research on ADHD symptoms and adaptability in preschoolers may be due to the relatively higher levels of inattention and hyperactivity exhibited by preschoolers as a typical part of development, which makes it difficult to diagnose ADHD at such an early age. However, the examination of ADHD symptoms as a continuous construct—rather than a discrete diagnosis—in preschool-aged children may allow researchers to establish an even earlier connection between ADHD symptoms and adaptability deficits, allowing for earlier intervention. The current study addressed this issue within the larger context of the relation between social perception and social skills and adaptability. In summary, a primary purpose of the study was to establish a link between ADHD symptoms and social skills as well as between ADHD symptoms and adaptability among preschoolers.

## ADHD and Social Perception

An examination of ADHD symptoms and their relation with social skills and adaptability within the context of social perception abilities is warranted, given that ADHD and social perception abilities are linked (Uekermann et al., 2010). In a recent review of the literature on social cognition in ADHD, the evidence suggests that social cognition deficits and ADHD symptoms may originate from dysfunction in the same brain regions, such as the prefrontal cortex (Uekermann et al., 2010). In fact, the authors found that the neuroimaging literature evidences brain dysfunction in individuals with ADHD in areas that are crucial to affect perception and complex social perception such as theory of mind (Uekermann et al., 2010). Perhaps, when children exhibit dysfunction in regions of the brain contributing to social cognition, greater social perception deficits (e.g., in affect recognition or theory of mind) resulting from this faulty processing may predict greater ADHD symptomology. This possible direct effect of social perception on ADHD symptoms may provide a channel through which social perception deficits can further affect social skills and adaptability. Indeed, Uekermann and colleagues (2010) speculate that social cognition may be one of the influential factors upon which social dysfunction in ADHD rests. However, they concede that this causal relation has inadequate evidence due to a lack of research on the topic (Uekermann et al., 2010). The current study aims to establish whether such relations exist among preschool children.

### *Theory of Mind and Affect Recognition*

Theory of mind and affect recognition are crucial components of social perception that allow individuals to efficiently interact with others. Theory of mind refers to the social perception abilities that allow individuals to understand that others may have a

different set of thoughts, beliefs, wants, desires, information, and intentions (Korkmaz, 2011). It does not refer to an individual's ability to know what another person's perspective is but, rather, to understand that another person may have a different perspective. Much of the research on theory of mind focuses on autism spectrum disorder (e.g., Baron-Cohen, 2011); however, impairments in theory of mind have been linked to a wide variety of disorders, including ADHD (Korkmaz, 2011). Affect recognition refers to an individual's ability to recognize an emotion in another individual based on a physical indicator, such as a facial expression, and it is an important component in emotion regulation processes (Southam-Gerow & Kendall, 2002).

Much of the literature indicates a negative relation between ADHD and theory of mind and between ADHD and affect recognition. For instance, Marton, Wiener, Rogers, Moore, and Tannock (2009) found that—among a sample of 8 to 12-year-old children—those with ADHD had less developed social perspective taking abilities than children without ADHD. They found that children with ADHD scored lower than would be expected for their age on social perspective taking and employed less advanced social perspective taking than their non-ADHD counterparts. Eight percent of the variance in social perspective taking for their sample was uniquely accounted for by ADHD status (Marton et al., 2009).

In regard to affect recognition, Pelc, Kornreich, Foisy, and Dan (2006) examined emotional facial expression recognition in children from 7 to 12 years old with predominantly hyperactive-impulsive type ADHD. Their results indicated that children with ADHD made significantly more emotion recognition errors than children without ADHD. Furthermore, they found that the children with ADHD in their sample had

significantly greater difficulty in identifying anger and sadness specifically than the children without ADHD (Pelc et al., 2006). The researchers suggested that the specific difficulty in identifying expressions of sadness and anger in children with ADHD may be due to inattentiveness to emotional cues or learned behavior to ignore those particular emotions (Pelc et al., 2006).

In their review, Uekermann and colleagues (2010) concluded that the widely held view of affect perception deficits as stemming solely from executive functioning deficits does not seem to be supported in the literature and must be examined more closely. It could be the case that, working in tandem with deficits in executive functioning, deficits in affect recognition place an increased demand for sustained attention to appropriate emotional cues upon a child with ADHD symptoms, and the child may be less likely to attend to those emotions that he or she finds less reinforcing. In other words, executive functioning deficits and affect recognition deficits may be contributing to social skills and adaptability in an additive manner. The idea of reinforcement sensitivity (i.e., a tendency to avoid engaging in tasks that are perceived to yield less reinforcing payoffs) in ADHD is widely supported (e.g., Luman, Oosterlaan, Hyde, Van Meel, & Sergeant, 2007). For example, Luman et al. found that children with ADHD exhibited suppressed heart rate variability (i.e., due to active attention) during tasks belonging to either a reward condition or a response cost condition but not during tasks belonging to a feedback only condition (i.e., no or only a mediocre reward; Luman et al., 2007). Ultimately, understanding whether the association between affect recognition and ADHD symptoms exists is critical because social perception deficits have consistently been associated with social skills problems and dysregulated, maladaptive behaviors (e.g., Williamson &

Jackobson, 2014). Thus, the current study examining ADHD symptoms as a possible mediator of that relation was warranted.

#### Social Perception Problems and Social Skills/Adaptability

Much research has provided supporting evidence for the link between children's social perception abilities and social outcomes (Capage & Watson, 2001; Jenkins & Astington, 2000; Razza & Blair, 2009; Williamson & Jackobson, 2014; Wocadlo & Rieger, 2006). Many of these studies have provided evidence that suggests specific facets of social perception alone (i.e., affect recognition and theory of mind) can affect children's social skills. In one such study examining the relation between nonverbal emotion decoding and social skills, Wocadlo and Rieger (2006) found that, when compared to children with above average social skills, children with below average social skills made significantly more errors in decoding the emotions in both adult and child faces and even more so when dealing with low intensity stimuli. Though the Wocadlo and Rieger study does not point to a causal model for the relation between social perception deficits and social skills/adaptability deficits, it provides strong evidence for the existence of a relation between these constructs.

A longitudinal study conducted by Jenkins and Astington (2000) examined whether theory of mind development in children predicts increased abilities to initiate joint plans and to explicitly assign roles during play over time. Their results suggested that children's theory of mind abilities at 34 to 45 months old predicted 13% of the variance in changes in joint planning 3 months later. Additionally, they found that theory of mind at 37 to 48 months old predicted 28% of the variance in change over time in explicit role assignment during play with a partner (Jenkins & Astington, 2000). The

authors conclude that the results indicate that better developed theory of mind skills in children allow them to interact during social situations with others in ways that are less ambiguous to the partner with whom they are engaging and that are conducive to joint planning (Jenkins & Astington, 2000). Furthermore, Jenkins and Astington (2000) went a step further by testing the competing hypothesis that pretend play supports theory of mind development. Their results yielded no evidence for this alternative causal model, indicating that theory of mind is perhaps a causal agent leading to cooperative social interaction (Jenkins & Astington, 2000). At minimum, they demonstrated a temporal sequencing that showed the relation among these variables only held when considering earlier theory of mind abilities and later social functioning. However, more research is needed in this area.

#### Indirect Relation of Social Perception and Social Skills/Adaptability through ADHD Symptoms

The failure of children with ADHD to accurately attribute mental states, emotions, and beliefs to other children during social interaction may be indirectly responsible for some of the social deficits associated with ADHD discussed earlier. Due to difficulties in seeing themselves from another person's perspective, children with theory of mind deficits may have a more difficult time reigning in hyperactive symptoms that would be viewed negatively by their social counterparts. Capage and Watson (2001) suggest that it may be necessary for children to understand how others' actions may be contingent upon differences between what they believe to be true and actual reality "...to make accurate attributions concerning behaviors, exhibit behaviors that are prosocial, and inhibit active responses." They further suggest that inhibiting reactive responses, such as

aggressive and maladaptive social behaviors, may depend upon theory of mind skills such as false belief understanding (Capage & Watson, 2001). The results of their study, which seem to support the latter assumption, indicate that false belief scores in young children are positively and significantly related to the ratio of relevant solutions to social problem situations in relation to the total number of solutions provided by the children (Capage & Watson, 2001). These authors also found that children's false belief scores were negatively and significantly related to the ratio of forceful or aggressive solutions to social problem situations in relation to the total number of solutions provided by the children (Capage & Watson, 2001). Perhaps, social perception deficits in theory of mind and affect recognition cause more severe manifestations of ADHD symptoms, which would in turn predict social skills deficits and adaptability deficits. If a child with these social perception deficits has difficulty taking their social counterpart's perspective and difficulty attending to the constantly changing emotional cues that are communicated during social interaction, it follows to reason that the child would miss important indicators that he or she needs to appropriately gauge his or her behaviors to suit the person with whom he or she is interacting.

