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EMOTION RECOGNITION AND SOCIAL FUNCTIONING IN CHILDREN WITH AND WITHOUT ATTENTION DEFICIT HYPERACTIVITY DISORDER

Rebecca Flake Aldea
University of Kentucky, alycson@aol.com

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Rebecca Flake Aldea, Student

Dr. Richard Milich, Major Professor

Dr. David Berry, Director of Graduate Studies

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DISSERTATION

A dissertation submitted in partial fulfillment of the
requirements for the degree of Doctor of Philosophy in the
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at the University of Kentucky

By
Rebecca Flake Aldea
Lexington, Kentucky

Director: Dr. Richard Milich, Professor of Clinical Psychology
Lexington, Kentucky

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ABSTRACT OF DISSERTATION

EMOTION RECOGNITION AND SOCIAL FUNCTIONING IN CHILDREN WITH AND WITHOUT ATTENTION DEFICIT HYPERACTIVITY DISORDER

This study examined the emotion recognition of children (ages 7-9 years) with and without Attention Deficit Hyperactivity Disorder (ADHD). Children completed two emotion recognition measures, the *Diagnostic Analysis of Nonverbal Accuracy 2 (DANVA2)* and the *Child and Adolescent Social Perception* measure *(CASP)*. Children and their parents also completed an assessment of children's social skills, the *Social Skills Improvement System* (*SSIS)*. Children with ADHD reported a significantly greater level of depressive symptoms and had significantly lower full scale IQ scores than children without ADHD. When these differences were accounted for, children with ADHD continued to show a handful of deficits in emotion recognition. They demonstrated difficulties in emotion recognition on the *DANVA2* regarding specific emotions, *fear* and *sadness.* On the *CASP*, children with ADHD made significantly more errors than children without ADHD due to a tendency to make up information to explain how they were able to identify feelings. Children's performance on the emotion recognition measures did not significantly mediate the relation between their diagnostic status and social skills (as rated by parents). In summary, additional evidence was found regarding the deficits in emotion recognition experienced by children with ADHD, however, further work needs to be done to determine if these deficits relate to the peer difficulties experienced by these children.

KEYWORDS: Emotion Recognition; Attention Deficit Hyperactivity Disorder; Social Functioning; Depression; Peer Relationship Problems

Rebecca Flake Aldea
Rebecca Flake Aldea

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Date

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By

Rebecca Flake Aldea

Richard Milich, PhD
Director of Dissertation

David Berry, PhD
Director of Graduate Studies

January 30, 2013
Date

DEDICATION

I dedicate my dissertation work to my two precious boys, Gabriel and Michael, and their little brother or sister on the way. I truly know now, as I hope you do someday, that with love, anything is possible.

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like money, as God would provide. Finally, I can not sufficiently express how grateful I am for the love of my husband, Ivanjo, and his willingness to not only support me, but go with me on this journey.

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Chapter 1: Introduction

An important aspect of children's development, and eventual success and happiness in life, is being able to form and maintain positive relationships with peers. These relationships benefit children in various ways; for example, peers are emotional and cognitive resources that provide children with support and companionship, which supplements the support received from their primary caregivers (Bagwell, 2004). However, a potentially more important reason to promote early peer relationships is because it is through these relationships that children learn how to connect and work with individuals other than their primary caregivers. Being able to effectively relate to others becomes increasingly more important as children mature, because less time is spent interacting with primary caregivers and more time is spent in school interacting with other children and adults. Thus, children who have difficulties with peer relations not only miss out on more immediate benefits, like extra support and companionship, but they also experience fewer positive peer interactions which limits their practice and development of interpersonal skills. This leads to the experience of continued interpersonal difficulties in the future, because even if/when children get the chance to interact with a new group of peers with whom they have not established negative reputations, they will not have developed the interpersonal skills necessary to establish positive relationships.

Peer relation difficulties are further concerning, because research studies have consistently found that these difficulties are associated with future negative outcomes in other areas of children's lives (i.e. Cowen, Pederson, Babigian, Izzo, & Trost, 1973). For example, findings from a longitudinal study showed that 4th graders who were rated

lower by their peers (or who were classified on peer sociometric measures as controversial and rejected) were later found to be more aggressive; to have conduct problems, higher substance use, and more court offenses; as well as to score lower on achievement tests and experience more grade failures (Ollendick, Weist, Borden, & Greene, 1992). Although it can not be concluded from this study that children's peer relation difficulties caused these negative outcomes to occur, the results indicate that children who have peer relation difficulties are at a higher risk for experiencing multiple other difficulties. Because of this higher risk, and the limitations discussed above that are associated with not being able to establish positive peer relationships, it is critical that children with peer relation difficulties are identified and assisted early on. Helping this group of children improve their peer relations may not prevent all future problems from developing; however, this will ensure that regardless of what other difficulties they experience in the future, they will be able to receive the benefits from being able to form healthy, positive relationships with others.

One group of children who appear especially susceptible to experiencing difficulties in peer relations is children with Attention Deficit Hyperactivity Disorder (ADHD). ADHD is a disorder characterized by developmentally inappropriate levels of inattention, impulsivity, and hyperactivity (Diagnostic and Statistical Manual of Mental Disorders-4th ed., text rev., American Psychiatric Association, 2000). It is one of the most common behavior disorders in children, with prevalence estimates between 2 and 9.5 percent (Barkley, 1998). In the past, ADHD was thought to be a childhood disorder that improved over time as kids matured; however, follow-up studies have indicated that between 35-80% of children with ADHD continued to experience difficulties with this

disorder as adolescents and between 49-66% reported significant symptoms or still met diagnostic criteria as adults (Barkley, Fischer, Smallish, & Fletcher, 2006). Thus, in addition to being a more frequently experienced disorder, ADHD also appears to be linked with chronic difficulties for many individuals. Although the individuals who continue to meet diagnostic criteria for ADHD as adolescents or adults report ongoing difficulties with symptoms of ADHD, studies have shown that it is the negative impact that these symptoms have had on their lives that is the most troublesome for them, e.g. low self-esteem, low educational achievement, and poor social skills and difficulties with interpersonal relationships (Hechtman & Weiss, 1983; Slomkowski, Klein, & Mannuzza, 1995; Waddell, 1984). Therefore, ADHD warrants our attention not only because it is a common and enduring disorder, but also because it negatively impacts multiple areas of children's lives, including their ability to develop healthy interpersonal relationships.