This theoretical model appears to be supported by the results of a study conducted by Demopoulos et al. (2012) comparing the social cognitive profiles of children with ADHD and children with autism spectrum disorder (ASD). In a sample of 573 children ranging in age from 6 to 17 years, they found that both children with ADHD and children with ASD are less skilled than their typically developing peers in areas of social cognition—including facial affect, vocal affect, pragmatic judgment, and problem solving—and in social skills as rated by parent and teacher report on the Social Skills

Scale of the Behavior Assessment Scale for Children-2<sup>nd</sup> Edition (BASC-2; Reynolds & Kamphaus, 2004). Demopoulous et al. (2013) discovered that the social cognitive profiles of the children with ADHD were nearly identical to the social cognitive profiles of the children with ASD and that the two groups merely differed in the severity of social cognitive deficits.

The traditional view of social deficits in ADHD posits that these deficits result from problems with executive functioning (Bunford et al., 2015; Chiang & Gau, 2014). However, the literature seems to suggest that these social deficits are, in part, due to early social perception deficits. Demopoulos and her colleagues (2013) suggest that the parallels between the types of social cognitive deficits observed in children with ADHD and in children with ASD point to early social perception deficits as an underlying cause of the social deficits often seen associated with ADHD. Therefore, perhaps the symptoms associated with ADHD are a mechanism through which social perception deficits predict social skills and adaptability. This is not to say that social perception deficits are theorized to replace executive functioning as the causal factor of social skill deficits that are often seen in children with ADHD. Simply, the evidence seems to support executive functioning and social perception deficits as co-contributors to social skills deficits in children with ADHD. An important initial step in testing this theory is conducting research to determine the relation between social perception and ADHD. Specifically, an examination of the relation between social perception abilities and ADHD symptoms within the context of predicting social and adaptive outcomes is crucial and is the focus of the current study.

## Current Study and Hypotheses

The current study sought to add to the literature by examining the relation between social perception abilities (i.e., theory of mind and affect recognition) and social skills—as well as the relation between social perception abilities and adaptability—and the potential mediating role of ADHD symptoms (i.e., inattention and hyperactivity) in a sample of preschool children. Although these constructs have been linked, no known study has tested this specific mediation model. Furthermore, because the current study examined the interrelations of these variables among preschoolers, it is a downward extension of previous work that has primarily focused on samples of elementary-aged children and adolescents. Finally, the current study focused on ADHD symptoms measured within a community sample, rather than the specific diagnosis of ADHD in a clinical sample, allowing for more variability within the measured construct of ADHD symptoms and more appropriately resembling the apparent true dimensional latent structure of ADHD (Marcus & Barry, 2011). The current study's sample of children with sub-clinical levels of ADHD allowed an examination of the relations among social perception abilities and multiple aspects of ADHD symptoms that may disrupt the development of social skills and adaptive functioning among young preschoolers. Such information can help to fine-tune preventative and early intervention efforts to maximize positive outcomes even in light of social perception problems or ADHD symptoms among preschoolers.

### *Hypotheses*

First, it was hypothesized that ADHD symptoms (i.e., attention problems and hyperactivity) would be negatively related to social perception abilities (i.e., theory of

mind and affect recognition) as well as social skills and adaptability (Hypothesis 1). Second, it was hypothesized that social perception abilities would be positively related to both social skills and adaptability (Hypothesis 2). Third, it was expected that these relations with social perception abilities would occur indirectly through ADHD symptoms. Specifically, social perception abilities would relate negatively to ADHD symptoms, which, in turn, would relate negatively to both social skills and adaptability (Hypothesis 3). All hypotheses were examined using parent- and teacher-report (separately).

To bolster interpretation of the hypothesized mediation models, a second set of mediational models (reversing the predictor and the criterion variable for each) were also examined. As another set of post-hoc analyses, the hypothesized mediation models were conducted examining attention problems and hyperactivity as separate constructs (resulting in eight additional mediation models) to determine if the mediation models held differently for attention problems and hyperactivity.

Finally, to determine if the complex interrelation between the variables of interest may be best explained as social perception abilities relating to social skills and/or adaptability conditionally at different levels of ADHD symptoms, ADHD symptoms were examined as a moderator in the relation between social perception abilities and social skills (and between social perception abilities and adaptability; Research Question 1).

## CHAPTER II

## METHOD

## Participants

The sample consisted of participants from a larger archival dataset of typically developing children who attended PACE Head Start and private preschools in Hattiesburg, Mississippi ( $N = 76$ ), one of their primary caregivers, and their preschool teachers. The child participants had no major developmental disorders, and their prenatal and early development history was unremarkable. The sample consisted of 38 males and 38 females, and the racial distribution was 59.7% Caucasian, 32.5% African American, 1.3% Hispanic American, 1.3% Asian American, 1.3% other, and 3.9% did not report race. The child participants ranged in age from 3 to 6 years of age,  $M = 4.04$ ,  $SD = .72$ , but only one six year old participated. The majority of the caregivers who participated in the study were biological parents (96.1%) and female (92.1%), ranging in age from 21 to 47 years ( $M = 32.04$ ,  $SD = 6.02$ ). Additional details about the sample characteristics are reported in Table 1.

Table 1

*Sample Descriptives*

		N	% of sample	Mean	SD
Child Age				4.04	.72
	3 years	17	22.4		
	4 years	40	52.6		
	5 years	18	23.7		
	6 years	1	1.3		
Child Sex	Male	38	50		
	Female	38	50		
Child Race					

		Caucasian	46	60.5		
Table 1 (continued).						
			N	% of sample	Mean	SD
Respondent Age	African American		25	32.9	32.04	6.02
	Hispanic American		1	1.3		
	Asian American		1	1.3		
	Other		1	1.3		
Respondent Relation to Child						
	Biological Parent		73	96.1		
	Adoptive Parent		2	2.6		
Respondent Marital Status						
	Single - Never Married		19	25		
	Married		41	53.9		
	Living Together - Not Married		4	5.3		
	Separated		5	6.6		
	Divorced		7	9.2		
Respondent Raising Child						
	Alone		9	11.8		
	With Spouse/Significant Other		56	73.7		
	With Help of Family Members		11	14.5		
Family Income						
	No Income/Welfare Dependent		4	5.3		
	Less than \$10,000		9	11.8		
	\$10,000 - \$14,999		6	7.9		
	\$15,000 - \$19,999		2	2.6		
	\$20,000 - \$24,999		10	13.2		
	\$30,000 - \$34,999		1	1.3		
	\$35,000 - \$39,999		2	2.6		
	\$40,000 - \$49,999		2	2.6		
	\$50,000 - \$59,999		4	5.3		
	\$60,000 - \$74,999		7	9.2		
	\$75,000 - \$99,999		14	18.4		
	\$100,000 or more		13	17.1		

*Note.* SD = standard deviation. Percentages do not total 100% when data are missing.

## Measures

### *Demographic Questionnaire*

The participating caregiver completed a demographic questionnaire, which addressed basic information about the child, caregiver, and others living in the house with the child. This questionnaire also addressed the child's prenatal, perinatal, developmental history, and the child's and family's mental health history.