Research studies applying various types of peer assessments, such as peer rating scales and peer nomination measures, have repeatedly shown that children with ADHD are perceived negatively by other children (Carlson, Lahey, Frame, Walker, & Hynd, 1987; Erhardt & Hinshaw, 1994; Hoza, Gerdes et al., 2005; King & Young, 1981; Klein & Young, 1979). For example, children with ADHD were less likely to be identified as friends or rated as popular by their peers; and they were chosen more frequently for negative roles and less frequently for positive roles when their peers were asked to select classmates for a hypothetical class play. Furthermore, children with ADHD have been shown to be perceived negatively by other children even when they have not previously interacted with these children and when these children were not aware of their diagnostic status (Bickett & Milich, 1990). The social difficulties children with ADHD experience

also continue over time and frequently get worse, rather than better (Whalen and Henker, 1985; Whalen, Henker, Castro, & Granger, 1987). Research studies have shown that adolescents who were diagnosed with ADHD as children have both fewer friends and more problems keeping friends than adolescents without ADHD. Additionally, the severity of childhood ADHD and the severity of current ADHD symptoms have been found to predict impairment in multiple domains of adolescent peer relationships (Bagwell, Molina, Pelham, & Hoza, 2001; Barkley et al., 2006; Waddell, 1984). Because many children with ADHD will experience ongoing social difficulties, and these difficulties have been linked to multiple limitations and negative outcomes, it is important that treatment interventions for children with ADHD target peer relation problems in addition to the core deficits associated with ADHD.

One type of intervention that is commonly used to treat children with ADHD is stimulant medication. Although several research studies have supported the efficacy of stimulant medication in reducing ADHD symptoms and various problematic behaviors demonstrated by children with ADHD (Cunningham, Siegel, & Offord, 1985; Hinshaw, Henker, Whalen, Erhardt, & Dunnington, 1989; Murphy, Pelham, & Lang, 1992; Pelham, Bender, Caddell, Booth, & Moorer, 1985; Pelham, Sturges et al., 1987; Schleifer et al., 1975; Whalen, Henker, Castro, et al., 1987; Whalen, Henker, Collins, Finck, & Dotemoto, 1979), these reductions do not resolve the peer relation difficulties experienced by children with ADHD. As several authors have pointed out (e.g. Abikoff, 1985; Bagwell et al., 2001; Buhrmester, Whalen, Henker, MacDonald, & Hinshaw, 1992; Hinshaw et al.; Landau & Moore, 1991; Pelham, Wheeler, & Chronis, 1998; Richters et al., 1995; Whalen, Henker, Buhrmester et al., 1989), the usage of stimulant medication

may lead to short-term improvements in the peer status of children with ADHD, but it does not result in the peer status of children with ADHD being raised to a level comparable to that of children without ADHD. Additionally, the usage of stimulant medication has not been shown to lead to long-term changes in peer acceptance or to increases in the interpersonal skills demonstrated by children with ADHD.

Various psychosocial interventions (i.e. social skills training) have also been used to treat children with ADHD. Mixed evidence has been found regarding the efficacy of these interventions in reducing the peer relation difficulties experienced by children with ADHD. Some research studies have indicated that psychosocial interventions produced little to no improvement in the social functioning of children with ADHD (e.g. Antshel & Remer, 2003; Frankel, Myatt, Cantwell, & Feinburg, 1997), while other studies have shown modest to significant increases in trained social skills and parent/teacher ratings of peer relations after treatment (e.g. Evans, Axelrod, & Langberg, 2004; Pfiffner & McBurnett, 1997; Sheridan & Dee, 1996). Although some studies have indicated positive treatment effects for psychosocial interventions, as with medication, evidence has not been found to support the long-term maintenance of these effects. Psychosocial interventions have additionally been implemented along with stimulant medication in hopes to enhance the resulting treatment effects. A series of studies have shown, however, that the improvements seen in children's social functioning, when they received both medication and psychosocial interventions, were not significantly better than the improvements associated with the usage of stimulant medication alone (Abikoff, Hechtman, Klein, Gallagher et al., 2004; Abikoff, Hechtman, Klein, Weiss et al., 2004;

Hechtman, Abikoff, Klein, Greenfield et al., 2004; Hechtman, Abikoff, Klein, Weiss et al., 2004; Klein, Abikoff, Hechtman, & Weiss, 2004).

The most comprehensive ADHD treatment study to date, the National Institute of Mental Health (NIMH) multimodal treatment study of ADHD (MTA), was conducted with a large sample of children across six sites to examine the intermediate and long-term effectiveness of treatment options for ADHD. In this study, children with ADHD (ages 7 to 9.9 years) were randomly assigned to one of four treatments: medication management, behavior modification, combined (medication plus behavior modification), or routine community care (MTA Cooperative Group, 2004). Results showed that at the end of both 14 and 24 months, children with ADHD who were assigned to the medication management group and the combined treatment group had significantly greater reductions in ADHD symptoms than children assigned to the behavior modification and routine community care groups. On measures of social functioning, however, little evidence was found for the superiority of any of the treatments implemented. Children with ADHD continued to experience significant peer problems at the end of treatment, regardless of the treatment they received (Hoza, Gerdes et al., 2005; Hoza, Mrug et al., 2005).

The above review indicates that current treatment interventions are not adequately addressing the peer relation difficulties experienced by children with ADHD. These interventions do lead to improvements -- children with ADHD show enhanced knowledge of social skills and demonstrate fewer problematic behaviors post-treatment -- however, these improvements do not appear to be enough to significantly decrease the social difficulties experienced by children with ADHD. For the most part, current

interventions for social difficulties target weaknesses identified by research studies comparing the social behavior of groups of children with and without ADHD (or groups of children with and without social difficulties). These research studies have consistently shown that children with social difficulties demonstrated problem behaviors, such as aggression and off-task, disruptive behavior, more often than children without peer relation difficulties (i.e. Ackerman, Elardo, & Dykman, 1979; Alessandri, 1992; Atkins & Stoff, 1993; Campbell & Paulauskas, 1979; Cunningham & Siegel, 1987; Erhardt & Hinshaw, 1994; Johnston, Pelham, & Murphy, 1985; Klein & Young, 1979; Merrell & Wolfe, 1998; Pope, Bierman, & Mumma, 1991; Schleifer et al., 1975; Whalen & Henker, 1985). Thus, current interventions have focused on reducing these problem behaviors and increasing knowledge of more effective ways to interact with peers (increasing social skills). However, it may be that other, more subtle deficits exist that are not as easily observed by comparing the social behavior of children with and without ADHD, and are therefore not being targeted by current interventions.

One aspect that may be contributing to the social problems experienced by children with ADHD, and that is not being addressed in current interventions, is difficulties recognizing others' emotions. Recognizing the nonverbal cues or signals (i.e. facial expressions) that convey peers' feelings is important, because these feelings must first be recognized for the child to know to tailor his/her behavior to them. For example, if a peer is feeling unhappy about something that occurred earlier, and the child is not able to pick up on these feelings, then he/she may approach the peer in a playful, joking manner that is inconsistent with the peer's current mood. Although the child's playful actions would not be considered "problem behavior," this behavior is not appropriate for

the current situation, and the peer will likely not respond positively to it. Additionally, if a child is able to recognize peers' emotions, then he/she can use this information to gauge the effects of his/her behavior on others to determine if future behavior needs to be adjusted. Adding to the previous example, the peer responds to the playful manner of the child by displaying nonverbal signs of annoyance. If the child is unable to recognize these cues though, then he/she will not know to adjust this behavior. This leads the peer to perceive the child as insensitive or uncaring, and thus the peer would not want to continue interacting with the child. Multiple research studies examining emotion recognition in children without ADHD have found support for this premise (i.e. Hubbard & Dearing, 2004; Izard et al., 2001; Mostow, Izard, Fine, & Trentacosta, 2002; Nowicki & Duke, 1991, 1994). These studies have indicated that the ability to recognize different emotions is significantly associated with future assessments of children's social competence and peer status.

Several studies have been conducted to examine the emotion recognition abilities of children with ADHD, however, somewhat mixed results have been found. Although the majority of studies have shown that children with ADHD exhibit emotion recognition impairments (Cadesky, Mota, & Schachar, 2000; Corbett & Glidden, 2000; Kats-Gold, Besser, & Priel, 2007; Singh et al., 1998; Williams et al., 2008), discrepancies have been found in the types of emotion recognition errors made by children with ADHD. In the study by Cadesky et al., children with ADHD were found to make random errors in emotion recognition, suggesting they have a more global deficit in recognizing emotions. Results from the studies by Kats-Gold et al., Singh et al., and Williams et al. indicated children with ADHD do not have a global deficit in recognizing emotions, but rather

have difficulties identifying certain emotions. It is difficult to interpret these contradictive findings because different age groups of children and assessments of emotion recognition were used in the studies. Additionally, in the study by Cadesky et al., the emotion recognition of four groups of children was assessed: children with ADHD; children with conduct problems; children with ADHD and conduct problems; and comparison children. The other three studies, however, did not assess or control for the presence of conduct problems.

Findings from two studies (Hall, Peterson, Webster, Bolen, & Brown, 1999; Sprouse, Hall, Webster, & Bolen, 1998) indicated that children with ADHD did not differ in emotion recognition from children without ADHD. These studies did not have adequate power to detect small to moderate effects, however, because they used small samples of children with ADHD. Also, in the study by Sprouse et al., children with ADHD were tested while on medication, which may have impacted the results obtained. Norvilitis, Casey, Brooklier, and Bonello (2000) also found limited support for emotion recognition impairments in children with ADHD. Results from this study showed that the emotion recognition of children with ADHD did not differ from that of children without ADHD on two tasks: 1) identifying emotions from photographs of facial expressions, and 2) identifying emotions from a video of a child demonstrating either a happy or angry affect. Children with ADHD were found to perform significantly worse on a third emotion recognition task though, in which they were asked to listen to taped conversations and identify the emotion presented.

Although, as stated above, the majority of research studies have indicated that children with ADHD have impaired emotion recognition, further research needs to be

conducted to clarify whether children with ADHD have a global deficit in emotion recognition or experience difficulties recognizing specific emotions. Additionally, future work should address several limitations of previous studies to enhance our understanding of the emotion recognition difficulties experienced by children with ADHD and the impact these difficulties have on children's peer relationships. One limitation of previous studies is that emotion recognition was assessed by administering only one measure, and these studies rarely applied the same measures of emotion recognition, which makes it difficult to interpret contradicting results across studies. Thus, it would be useful to administer more than one measure to the same group of children to get a more thorough assessment of emotion recognition.

Another limitation of previous research is that group differences in the following potentially confounding variables were not examined: depression, handedness, and facial recognition. Research studies have found significant associations between depression and emotion recognition, such that individuals perform more poorly on emotion recognition measures when they have a depressed affect versus a neutral affect (i.e. Chepenik, Cornew, & Farah, 2007). Studies have also shown that individuals who are left-handed versus right-handed process emotional faces differently (i.e. Bourne, 2008). Due to the fact that many assessments measure emotion recognition by asking children to identify emotions from photographs of facial expressions, children who have difficulties recognizing faces would likely perform poorly on these tasks as well, even if they did not have emotion recognition impairments. Thus, it is necessary to evaluate whether group differences exist for these three variables, to ensure that these factors are not contributing to observed differences in the emotion recognition of children with and without ADHD.

The purpose of the present study was to both confirm and build on previous research findings regarding the emotion recognition abilities of children with ADHD. Children with and without ADHD completed two emotion recognition measures: the *Diagnostic Analysis of Nonverbal Accuracy 2 (DANVA2*; Nowicki & Duke, 1999) and the *Child and Adolescent Social Perception* measure *(CASP*; Magill-Evans, Koning, Cameron-Sadava, & Manyk, 1996). The *DANVA* was administered in three previously discussed studies (Cadesky et al., 2000; Hall et al., 1999; Sprouse et al., 1998), however, the *CASP* had not been used with this population. Administering these two measures allowed for a more thorough assessment of emotion recognition abilities, as these measures present different test stimuli in varying manners. For example, in the *DANVA2*, in two of the subtests, children are asked to identify emotions from photographs of facial expressions; whereas, in the *CASP*, children are asked to identify emotions from videos of peers interacting.

In this study, children and their parents also completed the *Social Skills Improvement System* (*SSIS*; Gresham & Elliott, 2008), which is an assessment of children's current social functioning. This measure was completed so that the relationship between emotion recognition and social functioning could be examined. Children completed the *Index of Empathy for Children and Adolescents* (*IECA;* Bryant, 1982) to measure their empathy for others. They additionally completed measures of depression, handedness, and facial recognition, so that group differences on these variables could be assessed and accounted for, if necessary, as discussed above.

Chapter 2: Methods

Participants

Children with and without ADHD between the ages of 7 and 9 were asked to participate in this study. This age range was selected because during these early elementary school years, the amount of time spent around other children and the size of the peer group increases dramatically (Rubin, Bukowski, & Parker, 1998). Thus, deficits in emotion recognition are likely more detrimental and critical to address at this time, as it has become more important to effectively relate to peers. This age range is also more practical, in terms of recruiting participants, because children are frequently referred for ADHD evaluations at this age. A total of 14 children with ADHD and 16 children without ADHD participated in this study. Data for one child were excluded due to the child's age exceeding the required age range for participation (the child turned 10-years-old in the time period that elapsed between recruitment and the testing session).

Independent samples t-tests showed that the two groups of children did not differ significantly in age (*Ms* = 8.46 and 8.44 years for the children with ADHD and the children without ADHD, respectively), $t(27) = 0.06$, $p = .95$, $d = .02$. Chi-square analyses indicated that the groups of children did not differ significantly in ethnic make-up, $\chi^2(1, N = 29) = 3.02$, $p = .144$, $\phi = 0.32$, but did approach a significant difference in gender make-up, $\chi^2(1, N = 29) = 3.25$, $p = .071$, $\phi = 0.33$. Approximately 83% of the children were Caucasian and 17% were African American. Of the children with ADHD, 23% percent were female, whereas 56% of the children without ADHD were female. When examined as a potential confound, the group difference in gender did not alter the results presented and so will not be included in further discussion.