### *Behavior Assessment System for Children-2-Parent Rating Scale and Teacher Rating Scale (BASC-2-PRS and BASC-2-TRS; Reynolds & Kamphaus, 2004).*

The BASC-2 is a multidimensional assessment system that measures both adaptive and problem behaviors of children both in school (BASC-2-TRS) and in home settings (BASC-2-PRS). The items are scored on a 4-point scale ranging from *Never* to *Almost Always*. The BASC-2-PRS consists of 134 items, and the BASC-2-TRS consists of 100 items. Both forms yield four composite scores (Internalizing Problems, Externalizing Problems, Adaptive Skills, and the Behavioral Symptoms Index) and eight clinical scores (Aggression, Anxiety, Attention Problems, Atypicality, Depression, Hyperactivity, Somatization, and Withdrawal). From the parent form only, an adaptive score of Activities of Daily Living is available, whereas from both the teacher and parent form, adaptive scores of Adaptability, Functional Communication, and Social Skills are available.

For the current study, the Attention Problems, Hyperactivity, Social Skills, and Adaptability scales were of interest. The BASC-2 has demonstrated good reliability. Reynolds and Kamphaus (2004) reported internal consistencies for the composites, with alpha coefficients ranging from .87 to .96 (BASC-2-TRS) and .85 to .93 (BASC-2-PRS).

Alpha coefficients for the scales range from .75 to .93 (BASC-2-TRS) and .77 to .87 (BASC-2-PRS). Median inter-rater reliabilities have been reported as .74 and .65 on the BASC-2-TRS for the composites and scales, respectively. On the BASC-2-PRS, median inter-rater reliabilities have been reported as .71 and .74 for the composites and scales, respectively. In the current study, internal consistency for the scales of interest ranged from acceptable to excellent based on both parent and teacher ratings, with Cronbach's  $\alpha = .92$  and  $\alpha = .85$  for Attention Problems, Cronbach's  $\alpha = .89$  and  $\alpha = .83$  for Hyperactivity, Cronbach's  $\alpha = .74$  and  $\alpha = .81$  for Adaptability, and Cronbach's  $\alpha = .90$  and  $\alpha = .80$  for Social Skills for teacher-report and parent-report, respectively.

For the current study, the Attention Problems and Hyperactivity scales were used to assess the degree of ADHD symptoms within the sample. To assess ADHD symptoms, the scale scores for Attention Problems and Hyperactivity were converted to *T*-scores based upon the general norm group (with a mean of 50 and a standard deviation of 10), and these *T*-scores were averaged to obtain an ADHD symptom composite. An ADHD symptoms composite (combining both Attention Problems and Hyperactivity) was created based on both the parent and the teacher report (two composites). The Adaptability and Social Skills scales were used to assess the criterion variables of the model. The raw scores for Adaptability and Social Skills were also converted to *T*-scores based upon the general norm group to adjust the raw scores for the age of the child. The parent and teacher report on each of these scales were used separately.

*Social Perception from the Neuropsychological Assessment of Children-II (NEPSY- II; Korkman, Kirk, & Kemp, 2007).*

This measure was designed specifically to provide researchers and clinicians with a psychometrically sound instrument for studying typical and atypical neuropsychological development in preschool and school-age children. The NEPSY-II is comprised of a core battery and a full battery. These batteries each have separate forms for children from 3 to 4 years old and for children from 5 to 12 years old. The NEPSY assesses the child's neuropsychological status across six functional domains that include Social Perception. For the current study, the two subtests comprising this domain—Affect Recognition and Theory of Mind—were of interest. Reliability coefficients were obtained by utilizing split-half and alpha methods. For the Affect Recognition subtest of the Social Perception domain, the average reliability coefficient was .75 for children aged 3 to 4 years and .67 for children aged 5 to 6 years (Korkman et al., 2007). For the Theory of Mind subtest of the Social Perception domain, the average reliability coefficient was .76 for children aged 3 to 4 years and .84 for children aged 5 to 6 years (Korkman et al., 2007).

For the Affect Recognition subtest, the children were asked to complete four different tasks assessing their ability to recognize happy, sad, neutral, fear, angry, or disgust from photographs of children's faces. In one task the children were required to state whether or not two photographs present the same affect. In the second task, the children were required to choose two photographs depicting the same affect from three or four photographs. In the third task, the children were required to choose a face from five faces on a page that matched the affect of a face at the top of the page. For the fourth

task, children were briefly shown a face, and were then required from memory to choose two photographs that depict the same affect as the face previously shown.

For the Theory of Mind subtest, children were asked to complete two tasks designed to assess the ability to understand mental functions and another person's point of view. This subtest is composed of a Verbal task and a Contextual task. For the verbal task, stories, pictures, and questions are used to assess belief, intention, deception, emotion, imagination/pretending, imitation; the understanding of others' thoughts, ideas, and feelings; and the comprehension of abstract meanings in figurative language. The Contextual task employs pictures of children in a social context and requires children to point to the appropriate photo depicting the correct affect to assess their ability to relate emotion to social context.

For the current study, the Affect Recognition and Theory of Mind norm-referenced scaled scores (i.e., with a mean of 10 and a standard deviation of 3) were averaged to create a social perception abilities composite. This variable was used as the predictor in the hypothesized mediation models.

### Procedure

The original researcher obtained IRB approval for the study before recruiting participants and collecting data. Caregivers and their children were recruited through attending Parent-Teacher Organization meetings, posting announcements in schools, and arranging to have flyers and consent forms sent home with children to their parents. If parents consented to participate, signed the written informed consent, and returned it to the researcher, they were given the Demographic Questionnaire and BASC-2-PRS (along with other measures for the larger study) to complete. The researcher did not anticipate

distress as resulting from the study, but regardless caregivers were provided with phone numbers to referral sources as well as the research supervisor. Parents were also given the option of obtaining general feedback about their child's performance. Parents were instructed to return the completed forms in sealed envelopes to their child's teacher, and parents received a \$10 Walmart gift card upon completion of their forms. Teachers were also required to provide written consent, and—upon signing and returning this consent to the researcher—the teacher was given a BASC-2-TRS (along with other measures for the larger study) to complete for each child in the class whose parent had consented to participation and returned completed questionnaires. The child was required to have been in the teacher's class for at least four weeks before the teacher was asked to complete a BASC-2-TRS for the child. Teachers received a \$5 Walmart gift card for each teacher packet returned for each child.

In addition to the parent and teacher questionnaires, testing was scheduled for each child whose parent had consented to participation. Testing was conducted at either their Head Start Center or preschool or at The University of Southern Mississippi research lab. The NEPSY-II was administered to each child (along with some additional testing measures as part of the larger study), and the child was given stickers throughout the testing session and a small prize for completion of the test. Testing sessions ranged from 2 to 3 hours per child for completion of the full measures used in the larger study.

## CHAPTER III

### RESULTS

#### Missing data

A few demographic data points were missing as described in the Participants section and shown in Table 1. Theory of mind and affect recognition were based on a test administration, and there was no missing data per participant. A few participants were missing some item-level data on the BASC-2 (PRS or TRS); however, missing data was minimal and did not preclude creation of the *T*-scores on the BASC-2. Finally, the BASC-2-PRS was missing for 5 participants, and the BASC-2-TRS was missing for 2 different participants. Thus, there were 76 unique participants in the study, with a total of 71 included in analyses utilizing parent report and 74 included in analyses utilizing teacher report. Rather than limit the analyses to the 69 participants who had no missing data, all available data were used for each analysis to maximize power to test the complex models.

#### Score Creation

Before testing the hypotheses, specific scores were computed for each variable in the analyses, as indicated in the Measures section. Specifically, the Affect Recognition and Theory of Mind subtest scores from the Social Perception domain of the NEPSY-II (correlated,  $r = .22$ ,  $p = .058$ ) were examined in a composite format (based on the average of these two norm-referenced scaled scores) and were used as the predictor in the mediational models. Norm-referenced *T*-scores for social skills and adaptive functioning from both the parent and teacher forms of the BASC-2 were used as criterion variables. Additionally, a *T*-score composite was calculated for ADHD symptoms (i.e., averaging

the *T*-scores from the attention problems and hyperactivity scales from the BASC-2). Two such composites were calculated, one based on parent report (scales correlated,  $r = .64, p < .001$ ) and one based on teacher report (scales correlated,  $r = .63, p < .001$ ). These ADHD symptoms composites were used as the mediators in the mediational models.

### Preliminary Analyses

First, descriptive analyses were conducted to examine the variables of interest (Table 2). None of the variables of interest demonstrated problematic skewness or kurtosis. Second, all variables of interest (i.e., that were used in subsequent analyses testing hypotheses) were examined in a correlation matrix (Table 3). Parent- and teacher-reported ADHD symptoms were significantly positively correlated. Social perception abilities were significantly negatively correlated with parent-reported ADHD symptoms and significantly positively correlated with parent-reported social skills, parent-reported adaptability, and teacher-reported adaptability. However, social perception abilities were not significantly related to teacher-reported ADHD symptoms or social skills. Parent-reported ADHD symptoms were also significantly negatively correlated with parent-reported social skills and parent-reported adaptability, whereas teacher-reported ADHD symptoms were significantly negatively correlated with teacher-reported social skills and teacher-reported adaptability. Social skills and adaptability were significantly positively correlated based on both parent- and teacher-report. Some of the cross-informant positive correlations among social skills and adaptability were significant as well.

Third, the mediators (parent- and teacher-report of ADHD symptoms) and the criterion variables (parent- and teacher-report of social skills and adaptability) were correlated with demographic variables to determine if any needed to be used as covariates in the

analyses testing the hypotheses. The potential covariates were either continuous variables (e.g., child age) or dichotomized variables (e.g., child sex). Child race (a categorical variable with more than two categories) was dichotomized as 0 = White and 1 = non-White for these analyses. Table 4 shows the results of these analyses. Child sex (coded 0 = males, 1 = females) was significantly negatively related to both ADHD symptoms composites (parent and teacher report), indicating that boys had significantly higher levels of ADHD symptoms than girls. Child age was significantly negatively correlated with teacher-reported adaptability, indicating that younger children demonstrated more age-adjusted adaptability than did older children (per the teachers). Thus, to be most conservative as well as consistent across models, it was determined that both sex and age of a child would be used as covariates in subsequent tests of the hypotheses.

#### Tests of Hypotheses

For the current study, Hypothesis 1 stated that ADHD symptoms (i.e., attention problems and hyperactivity) would be negatively related to social perception abilities, social skills, and adaptability. This hypothesis was tested using partial correlations, accounting for child sex and age (Table 5). Parent-reported ADHD symptoms were significantly negatively correlated with parent-reported social skills,  $pr = -.47, p < .001$ , and parent-reported adaptability,  $pr = -.37, p = .002$ . However, the correlation between parent-reported ADHD symptoms and social perception abilities only approached significance,  $pr = -.23, p = .05$ . Teacher-reported ADHD symptoms were significantly negatively correlated with teacher-reported social skills,  $pr = -.37, p = .001$ , and teacher-reported adaptability,  $pr = -.39, p = .001$ . However, teacher-reported ADHD symptoms were not significantly correlated with social perception abilities,  $pr = -.19, p = .12$ .

Table 2

*Descriptive Data for Variables of Interest*

	N	Mean	SD	Minimum	Maximum	Skew	Kurtosis
Social Perception Abilities	76	9.70	2.34	4.50	15.00	-.29	-.31
ADHD Symptoms (Parent)	72	50.67	8.27	34.50	78.50	.81	1.13
Social Skills (Parent)	71	50.42	8.46	33.00	68.00	-.21	-.74
Adaptability (Parent)	73	47.66	9.22	27.00	67.00	.02	-.88
ADHD Symptoms (Teacher)	74	52.28	9.36	37.00	80.00	.61	.38
Social Skills Teacher	74	52.93	12.10	32.00	75.00	.36	-1.06
Adaptability Teacher	74	46.65	10.28	25.00	68.00	.18	-.73

*Note.* SD = standard deviation; ADHD = attention-deficit/hyperactivity disorder. For social perception abilities, the normative mean is 10 with a standard deviation of 3. For ADHD symptoms, social skills, and adaptability, the normative mean is 50, with a standard deviation of 10.

Table 3

*Zero-Order Correlations among Variables of Interest*

	2.	3.	4.	5.	6.	7.
1. Social Perception Abilities	-.23*	.26*	.25*	-.17	.16	.29*
2. ADHD Symptoms (Parent)	--	-.48***	-.33**	.58***	-.19	-.15
3. Social Skills (Parent)		--	.62***	-.40**	.31**	.32**
4. Adaptability (Parent)			--	-.28*	.20†	.39**
5. ADHD Symptoms (Teacher)				--	-.42***	-.42***
6. Social Skills (Teacher)					--	.72***
7. Adaptability (Teacher)						--

Note. ADHD = attention-deficit/hyperactivity disorder.

† trend;  $p < .10$ . \*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

Table 4

*Zero-Order Correlations between Demographic Variables and Mediator and Criterion Variables*

	Child Age	Child Sex	Child Race	Family Income
ADHD Symptoms (Parent)	-.03	-.27*	-.12	-.09
Social Skills (Parent)	-.21	.19	-.04	.18
Adaptability (Parent)	-.27*	.01	-.05	.23
ADHD Symptoms (Teacher)	-.10	-.35**	-.15	.02

Table 4 (continued).

	Child Age	Child Sex	Child Race	Family Income
Social Skills (Teacher)	.15	.19	.13	-.08
Adaptability (Teacher)	-.08	.21	.01	-.08

*Note.* Child sex coded 0 = males, 1 = females; child race coded 0 = White, 1 = non-White; ADHD = attention-deficit/hyperactivity disorder.

\*  $p < .05$ . \*\*  $p < .01$ .

Table 5

*Partial Correlations to Test Hypotheses 1 and 2*

	Social Perception Abilities	Social Skills (Parent)	Adaptability (Parent)	Social Skills (Teacher)	Adaptability (Teacher)
1. Social Perception Abilities	--	.20†	.19	.19	.27*
2. ADHD Symptoms (Parent)	-.23†	-.47***	-.37**	--	--
3. ADHD Symptoms (Teacher)	-.19	--	--	-.37**	-.39**

*Note.* Child sex and age entered as control variables; ADHD = attention-deficit/hyperactivity disorder.

† trend;  $p < .10$ . \*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .00$

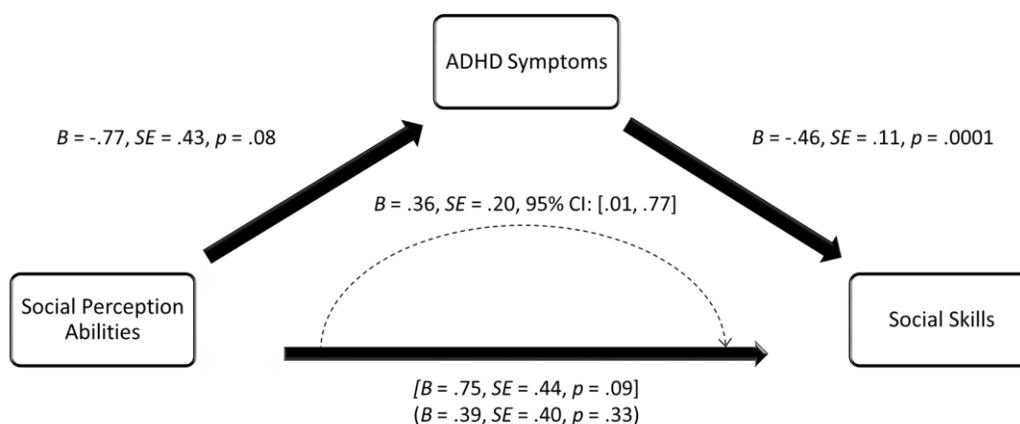
Hypothesis 2 stated that social perception abilities would be positively related to both social skills and adaptability. This hypothesis was also tested using partial correlations (Table 5), accounting for child sex and age. The relation between social perception abilities and parent-reported social skills approached significance  $pr = .20, p = .095$ . Social perception abilities were not significantly related to parent-reported adaptability,  $pr = .19, p = .11$ , or teacher-reported social skills,  $pr = .19, p = .11$ . Finally, social perception abilities were significantly related to teacher-reported adaptability,  $pr = .27, p = .02$ .