Children were not recruited to participate in this study if they had a hearing or other significant sensory impairment, epilepsy, or were diagnosed with a psychotic disorder. They also were not eligible to participate if they were prescribed medication that could not be discontinued temporarily for the testing session. Children with ADHD were not excluded from participation in this study based on the presence of comorbid psychological disorders. Parents of the children with ADHD who were prescribed psychostimulant medication were asked not to give their child any psychostimulant medication on the day of the testing session. This provided an acceptable period of time (around 24 hours) to occur for the drug to be pass out of the children's system (length of drug effect between 3-7 hours; see for example Greenhill, 2001 or Pelham et al., 1999).

Children with and without ADHD were recruited from a local pediatric clinic. The children with ADHD had received a diagnosis of ADHD after a thorough assessment independent from and prior to participation in this study. To ensure that children in the ADHD group had appropriate symptomatology for a diagnosis of ADHD and that children in the comparison group did not meet the criteria for this disorder, parents completed several assessments. Parents participated in a semi-structured interview, similar to the *Children's Interview for Psychiatric Syndromes - Parent Version* (*P-ChIPS*; Weller, Weller, Rooney, & Fristad, 1999), but only consisting of verbatim *DSM-IV-TR* criteria for ADHD and Oppositional Defiant Disorder (ODD) (American Psychiatric Association, 2000). In the interview, the parent was asked whether each diagnostic criterion was true of his/her child, and, if so, to provide behavioral examples. If a behavioral symptom was deemed to be characteristic of the child, the parent was additionally asked whether that behavior seemed inappropriate for the child's age and

whether it impaired the child's academic and social functioning. A diagnostic criterion was only considered as endorsed, if the parent indicated the behavior was age inappropriate and impairing. This interview procedure has been used successfully in previous studies, with interrater reliabilities for the number of ADHD symptoms endorsed by the parent to be above 95% (e.g., Lorch et al., 1999). Parents also completed the *Child Behavior Checklist* (*CBCL*; Achenbach & Rescorla, 2001) and the *Conners 3 – Parent Short* (*Conners 3 – P(S)*; Conners, 2008).

Independent samples t-tests were conducted to confirm that the two groups of children differed significantly on the diagnostic measures. As depicted in Table 1, in comparison to children without ADHD, children with ADHD had significantly greater mean scores on all scales of the *CBCL* and the *Conners 3 – P(S)*. Additionally, the mean number of ADHD symptoms reported by parents of children with ADHD in the semi-structured interview was significantly larger than the mean number of symptoms reported by parents of children without ADHD. These results are consistent with the children's diagnostic status and group placement. They also indicate that along with inattentiveness and hyperactivity, the children with ADHD experienced more symptoms of other psychological problems as well.

Children completed several measures in order to determine whether group differences existed for the following potentially confounding variables: intelligence, depressive symptoms, handedness, and facial recognition. Children were administered the Vocabulary and Matrix Reasoning subtests of the *Wechsler Abbreviated Scale of Intelligence* (*WASI*; Wechsler, 1999), to provide an estimate of intelligence. They also completed the *Children's Depression Inventory* (*CDI*; Kovacs, 2003), a brief measure of

handedness (adapted from the handedness questionnaire by Briggs & Nebes, 1975), and the *Facial Recognition Test* (*FRT*, Benton, Sivan, Hamsher, Varney, & Spreen, 1994).

Independent samples t-tests were conducted to evaluate whether the two groups of children differed on the above measures. As seen in Table 2, the two groups of children did not differ significantly in handedness or the ability to recognize faces. Children with ADHD had a significantly lower mean Full Scale IQ score and Matrix Reasoning score on the *WASI* in comparison to children without ADHD; however, the two groups of children's mean scores on the Vocabulary subtest were not significantly different. On the *CDI*, the children with ADHD had a significantly higher mean total score, mean Interpersonal Problems score, and mean Anhedonia score than the children without ADHD. No significant differences were observed in the children's means scores on the Negative Mood, Ineffectiveness, and Negative Self-Esteem scales of the *CDI*.

Materials

Children and parents completed the *Social Skills Improvement System* (*SSIS*; Gresham & Elliott, 2008) to assess children's current social functioning. Two domains were assessed in this measure: Social Skills and Problem Behaviors. In the social skills domain, the following seven subdomains were assessed: Communication, Cooperation, Assertion, Responsibility, Empathy, Engagement, and Self-Control. In the Problem Behaviors domain, the following five subdomains were assessed: Externalizing, Bullying, Hyperactivity/Inattention, Internalizing, and Autism Spectrum. Evidence has been found to support the internal consistency, test-retest, and interrater reliability of the *SSIS*. For example, median scale reliabilities for the Social Skills and Problem Behaviors scales are reported to be in the mid- to upper .90s for every age group on all forms. Additionally,

evidence has been found to support the validity of the *SSIS.* For example, studies were conducted to examine correlations between the *SSIS* and other established measures of social skills. Correlations between the parent form of the *SSIS* and the parent form of the *Social Skills Rating System (SSRS;* Gresham & Elliott, 1990) were .75, .73, and .69 for ages 3 to 5, 5 to 12, and 13 to 18 years. Correlations between the student form of the *SSIS* and the student form of the *SSRS* were .64 and .36 for ages 8 to 12 and 13 to 18 years, respectively. It should be noted that the student form of this measure has only been normed for usage with children as young as 8 years of age; however, in this study, it was used with children who were 7-years-old.

Children completed the *Index of Empathy for Children and Adolescents* (*IECA;* Bryant, 1982) to measure their empathy for others. This is a 22-item self-report questionnaire on which children are asked to respond yes/true or no/false to items such as, "It makes me sad to see a girl who can't find anyone to play with." Evidence has been found to support the reliability and validity of this measure (i.e. see Bryant, 1982). Results from a study by Wied et al. (2007), however, suggest that two separate factors are measured by the *IECA*: 1) Empathetic Sadness, which showed good reliability in two of their three samples, and 2) Attitude, which showed weak reliability in all three of their samples.

Children completed the *Diagnostic Analysis of Nonverbal Accuracy 2* (*DANVA2*; Nowicki & Duke, 1999), which measures nonverbal processing via the following four receptive subtests: Adult Faces 2, Child Faces 2, Adult Paralanguage 2, and Child Paralanguage 2. The target emotions that were presented in each subtest were happiness, sadness, anger, and fear. Each emotion was presented at two intensity levels (low and

high intensity levels). For the Adult and Child Faces subtests, children were shown slides of adult and child faces expressing different emotions. For the Adult and Child Paralanguage subtests, children listened to adults and children say the same standard sentence ("I am going out of the room now but I'll be back later") to reflect different emotions. Children's responses were scored for the number of correctly recognized emotions (accuracy) and the number of errors they made for the different emotions at each intensity level.