Hypothesis 3 stated that the relations between social perception abilities and social skills (as well as between social perception abilities and adaptability) would occur indirectly through ADHD symptoms (i.e., attention problems and hyperactivity). Specifically, it was predicted that social perception abilities would relate negatively to ADHD symptoms which, in turn, would relate negatively to both social skills and adaptability. This hypothesis was tested using PROCESS (Hayes, 2013) in SPSS, which allows bootstrapping analytical techniques to estimate a point estimate of an indirect effect as well as the asymmetric confidence interval around that estimate. Confidence intervals non-inclusive of zero are considered significant (i.e., evidence of an indirect effect).

A total of four mediational models were tested—two separate models for each criterion variable (social skills and adaptability), with both of these models being examined separately for parent and teacher report of the variables (ADHD symptoms, social skills, and adaptability). All four analyses were conducted using 5,000

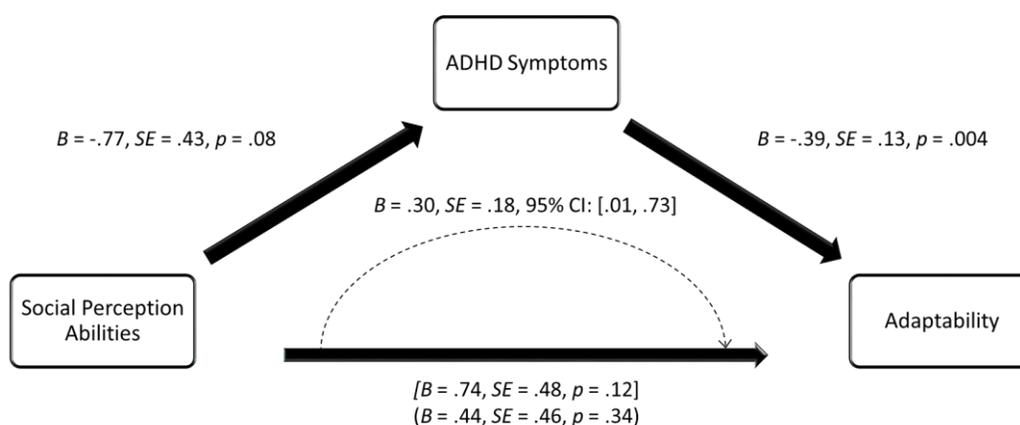
bootstrapping samples with resampling. Child sex and age were entered as covariates for all four models.

Figure 1 depicts the results of the analysis examining the indirect effect of social perception abilities on parent-reported social skills through parent-reported ADHD symptoms. Whereas the total effect was marginally significant, the direct effect (i.e., accounting for ADHD symptoms) was not. The indirect effect of social perception abilities on parent-reported social skills through ADHD symptoms resulted in a point estimate of .36,  $SE = .20$ , (95% CI [.01, .77]). Because the indirect effect was non-inclusive of zero, it is considered significant. However, it is notable that the relation between social perception abilities and parent-reported ADHD symptoms only approached significance,  $B = -.77$ ,  $SE = .11$ ,  $p = .08$ .



*Figure 1.* The Indirect Effect of Children’s Social Perception Abilities on Parent-Reported Social Skills Through Parent-Reported ADHD Symptoms (Hypothesis 3). Child sex and age entered as control variables. Unstandardized regression coefficients are reported. The statistics in brackets show the total effect of social perception abilities on social skills; the statistics in parentheses show the direct effect of social perception abilities on social skills, after accounting for the indirect effect of ADHD symptoms. The indirect effect is depicted above each curved, dashed arrow. The mediator and criterion variable are based on parent report.  $N = 71$ .

Figure 2 depicts the results of the analysis examining the indirect effect of social perception abilities on parent-reported adaptability through parent-reported ADHD symptoms. Neither the total effect nor the direct effect was significant. However, the indirect effect was non-inclusive of zero and, thus, significant. Specifically, the indirect effect of social perception abilities on parent-reported adaptability through ADHD symptoms resulted in a point estimate of .30,  $SE = .18$ , (95% CI [.01, .73]). Thus, the results indicated that social perception abilities related to social skills indirectly through ADHD symptoms. Still, as noted above the relation between social perception abilities and parent-reported ADHD symptoms only approached significance.

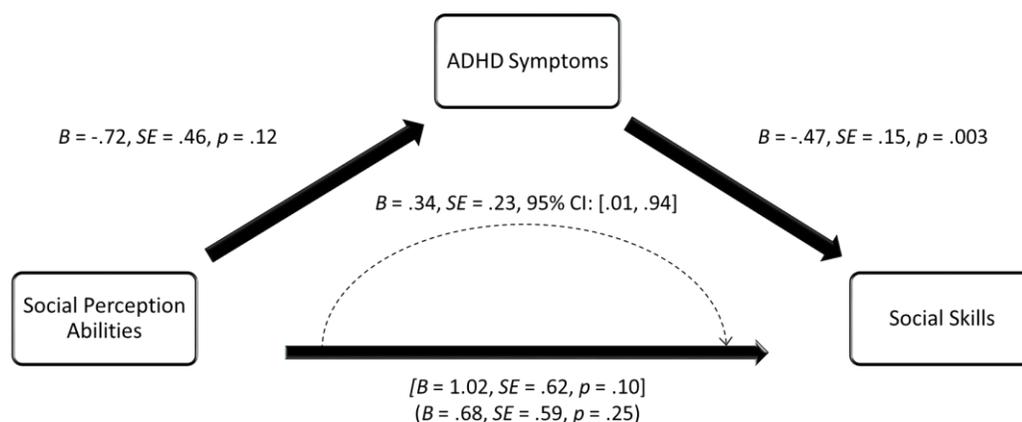


*Figure 2.* The Indirect Effect of Children’s Social Perception Abilities on Parent-Reported Adaptability Through Parent-Reported ADHD Symptoms (Hypothesis 3). Child sex and age entered as control variables. Unstandardized regression coefficients are reported. The statistics in brackets show the total effect of social perception abilities on adaptability; the statistics in parentheses show the direct effect of social perception abilities on adaptability, after accounting for the indirect effect of ADHD symptoms. The indirect effect is depicted above each curved, dashed arrow. The mediator and criterion variable are based on parent report.  $N = 71$ .

Figure 3 depicts the results of the analysis examining the indirect effect of social perception abilities on teacher-reported social skills through teacher-reported ADHD symptoms. Neither the total effect nor the direct effect was significant. However, the indirect effect was non-inclusive of zero and, thus, significant. Specifically, the indirect

effect of social perception abilities on teacher-reported social skills through ADHD symptoms resulted in a point estimate of .34,  $SE = .23$ , (95% CI [.01, .94]). Thus, the results indicated that social perception abilities related to social skills indirectly through ADHD symptoms. However, it is notable that the relation between social perception abilities and teacher-reported ADHD symptoms was non-significant,

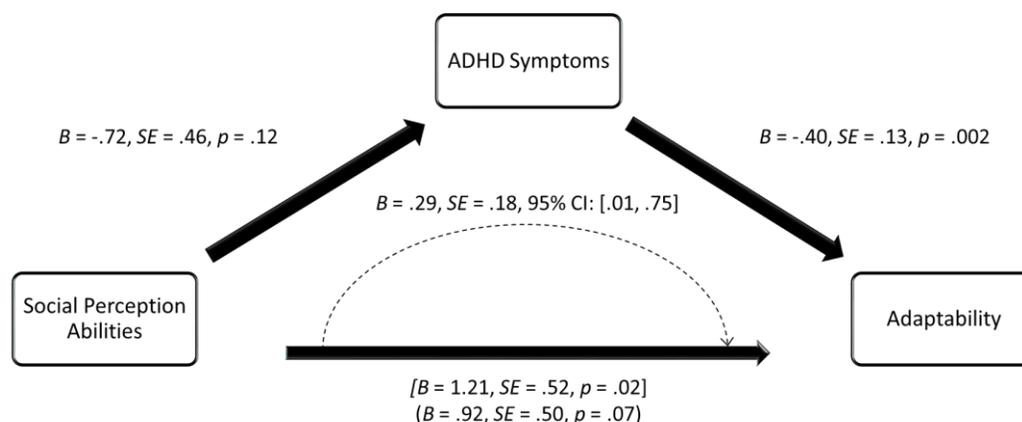
$B = -.72$ ,  $SE = .46$ ,  $p = .12$ .



*Figure 3.* The Indirect Effect of Children’s Social Perception Abilities on Teacher-Reported Social Skills Through Teacher-Reported ADHD Symptoms (Hypothesis 3). Child sex and age entered as control variables. Unstandardized regression coefficients are reported. The statistics in brackets show the total effect of social perception abilities on social skills; the statistics in parentheses show the direct effect of social perception abilities on social skills, after accounting for the indirect effect of ADHD symptoms. The indirect effect is depicted above the curved, dashed arrow. The mediator and criterion variable are based on teacher report.  $N = 74$ .

Figure 4 depicts the results of the analysis examining the indirect effect of social perception abilities on teacher-reported adaptability through teacher-reported ADHD symptoms. Whereas the total effect was significant, the direct effect (i.e., accounting for ADHD symptoms) was only marginally significant. Because the indirect effect of social perception abilities on teacher-reported adaptability through ADHD symptoms resulted in a point estimate of .29,  $SE = .18$ , (95% CI [.01, .75])—which did not include zero—it is

considered significant. Again, as noted above the relation between social perception abilities and teacher-reported ADHD symptoms only approached significance.



*Figure 4.* The Indirect Effect of Children’s Social Perception Abilities on Teacher-Reported Adaptability Through Teacher-Reported ADHD Symptoms (Hypothesis 3). Child sex and age entered as control variables. Unstandardized regression coefficients are reported. The statistics in brackets show the total effect of social perception abilities on adaptability; the statistics in parentheses show the direct effect of social perception abilities on adaptability, after accounting for the indirect effect of ADHD symptoms. The indirect effect is depicted above the curved, dashed arrow. The mediator and criterion variable are based on teacher report.  $N = 74$ .

#### Post-Hoc Analyses

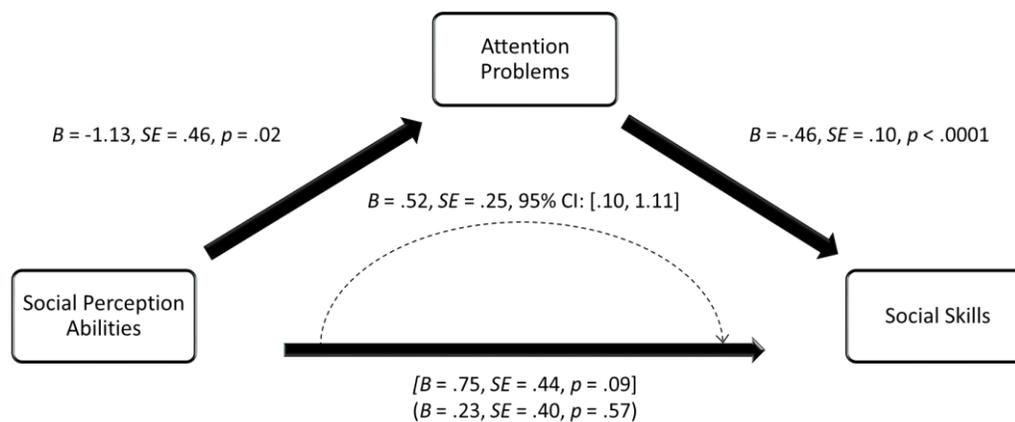
Reverse mediational testing was conducted to determine whether social skills predicted social perception abilities through ADHD symptoms and whether adaptability predicted social perception abilities through ADHD symptoms. Again, four mediational models were tested—two separate models for each predictor (social skills and adaptability), with both of these models being examined separately for parent and teacher report of the variables (ADHD symptoms, social skills, and adaptability). All four reverse mediation analyses were conducted using 5,000 bootstrapping samples with resampling. None of the reverse mediation analyses supported an indirect effect of social skills (or adaptability) on social perception abilities through ADHD symptoms. For all four analyses, the indirect effect was inclusive of zero (and non-significant). Furthermore,

reverse mediational testing was conducted to determine whether ADHD symptoms predicted social skills through social perception abilities and whether ADHD symptoms predicted adaptability through social perception abilities. Four mediational models were tested—two separate models for each criterion (social skills and adaptability), with both of these models being examined separately for parent and teacher report of the variables (ADHD symptoms, social skills, and adaptability). For all four analyses, the indirect effect was inclusive of zero (and non-significant).

Planned post-hoc analyses included conducting the primary mediation analyses again to examine attention problems and hyperactivity separately. Eight mediational models were tested—separate models for each criterion variable (social skills and adaptability) and separate models for each mediator (attention problems and hyperactivity), with all four of these models being examined separately for parent and teacher report of the variables (attention problems or hyperactivity, social skills, and adaptability). All eight mediation analyses were conducted using 5,000 bootstrapping samples with resampling.

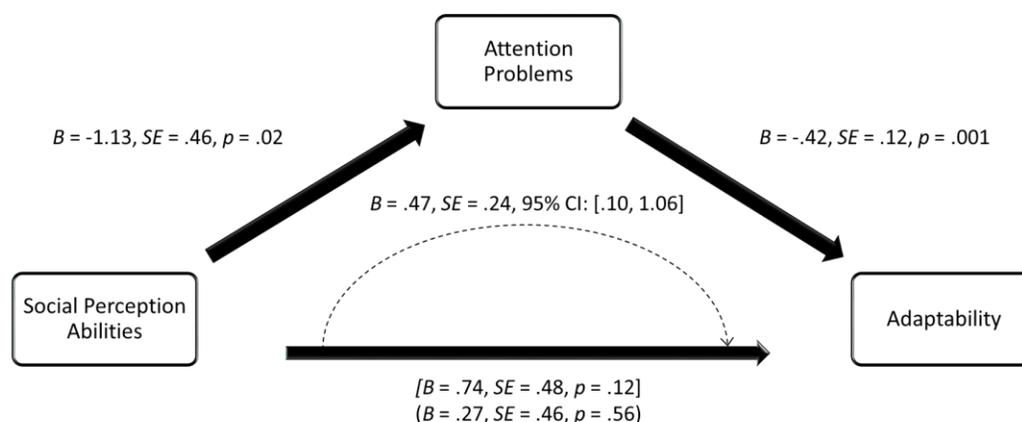
Figure 5 depicts the results of the analysis examining the indirect effect of social perception abilities on parent-reported social skills through parent-reported attention problems. Whereas the total effect only approached significance and the direct effect (i.e. accounting for attention problems) was non-significant, the indirect effect was non-inclusive of zero and, thus, was considered significant. Specifically, the indirect effect of social perception abilities on parent-reported social skills through parent-reported attention problems resulted in a point estimate of .52,  $SE = .25$ , (95% CI [.10, 1.11]). Notably, both the relation between social perception abilities and parent-reported

attention problems,  $B = -1.13$ ,  $SE = .46$ ,  $p = .02$ , and the relation between parent-reported attention problems and parent-reported social skills,  $B = -.46$ ,  $SE = .10$ ,  $p < .0001$ , were significant in the direction consistent with the initial hypotheses.



*Figure 5.* The Indirect Effect of Children’s Social Perception Abilities on Parent-Reported Social Skills Through Parent-Reported Attention Problems (Hypothesis 3 post-hoc). Child sex and age entered as control variables. Unstandardized regression coefficients are reported. The statistics in brackets show the total effect of social perception abilities on adaptability; the statistics in parentheses show the direct effect of social perception abilities on adaptability, after accounting for the indirect effect of attention problems. The indirect effect is depicted above the curved, dashed arrow. The mediator and criterion variable are based on parent report.  $N = 71$ .

Figure 6 depicts the results of the analysis examining the indirect effect of social perception abilities on parent-reported adaptability through parent-reported attention problems. Whereas neither the total effect nor the direct effect (i.e. accounting for attention problems) were significant, the indirect effect was non-inclusive of zero and, thus, was considered significant. Specifically, the indirect effect of social perception abilities on parent-reported adaptability through parent-reported attention problems resulted in a point estimate of  $.47$ ,  $SE = .24$ , (95% CI [.10, 1.06]). As noted earlier, the link between social perception abilities and parent-reported attention problems was significant, as was the link between parent-reported attention problems and parent-reported adaptability,  $B = -.42$ ,  $SE = .12$ ,  $p = .001$ .