The authors of the *DANVA2* constructed the subtests independently from each other, and selected the test items primarily on empirical-normative grounds. Evidence has been found to support the internal consistency, test-retest reliability, and validity (convergent, discriminative, and criteria related) of all of the *DANVA2* subtests. For example, regarding the Adult Faces 2 subtest, Nowicki and Carton (1993) reported coefficient alphas ranging from .62 to .77 based on a sample of 1st, 3rd, and 5th graders and college students. They also indicated that scores on the Adult Faces 2 subtest were consistent over a two month period for 3rd graders (r=.74, n= 33) and college students (r=.84, n=45). The convergent validity for the Adult Faces 2 subtest was assessed by correlating scores from this subtest with scores from the corresponding Adult Faces subtest on the original *DANVA*. Significant correlations between these measures ranged from .44 to .54 for a sample of 1st, 3rd, and 5th graders and college students.

The second assessment of emotion recognition that children completed was the *Child and Adolescent Social Perception* measure (*CASP*; Magill-Evans, Koning, Cameron-Sadava, & Manyk, 1996). This measure assessed children's ability to recognize emotions from facial expressions, tone of voice, gestures, postures, and situational cues

occurring simultaneously, which is proposed to be a more accurate representation of what actually occurs in interpersonal interactions. Children were shown 9 out of 10 videotaped scenes of between 2-4 children or adolescents interacting and presenting various emotions (scenes last between 19 to 40 seconds). After each scene was viewed, children were asked questions from a standardized protocol, regarding what happened in each scene, how each person was feeling, and how they could tell the person was feeling that way. Three scores were obtained: 1) emotion score- the number of accurately recognized emotions, 2) nonverbal cues score- the number of nonverbal cue categories that were correctly identified for each character in each scene, and 3) number of errors (descriptions of nonverbal cues or story information that were not true or did not take place).

Evidence has been found to support the internal consistency, test-retest reliability, and validity of the *CASP*. Magill-Evans, Koning, Cameron-Sadava, and Manyk (1995) reported coefficient alphas of .88 for the Total Emotion Score and .92 for the Total Nonverbal Cues Score based on a sample of 212 children ages 6-15 years old. Fourteen of these children completed the *CASP* twice (on average 51 days apart), and the test-retest correlation coefficient was .83 for the Total Emotion Score and .87 for the Total Nonverbal Cues Score. A study by Guiltner (2000) was conducted to evaluate the validity of the *CASP*. Findings showed that the Total Emotion Score was significantly correlated with measures of social competence and school-related skills based on a sample of 100 5th graders. Although the Total Nonverbal Cues Score also showed positive correlations with these measures, significant correlations were not observed. Thus, this study

concluded that the *CASP* Emotion Score was the best indicator of social-perception abilities.

Procedure

Upon arrival to the testing session, the child and parent spent several minutes getting to know the experimenter in the central room of the Complex Brain Functioning lab. The study was reviewed with them during this time, and all questions were addressed before consent (from the parent) and assent (from the child) were obtained. After this, the child was taken into the testing room, which was adjacent to the central room where the parent remained. There was a two-way mirror between the two rooms, so parents could regularly observe children during testing. The child completed the student version of the *SSIS*, the *CDI*, and the *IECA*. After these measures were completed, the experimenter administered the *WASI* subtests to the child, the brief handedness measure, and the *FRT*. The child was offered a 5-10 minute break. Following this, the child completed the *DANVA2* and the *CASP*.

While the child was completing the above tasks, the parent filled out the following forms: *CBCL*, *Conners 3 – P (S)*, and the parent version of the *SSIS*. When the child was finished with testing, the experimenter conducted the *DSM-IV* interview with the parent. After this, the child and parent were thanked for their participation and paid $10.00 and $20.00 respectively.

Table 1

Means (and Standard Deviations) for Children with and without ADHD and Group Comparisons on Diagnostic Information.

Factor	ADHD (*n*=13)		Non-ADHD (*n*=16)			
	M	***(SD)***	***M***	***(SD)***	***t***	**d**
CBCL						
Anxious/Depressed	61.00	(8.56)	52.25	(4.73)	3.49**	1.34
Withdrawn/Depressed	61.15	(9.32)	55.00	(6.69)	2.07*	0.80
Somatic Complaints	62.08	(10.39)	54.75	(6.04)	2.38*	0.92
Social Problems	63.00	(7.48)	52.38	(4.65)	4.69***	1.81
Thought Problems	64.08	(9.85)	51.69	(3.65)	4.67***	1.80
Attention Problems	69.00	(7.14)	51.19	(1.52)	9.75***	3.75
Rule-Breaking Behavior	59.77	(9.13)	53.50	(4.21)	2.45*	0.94
Aggressive Behavior	64.92	(11.25)	52.13	(2.50)	4.44***	1.71
Internalizing Problems	62.46	(10.92)	47.88	(11.23)	3.52**	1.35
Externalizing Problems	62.77	(10.28)	46.75	(10.14)	4.20***	1.62
Total Problems	65.92	(8.99)	44.88	(9.56)	6.06***	2.33
Affective Problems	65.31	(11.19)	52.81	(5.28)	3.97***	1.53
Anxiety Problems	60.46	(8.74)	51.44	(1.86)	4.03***	1.55
Somatic Problems	62.00	(11.30)	54.19	(6.87)	2.30*	0.89
Attention Problems[1]	69.08	(5.35)	51.31	(2.21)	12.12***	4.66
Oppositional Problems[2]	63.77	(9.09)	52.50	(2.78)	4.71***	1.81
Conduct Problems	61.77	(10.70)	53.38	(4.69)	2.83**	1.09
Conners 3 – P(S)						
Inattention Scale	80.85	(10.43)	47.94	(6.19)	10.56***	4.06
Hyperactivity/Impulsivity Scale	79.77	(11.21)	48.69	(8.19)	8.63***	3.32
Learning Problems Scale	63.92	(15.35)	43.31	(3.24)	5.25***	2.02
Executive Functioning Scale	67.08	(14.25)	50.63	(8.40)	3.87**	1.49
Aggression Scale	62.00	(15.73)	49.56	(7.52)	2.80**	1.08
Peer Relationships Scale	69.92	(19.56)	50.75	(8.93)	3.51**	1.35
DSM-IV Interview						
Inattention	6.92	(1.44)	0.06	(.25)	18.77***	7.22
Hyperactivity/Impulsivity	6.23	(2.17)	0.44	(1.09)	9.36***	3.60
Oppositionality	2.85	(2.48)	0.13	(.50)	4.30***	1.66

Note: *CBCL* is *Child Behavior Checklist; Conners 3 – P(S)* is *Conners 3 – Parent Short*.
[1] Attention Problems = Attention Deficit/Hyperactivity Problems. [2] Oppositional Problems = Oppositional Defiant Problems. *p < .05, **p < .01, and ***p < .001

Table 2

Group Comparisons on Potential Confounds.

	ADHD (*n*=13)		**Comparison (*n*=16)**			
Factor	***M***	***(SD)***	***M***	***(SD)***	***t***	**d**
FRT Total Score	42.08	(5.02)	41.75	(3.09)	0.22	0.08
Child Depression Inventory						
Total Score	**54.38**	**(7.71)**	**46.94**	**(8.30)**	**2.48***	**0.95**
Negative Mood Scale	51.38	(9.31)	48.19	(8.77)	0.95	0.37
Interpersonal Problems Scale	**59.23**	**(13.52)**	**49.38**	**(8.17)**	**2.43***	**0.94**
Ineffectiveness Scale	52.15	(10.35)	45.19	(9.35)	1.90	0.73
Anhedonia Scale	**61.08**	**(5.78)**	**50.38**	**(8.72)**	**3.79****	**1.46**
Negative Self-Esteem Scale	42.23	(3.70)	45.38	(5.51)	-1.76	-0.68
Handedness Total Score	9.62	(12.15)	14.63	(5.16)	-1.50	-0.58
WASI Full Scale IQ	**100.54**	**(15.54)**	**118.31**	**(11.31)**	**-3.56****	**-1.37**
Vocabulary	53.54	(10.60)	60.44	(12.22)	-1.60	-0.62
Matrix Reasoning	**46.31**	**(12.55)**	**58.25**	**(5.60)**	**-3.42****	**-1.32**

Note: *FRT* is *Facial Recognition Test*; and *WASI* is *Wechsler Abbreviated Scale of Intelligence*. Possible Handedness scores range from -22 to 22 (negative scores indicate left-handed preference). *p <.05 & **p <.01

Chapter 3: Results

Emotion Recognition

In order to examine group differences in children's emotion recognition, 2 x 2 ANCOVA analyses were conducted with the following two independent variables: diagnosis (with or without ADHD) and depressive symptoms (low or high). Depressive symptoms was included as a second independent variable in these analyses for several reasons. Past research studies have shown that individuals perform more poorly on emotion recognition measures when they have a depressed affect versus a neutral affect (i.e. Chepenik et al., 2007). As previously discussed, the groups of children with and without ADHD were found to differ significantly on reported symptoms of depression. Thus including depressive symptoms as a second independent variable ensured that any effects of this variable would not be confounded with effects related to children's diagnostic status. Additionally, there is a high comorbidity between ADHD and depression among adults. For example, in a long-term follow-up study by Biederman, Faraone, Milberger, and Guite (1996), the baseline rate of major depression in children diagnosed with ADHD was approximately 30%. Therefore, another reason to include depressive symptoms as a second independent variable was to learn more about this factor's impact on emotion recognition and determine whether this factor interacted with children's diagnostic status. Children's status on the depressive symptoms variable was determined by calculating a median split using the overall sample median on the total score of the *Children's Depression Inventory (CDI)* (low = *CDI* total score ≤ 49). The total score on the *CDI* was used instead of the Anhedonia or Interpersonal Problems scores because the total score reflects depressive symptomatology across all areas

measured on the *CDI*. In the ANCOVA analyses, children's full scale IQ on the *Wechsler Abbreviated Scale of Intelligence (WASI)* was included as a covariate, due to the previously described finding of group differences on this factor. Children's full scale IQ was found to correlate significantly with many of the criterion variables (e.g., for IQ and total errors on the adult subtests of the *DANVA2*, r = -.63).

Before IQ was included as a covariate, the following results were found regarding scores on the *CASP*: 1) children with ADHD were found to make significantly more errors than children without ADHD, $F(1, 25) = 20.19$, $p = .000$, $\eta^2_p = .447$; 2) children with ADHD had significantly lower Emotion scores than children without ADHD, $F(1, 25) = 7.15$, $p = .013$, $\eta^2_p = .222$; and 3) children with ADHD had significantly lower Nonverbal Cues scores than children without ADHD, $F(1, 25) = 6.25$, $p = .019$, $\eta^2_p = .200$. Unadjusted group means and standard deviations are reported in Table 3. Results of the ANCOVA analyses revealed that after accounting for differences in IQ, the difference between the number of errors made by children with and without ADHD remained significant, $F(1, 24) = 15.23$, $p = .001$, $\eta^2_p = .388$. Group differences in children's Emotion scores, $F(1, 24) = 3.60$, $p = .070$, $\eta^2_p = .131$, and group differences in Nonverbal Cues scores, $F(1, 24) = 2.04$, $p = .166$, $\eta^2_p = .078$, were no longer significant. No significant differences were found on the *CASP* between the low and high depressive symptoms groups, nor were there any significant diagnosis x depressive symptoms interactions.

As shown in Table 3, significant differences were found between the performance of children with and without ADHD on several of the scales of the *Diagnostic Analysis of Nonverbal Accuracy 2 (DANVA2)* prior to accounting for the effect of IQ. When all four

subtests were considered, children with ADHD were found to make significantly more errors on the *DANVA2* than children without ADHD, $F(1, 25) = 5.50$, $p = .027$, $\eta^2_p = .180$. More specifically, children with ADHD made significantly more errors on items depicting the emotion *fear*, $F(1, 25) = 8.43$, $p = .008$, $\eta^2_p = .252$, and items depicting emotions at a *low* intensity, $F(1, 25) = 8.57$, $p = .007$, $\eta^2_p = .255$, in comparison to children without ADHD. Additionally, when they made errors, children with ADHD were significantly more likely than children without ADHD to incorrectly classify a stimulus as *sad*, $F(1, 25) = 13.15$, $p = .001$, $\eta^2_p = .345$. When IQ was included as a covariate, children with and without ADHD no longer differed significantly on total errors on the *DANVA2*, $F(1, 24) = 1.90$, $p = .181$, $\eta^2_p = .073$ or the number of errors they made on *low* intensity items, $F(1, 24) = 3.94$, $p = .059$, $\eta^2_p = .141$. Significant group differences remained, however, regarding the number of errors made on *fear* items, $F(1, 24) = 5.11$, $p = .033$, $\eta^2_p = .175$ and items incorrectly identified as *sad*, $F(1, 24) = 9.28$, $p = .006$, $\eta^2_p = .279$.

When the children's scores on the Child and Adult subtests of the *DANVA2* were examined separately, several significant group differences were found prior to accounting for the effect of IQ (Table 3). Children with ADHD made significantly more errors on the Adult subtests than children without ADHD, $F(1, 25) = 6.25$, $p = .019$, $\eta^2_p = .019$. They had significantly lower mean scores on the Child and Adult Paralanguage subtests in comparison to children without ADHD, $F(1, 25) = 7.18$, $p = .013$, $\eta^2_p = .223$, and $F(1, 25) = 8.17$, $p = .008$, $\eta^2_p = .246$, respectively. The Paralanguage subtests require one to identify emotions by listening to children and adults say the same standard sentence ("I am going out of the room now but I'll be back later") while depicting different emotions.