*Figure 6.* The Indirect Effect of Children’s Social Perception Abilities on Parent-Reported Adaptability Through Parent-Reported Attention Problems (Hypothesis 3 post-hoc). Child sex and age entered as control variables. Unstandardized regression coefficients are reported. The statistics in brackets show the total effect of social perception abilities on adaptability; the statistics in parentheses show the direct effect of social perception abilities on adaptability, after accounting for the indirect effect of attention problems. The indirect effect is depicted above the curved, dashed arrow. The mediator and criterion variable are based on parent report.  $N = 71$ .

The remaining six post-hoc analyses specifically examining attention problems and hyperactivity as mediators were inclusive of zero and, therefore, non-significant. Given the post-hoc nature of these analyses, figures are not included for non-significant findings.

Reverse mediational testing was also conducted to determine whether parent-reported social skills predicted social perception abilities through parent-reported attention problems and whether parent-reported adaptability predicted social perception abilities through parent-reported attention problems. Both mediation analyses were conducted using 5,000 bootstrapping samples with resampling. Neither reverse mediation analysis supported an indirect effect of parent-reported social skills or parent-reported adaptability on social perception abilities through parent-reported ADHD symptoms. For both analyses, the indirect effect was inclusive of zero (and non-significant).

Furthermore, reverse mediational testing was conducted to determine whether parent-reported attention problems predicted parent-reported social skills through social perception abilities and whether parent-reported attention problems predicted parent-reported adaptability through social perception abilities. For both analyses, the indirect effect was inclusive of zero (and non-significant). The lack of support for the reverse mediation analyses further bolters support for the directionality of the tested mediation models.

Finally, theory of mind and affect recognition were examined as simultaneous predictors and as parallel predictors. These analyses did not result in a better model than using the social perception composite as the predictor and all indirect effects were non-significant. Attention problems and hyperactivity were also examined as parallel mediators, but this did not result in a better model than isolating attention problems alone as the mediator.

#### Research Question

Finally, to answer Research Question 1, moderated multiple regression analyses were conducted to determine if ADHD symptoms moderated the relation between social perception abilities and social skills and between social perception abilities and adaptability. Four analyses in total were conducted—two separate models for each criterion variable (social skills and adaptability), with both of these models being examined separately for parent and teacher report of the variables (ADHD symptoms, social skills, and adaptability). Variables were centered prior to creating the interaction terms. The covariates (child age and sex) were entered on the first step, the two main effects (social perception abilities and ADHD symptom composite) were entered on the

second step, and the interaction term was entered on the third step. None of the four interaction terms were significant (only adding .004 to .015 additional variance to the prediction of the criterion variables). Thus, ADHD symptoms as a moderator in the relation between social perception abilities and the criterion variables was not supported.

Finally, given the findings regarding attention problems as a mediator, moderated multiple regression analyses were conducted to examine whether attention problems moderated the relation between social perception abilities and social skills and between social perception abilities and adaptability. Four analyses in total were conducted—two separate models for each criterion variable (social skills and adaptability), with both of these models being examined separately for parent and teacher report of the variables (attention problems, social skills, and adaptability). The covariates (child age and sex) were entered on the first step, the two main effects (social perception abilities and attention problems) were entered on the second step, and the interaction term was entered on the third step. None of the four interaction terms were significant. Thus, attention problems as a moderator in the relation between social perception abilities and the criterion variables was not supported.

## CHAPTER IV

## DISCUSSION

## Support for Hypotheses

*Relations with ADHD Symptoms*

Hypothesis 1, that ADHD symptoms (i.e., attention problems and hyperactivity) would be negatively related to social perception abilities (i.e., theory of mind and affect recognition) as well as social skills and adaptability, was partially supported. Both parent-reported and teacher-reported ADHD symptoms were significantly negatively correlated with adaptability and social skills but not with social perception abilities.

The findings from both parent and teacher data suggesting that children's social skills and adaptability decrease as ADHD symptoms increase are consistent with the previous literature (e.g., Martin, Nejad, Colmar, & Liem, 2012; Merrell & Wolfe, 1998), and the consistency across reporters lends further support to the theory that social skills and adaptability are negatively related to ADHD symptoms in children. There was no evidence of a significant negative relation between social perception abilities and teacher-reported ADHD symptoms, even at the zero-order level. The negative relation between social perception abilities and parent-reported ADHD symptoms approached significance but was nevertheless non-significant when accounting for the child's sex and age. However, this relation was significant at the zero-order level. Overall, given the findings of a general lack of relation between social perception abilities and ADHD symptoms, the current results do not support the theory that children's social perception abilities significantly influence the degree to which they demonstrate the behavioral expression of ADHD symptoms (i.e., both inattention and hyperactivity).

### *Relations with Social Perception Abilities*

Hypothesis 2, that social perception abilities would be positively related to both social skills and adaptability, was partially supported. The positive correlation between social perception abilities and parent-reported social skills was only marginally significant, whereas the positive correlation between social perception abilities and parent-reported adaptability was non-significant, as was the positive correlation between social perception abilities and teacher-reported social skills. However, the positive correlation between social perception abilities and teacher-reported adaptability was significant.

It is not clear why this one relation was significant whereas others were not; however, a post-hoc comparison of the magnitude of the correlations between social perceptions abilities and the four criterion variables using Fisher's  $r$ -to- $z$  transformation (Lee & Preacher, 2013) indicated that none of the variables was of a greater magnitude than the other. Therefore, there does not appear to be a clinically meaningful difference among them.

### *ADHD Symptoms as a Mediator*

For Hypothesis 3, it was expected that the aforementioned relations with social perception abilities would occur indirectly through ADHD symptoms. Specifically, social perception abilities would relate negatively to ADHD symptoms, which, in turn, would relate negatively to both social skills and adaptability. Social perception abilities did not seem to directly relate to social skills and adaptability in a significant way (other than for teacher-reported adaptability). However, for both parent and teacher-report, the indirect effect of social perception abilities on social skills through ADHD symptoms was

significant. Similarly, for both parent- and teacher-report, the indirect effect of social perception abilities on adaptability through ADHD symptoms was significant. Therefore, Hypothesis 3 was generally supported.

According to Hayes (2013), the existence of a total effect of the predictor on the criterion is not a necessary precondition for the existence of an indirect effect, nor is it necessary for the interpretation of the indirect effect. Furthermore, the relation between the predictor and mediator and the relation between the mediator and the criterion need not be significant for a mediating effect to exist. The product of these two relations—not the relations themselves—is of interest in determining whether or not the proposed mediator (i.e., ADHD symptoms in this case) indeed acts as a mediator in each model (Hayes, 2013). Thus, the four tested mediation models do support an indirect effect but within the context of a non-significant total effect and a non-significant relation between the predictor and the mediator. Thus, the initial findings in testing Hypothesis 3 suggest that a complex interrelation of social perception abilities and ADHD symptoms appears important in the prediction of social skills and adaptability in preschoolers. However, for all four models, the confidence intervals for the indirect effect approached zero and represent a very small effect size (Hayes, 2013).

It is important to consider that, whereas social perception abilities do not seem to significantly relate to ADHD symptoms, children's social perception abilities indirectly influenced social skills and adaptability through ADHD symptoms. As can be seen in Figures 1 through 4, children demonstrating less developed social perception abilities demonstrated less developed social skills and adaptability and this relation occurred, at least in part, indirectly through ADHD symptoms (which were negatively related to the

criterion variables). Furthermore, moderation of the relation between social perception and social skills and between social perception and adaptability by ADHD symptoms was not supported. These findings suggest that ADHD symptoms provide an indirect pathway but do not themselves attenuate or exacerbate the relations among the constructs. Still, given the non-significant total effects, the non-significant paths from the social perception abilities to ADHD symptoms, and the small effect sizes for the indirect effects, this interpretation should be made cautiously.

In considering the possibility that attention problems and hyperactivity may differentially mediate the relation between social perception abilities and the criterion variables, they were examined as separate mediators. This decomposition of the mediator seemed appropriate also given that the initial tests of the mediation left some questions about the complex relation among the variables of interest. The indirect effect of social perception abilities on both parent-reported social skills and adaptability through parent-reported attention problems was significant. When examining these models, the indirect effect, the relations between social perception abilities and the mediator (i.e., attention problems), and the relation between the mediator and the two criterion variables are all significant, providing a clearer context for interpreting the significant indirect effect. However, the analyses examining hyperactivity as a mediator were not significant as were all analyses with the teacher data.

These latter findings demonstrated that isolating attention problems as a mediator of these relations seems to reveal a mediation process that is far clearer than that revealed by attention problems and hyperactivity combined. Therefore, the current study's results suggest that attention problems associated with ADHD may be a more appropriate

mediator in the relation between social perception abilities and the criterion variables of interest. It appears that the hyperactivity component of the ADHD composite used as a mediator in the primary hypothesized models may be introducing error, thereby weakening the results. For instance, when using the ADHD composite as a mediator in the hypothesized models, the relation between social perception abilities and ADHD symptoms is non-significant; however, social perception abilities significantly relate to attention problems when they are isolated from hyperactivity. These findings are consistent with previous research that supports the relation between social perception and attention problems, specifically, even when considering within the context of hyperactivity and impulsivity—and when examining these relations within clinical populations, including children with ADHD (Pelc et al., 2006; Fine, Semrud-Clikeman, Butcher, & Walkowiak, 2008). Perhaps social perception deficits in young children place additional demands on their attention when in social situations. It seems plausible that higher demands on attention during children's interactions with others may provide increased opportunity for teachers and caregivers to observe behaviors indicative of attention problems in children.

Not only is there support for the hypothesized mediational models, particularly when isolating attention problems as the mediator, but also the lack of support for any of the reverse mediation models further bolsters the theory regarding the directionality of the indirect effect. However, longitudinal research is needed to support the temporal sequencing of the relation between social perception abilities, ADHD symptoms, and social skills and adaptability.

In the context of the current study, social perception deficits were conceptualized as resulting from dysfunctional genes and neurological abnormalities. Furthermore, social perception deficits were conceptualized as contributing to the behavioral expression of ADHD symptoms in children, which in turn would predict social skills and adaptability. Overall, the results of the current study support the existence of an indirect relation between social perception abilities and social skills and adaptability through ADHD symptoms. The non-significant relation between social perception and ADHD symptoms in the primary mediation analyses suggests that social perception abilities do not predict the behavioral expression of both the hyperactivity and the attention problems that are often seen in children with ADHD. However, when deconstructing ADHD into attention problems and hyperactivity as separate mediators, the emergence of a significant relation between social perception abilities and attention problems suggests that social perception abilities predict the behavioral expression of specifically the attention problems often observed in children with ADHD. Furthermore, when considering the non-significant direct effect of social perception abilities on social skills and adaptability in each of the mediation models, the findings suggest that social perception abilities only impact children's social skills and adaptability within the context of relatively high attention problems.

The current study's findings concerning the mediating role of attention problems in the development of social skills deficits and adaptability deficits highlights the importance of addressing the use of medication for attentional difficulties. Indeed, attention problems may be, in part, the behavioral expression of social perception deficits resulting from neurological abnormalities, so the use of medication to reduce significant

levels of attention problems experienced by children may be one viable way to prevent social perception deficits from negatively impacting social skills and adaptability.

Perhaps alleviating the severity of attention problems in young children would allow them to better attend to and learn from the modeling of acceptable social and adaptive behaviors by their peers and caregivers.

#### Strengths of the Current Study

The current study examined ADHD symptoms, social perception abilities, social skills, and adaptability within a preschool sample and, therefore, provided a downward extension of the existing ADHD literature. Previous research has examined these constructs in school-aged children and adolescents (e.g. Burns & Martin, 2014; Jarratt, Riccio, & Siekierski, 2005; Marton et al., 2009; Merrell & Wolfe, 1998;), yet this relation in preschool-aged children has not been thoroughly examined. The examination of ADHD symptoms as a continuous construct rather than a discrete diagnosis afforded the current study the ability to examine the relations among these constructs in younger children (given that children are often not diagnosed with ADHD as young as preschool). Furthermore, the use of both parent and teacher data to examine these constructs bolsters the confidence that can be placed in the current study's findings. Finally, whereas many studies of clinical samples have predominantly male participants (Arnold, 1996), the current study utilized a community sample comprised of an equal number of males and females.

#### Limitations of the Current Study

The current study has several limitations. First, the current study had a relatively small sample size. Therefore, the study was somewhat underpowered and unable to detect

small effect sizes in relations among the variables. Second, participants were from a very limited geographical area, so it is unclear how well the results of the current study would generalize to individuals who were not represented in this sample. Thirdly, although examining ADHD dimensionally was a strength in one sense (per the apparent latent structure of ADHD; Marcus & Barry, 2011), it is unclear how the mediational model would hold considering the diagnosis of ADHD. Finally, both the mediator and criterion variables were derived from the same omnibus rating scale. Therefore, there may have been a response pattern that inflated the relations among the variables of interest.

#### Directions for Future Research

Given the findings of the current study, future research should focus on examining attention problems, specifically, as a potential mediator of the relation between social perception and social skills and adaptability. Future research should use a larger sample from a broader geographical area to examine the relations among the constructs examined in the current study. Future research should also use a longitudinal design to examine these relations. Using a longitudinal design may shed further light on the temporal sequencing of the relations between social perception, attention problems, and social skills and adaptability (preferably measuring social perception abilities at Time 1, attention problems at Time 2, and social skills and adaptability at Time 3). Furthermore, a longitudinal design would allow for the exploration of whether these relations persist from early childhood into adolescence. To reduce the risk to internal validity, a variety of measures should be used to assess each construct in the model. Perhaps future studies could use direct observation of social skills of children while they are engaged with peers and an ADHD rating scale other than the BASC-2 to determine

the level of attention problems present. It would be beneficial to use a rating scale that specifically assesses the DSM-5 symptoms of ADHD (American Psychiatric Association, 2013). Another direction for future research could be to examine the mediation models within a clinical sample of children diagnosed with ADHD. Future studies could compare an ADHD group to a control group. Additionally, social perception is a complex construct, and future research may benefit from including a wider array of social cognitive factors (e.g., social attributions) not used in the operationalization of social perception for the present study.

Finally, future research should examine social perception alongside executive function within the context of the current study's model. The current study found support for the mediating role of attention problems as a moderator in the relation between social perception abilities and social skills and adaptability. Therefore, the logical next step in testing the theory that executive function and social perception abilities additively contribute to the expression of attention problems and thus social skills and adaptability is to determine whether the supported mediation models hold when considering executive function as a covariate in each of the models. Furthermore, future research should explore executive function as a first-stage moderator of these mediation models to determine if this established mediation holds only under certain levels of executive functioning (i.e., moderated mediation). Such an alternative examination would consider executive function and social perception abilities within a multiplicative model.

### Conclusions and Clinical Implications

Although the primary mediation analyses supported ADHD symptoms as mediating the relations between social perception and the criterion variables, the overall

findings of the current study suggest that social perception may have an indirect effect on social skills and adaptability through attention problems, more specifically. One plausible rationale for this mediational process is that a deficit in social perception abilities may impair a child's attention more broadly due to increased demands for sustained attention to emotional and social cues. Thus, these social perception deficits may exert their influence on the degree to which the child experiences attention problems, which in turn impacts the child's social skills and adaptability. Furthermore, it appears that among young, preschool children, attention problems measured by parent report (as compared to teacher report) is more likely to vary in relation to the other variables of interest in this model.

The findings of the current study inform the necessity of early intervention for children experiencing ADHD symptoms, especially for children experiencing attention problems. By using simple rating scale measures to identify children struggling with attention problems during the preschool years, clinicians can provide preventative care that has the potential to thwart later social problems and adaptive deficits in older children and adolescents, even among children who may have social perception deficits. Research supports the idea that attention problems in preschool result in long-term social deficits. Attention problems carried over into older childhood and adolescence seem to result in lasting social deficits (Kawabata et al., 2012). These types of findings in conjunction with the results of the current study underscore the need for preventative strategies to address attention problems before they result in impairment in other areas of a child's functioning (i.e. adaptive and social).

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