Results revealed that children with ADHD made significantly more errors on *fear* items than children without ADHD on both the Child and Adult subtests, $F(1, 25) = 4.89$, $p = .036$, $\eta^2_p = .163$, and $F(1, 25) = 5.36$, $p = .029$, $\eta^2_p = .177$, respectively. It was only on the Adult subtests, however, where children with ADHD made significantly more errors on items depicting emotions at a *low* intensity, $F(1, 25) = 10.79$, $p = .003$, $\eta^2_p = .301$, and were more likely than children without ADHD to incorrectly classify adults as *sad*, $F(1, 25) = 12.01$, $p = .002$, $\eta^2_p = .324$.

When children's IQ was included as a covariate, children with and without ADHD no longer differed significantly on errors on Adult subtests, $F(1, 24) = 1.73$, $p = .201$, $\eta^2_p = .067$; errors on the Child Paralanguage subtest, $F(1, 24) = 3.13$, $p = .089$, $\eta^2_p = .115$; errors on the Adult Paralanguage subtest, $F(1, 24) = 3.09$, $p = .091$, $\eta^2_p = .114$; errors on *fear* Child items, $F(1, 24) = 3.57$, $p = .071$, $\eta^2_p = .130$; or errors on *fear* Adult items, $F(1, 24) = 2.65$, $p = .117$, $\eta^2_p = .099$. Children with ADHD, however, were still significantly more likely than children without ADHD to make errors on low intensity Adult items, $F(1, 24) = 5.48$, $p = .028$, $\eta^2_p = .186$, and to incorrectly identify an adult as *sad*, $F(1, 24) = 8.59$, $p = .007$, $\eta^2_p = .264$.

Significant differences were also found between the performance of children in the low depressive symptoms group and children in the high depressive symptoms group on several scales of the *DANVA2*. When all four subtests were considered, results showed that children in the high depressive symptoms group made significantly more errors on items depicting the emotion *happy* than children in the low depressive symptoms group $F(1, 25) = 5.34$, $p = .029$, $\eta^2_p = .176$. When they made errors, children in the high depressive symptoms group were also significantly more likely than children in the low

depressive symptoms group to incorrectly classify a stimulus as *fear*, $F(1, 25) = 15.99$, $p = .000$, $\eta^2_p = .390$. These significant group differences remained after entering IQ as a covariate.

When the Adult and Child subtests on the *DANVA2* were considered separately, results showed that in comparison to children in the low depressive symptoms group, children in the high depressive group made significantly more errors on the Adult subtests, $F(1, 25) = 6.25$, $p = .019$, $\eta^2_p = .200$; on the Adult Paralanguage subtest, $F(1, 25) = 7.11$, $p = .013$, $\eta^2_p = .222$; and on Adult high intensity items, $F(1, 25) = 6.73$, $p = .016$, $\eta^2_p = .212$. Results revealed that it was also on the Adult subtests where children in the high depressive symptoms group had problems recognizing the emotion *happy*, $F(1, 25) = 6.25$, $p = .019$, $\eta^2_p = .200$. They showed a tendency to incorrectly classify items as *fear*, however, on both the Child and Adult subtests, $F(1, 25) = 5.61$, $p = .026$, $\eta^2_p = .183$, and $F(1, 25) = 20.44$, $p = .000$, $\eta^2_p = .450$, respectively. Entering IQ as a covariate did not alter the observed significant group differences, except for those regarding errors made on the Adult subtests, $F(1, 24) = 3.94$, $p = .059$, $\eta^2_p = .141$. Finally, it should be noted that no significant diagnosis x depressive symptoms interactions were found on the *DANVA2*.

Social Skills and Empathy

ANCOVA analyses were also conducted to examine group differences in the children's social skills as reported by both the children themselves and one of their parents on the *Social Skills Improvement System (SSIS)*. Results and unadjusted means (standard deviations) are conveyed in Table 4. No significant differences were observed between the ratings of children with and without ADHD on the composite Social Skills

scale, $F(1, 25) = .21$, $p = .652$, $\eta^2_p = .008$, or any of the seven social skills subscales. This indicates that children with ADHD perceive themselves as having a similar level of social skills to children without ADHD. Prior to entering IQ as a covariate, children with ADHD rated themselves significantly higher than children without ADHD on the Externalizing subscale, $F(1, 25) = 4.63$, $p = .041$, $\eta^2_p = .156$; Hyperactivity/Inattention subscale, $F(1, 25) = 4.59$, $p = .042$, $\eta^2_p = .155$; and the Problem Behaviors composite scale, $F(1, 25) = 5.17$, $p = .032$, $\eta^2_p = .171$. After entering IQ as a covariate, however, no significant differences were found in children's ratings on the Externalizing subscale, $F(1, 24) = .71$, $p = .410$, $\eta^2_p = .028$; Hyperactivity/Inattention subscale, $F(1, 24) = .94$, $p = .342$, $\eta^2_p = .038$; or Problem Behaviors scale, $F(1, 24) = 1.24$, $p = .276$, $\eta^2_p = .049$.

The parents of children with ADHD rated their children significantly lower than the parents of children without ADHD on the Social Skills composite scale, $F(1, 25) = 6.90$, $p = .015$, $\eta^2_p = .216$, and on the following social skills subscales: Communication, $F(1, 25) = 9.73$, $p = .005$, $\eta^2_p = .280$; Cooperation, $F(1, 25) = 7.75$, $p = .010$, $\eta^2_p = .237$; and Self-Control, $F(1, 25) = 9.95$, $p = .004$, $\eta^2_p = .285$. They rated their children significantly higher on the Problem Behaviors composite scale, $F(1, 25) = 21.74$, $p = .000$, $\eta^2_p = .465$, and the following problem behaviors subscales: Externalizing, $F(1, 25) = 24.10$, $p = .000$, $\eta^2_p = .491$; Hyperactivity/Inattention, $F(1, 25) = 48.61$, $p = .000$, $\eta^2_p = .660$; and Autism, $F(1, 25) = 8.46$, $p = .008$, $\eta^2_p = .253$. Including IQ as a covariate did not alter the significance of these findings.

Prior to accounting for the effects of IQ, results showed that in comparison to children in the low depressive symptoms group, children in the high depressive symptoms group rated themselves significantly lower on the social skills subscale,

Engagement, $F(1, 25) = 4.51$, $p = .044$, $\eta^2_p = .153$. They rated themselves significantly higher than children in the low depressive symptoms group on the Hyperactivity/Inattention subscale, $F(1, 25) = 4.59$, $p = .042$, $\eta^2_p = .155$, Internalizing subscale, $F(1, 25) = 13.17$, $p = .001$, $\eta^2_p = .345$, and the Problem Behaviors composite scale, $F(1, 25) = 9.86$, $p = .004$, $\eta^2_p = .283$. After accounting for the effects of IQ, group differences were no longer significant for the Engagement subscale, $F(1, 24) = 3.97$, $p = .058$, $\eta^2_p = .142$, or the Hyperactivity/Inattention subscale, $F(1, 24) = 2.61$, $p = .119$, $\eta^2_p = .098$. They remained significant, however, for the Internalizing subscale, $F(1, 24) = 10.47$, $p = .004$, $\eta^2_p = .304$, and the Problem Behaviors scale, $F(1, 24) = 6.98$, $p = .014$, $\eta^2_p = .225$.

No significant differences were found in the parent ratings of children in the low and high depressive symptoms groups, except for on the social skills subscale, Cooperation. Parents of children in the high depressive symptoms group rated their children significantly lower on this subscale than parents of children in the low depressive symptoms group, $F(1, 25) = 4.92$, $p = .036$, $\eta^2_p = .164$. This group difference remained significant after entering IQ as a covariate, $F(1, 24) = 5.17$, $p = .032$, $\eta^2_p = .177$. No significant diagnosis x depressive symptoms interactions were found on the *SSIS*.

Children completed the *Index of Empathy for Children and Adolescents (IECA)* to obtain an assessment of their empathy. No significant differences were found between the responses of children with ADHD ($M = 12.92$, $SD = 3.01$) and children without ADHD ($M = 14.19$, $SD = 3.45$) on this measure, $F(1, 25) = .54$, $p = .470$, $\eta^2_p = .021$. This finding is consistent with the results on the *SSIS*. The ratings of children with and without ADHD on the Empathy subscale of the *SSIS* were not significantly different, $F(1, 25) = 1.23$, $p =$

.277, η^2_p = .047. Similarly, parent ratings for children with ADHD were not significantly different from parent ratings of children without ADHD on the Empathy subscale, $F(1, 25) = 2.62$, $p = .118$, $\eta^2_p = .095$. Additionally, no significant differences were found on the *IECA* between the low and high depressive symptoms groups, $F(1, 25) = .26$, $p = .612$, $\eta^2_p = .010$, nor was there a significant diagnosis x depressive symptoms interaction, $F(1, 25) = .01$, $p = .922$, $\eta^2_p = .000$.

Relation Between Emotion Recognition and Social Skills

Following the procedures established by Baron and Kenny (1986), a series of regression analyses were performed to test the prediction that emotion recognition abilities mediate the relation between diagnostic status and social skills. For these analyses, the criterion variable (measure of social skills) was parent ratings on the composite Social Skills scale of the *SSIS*. Four different emotion recognition scores were examined as mediators: 1) the number of errors on the *CASP*; 2) the number of errors on fear items on the *DANVA2*; 3) the number of times children incorrectly identified an item as sad on the *DANVA2*; and 4) the number of errors on low intensity items on the Adult subtests of the *DANVA2*. Children's full scale IQ scores and total scores on the *CDI* were entered as covariates in these analyses to account for the group differences on these variables. As seen in Table 5, results of the regression analyses indicated that the relation between diagnostic status and social skills was not mediated by any of the emotion recognition scores.

The relation between emotion recognition, as depicted by children's scores on the *CASP* and the *DANVA2*, and parents' ratings of children's social skills was examined further by calculating the correlations between these factors separately for the two groups

of children. Results are reported in Table 6. For the group of children with ADHD, no scores on the emotion recognition measures were significantly related to parents' ratings of social skills. Five scores on the emotion recognition measures were significantly related to parents' rating of social skills for the group of children without ADHD. These were as follows: the Emotion score on the *CASP*; the Nonverbal Cues score on the *CASP*; the number of errors on the Child Paralanguage subtest of the *DANVA2*; and the number of errors on angry items and high intensity items on the Adult subtests of the *DANVA2*.

Table 3

Unadjusted Means (and Standard Deviations) and Summary of Emotion Recognition Results.

	Children with ADHD		Children without ADHD		Effects	
DANVA2	***Low Dep***	***High Dep***	***Low Dep***	***High Dep***	***i***	***ii***
Number of errors	30.00 (6.78)	36.44 (11.26)	24.64 (6.42)	26.40 (4.72)	A	
Errors on Happy items	4.25 (2.06)	7.22 (2.17)	4.27 (2.57)	5.80 (2.68)	D	D
Errors on Sad items	5.00 (1.63)	8.56 (5.70)	4.91 (3.75)	6.40 (3.44)		
Errors on Angry items	8.00 (4.08)	9.33 (5.07)	6.92 (1.14)	6.60 (3.21)		
Errors on Fear items	12.75 (2.63)	11.33 (4.27)	8.55 (3.27)	7.60 (1.82)	A	A
Errors on High intensity items	10.25 (2.22)	14.11 (7.37)	8.82 (3.40)	10.20 (1.30)		
Errors on Low intensity items	19.75 (4.57)	22.33 (4.72)	15.82 (3.92)	16.20 (3.83)	A	
Incorrectly identified as Happy	10.50 (6.81)	7.78 (3.99)	9.09 (6.73)	5.80 (2.59)		
Incorrectly identified as Sad	12.25 (2.50)	9.00 (3.39)	6.45 (2.34)	7.20 (0.84)	A	A
Incorrectly identified as Angry	3.50 (1.29)	8.33 (6.00)	3.36 (2.73)	3.00 (0.71)		
Incorrectly identified as Fear	3.75 (2.22)	11.33 (4.77)	5.73 (2.41)	10.40 (5.13)	D	D
Child Subtests of *DANVA2*						
Errors on Child Subtests	14.00 (4.83)	15.22 (6.78)	12.00 (4.94)	10.40 (4.56)		
Errors on Child Faces	5.25 (2.50)	4.78 (3.56)	5.82 (3.71)	4.40 (1.82)		
Errors on Child Paralanguage	8.75 (2.50)	10.44 (4.42)	6.18 (2.04)	6.00 (3.39)	A	
Errors on Happy items	2.00 (1.63)	2.44 (1.13)	1.64 (1.43)	2.00 (1.23)		
Errors on Sad items	1.75 (0.50)	3.44 (3.40)	2.27 (2.94)	2.40 (2.30)		
Errors on Angry items	4.00 (1.83)	4.00 (2.96)	3.73 (0.79)	2.60 (1.82)		
Errors on Fear items	6.25 (2.36)	5.33 (2.24)	4.36 (2.29)	3.40 (1.14)	A	
Errors on High intensity items	5.00 (2.16)	5.44 (3.64)	4.09 (2.55)	3.00 (2.00)		
Errors on Low intensity items	9.00 (2.83)	9.78 (3.60)	7.91 (2.74)	7.40 (2.61)		
Incorrectly identified as Happy	5.00 (3.83)	3.33 (2.29)	5.00 (3.92)	3.00 (1.00)		
Incorrectly identified as Sad	6.00 (2.94)	3.44 (2.13)	3.18 (1.54)	3.00 (2.00)		
Incorrectly identified as Angry	1.50 (0.58)	3.44 (2.88)	1.27 (1.68)	0.60 (0.89)		
Incorrectly identified as Fear	1.50 (1.73)	5.00 (3.04)	2.55 (1.64)	3.80 (3.35)	D	D

Table 3 (continued)

	Children with ADHD		Children without ADHD		Effects	
Adult Subtests of *DANVA2*	***Low Dep***	***High Dep***	***Low Dep***	***High Dep***	***i***	***ii***
Errors on Adult Subtests	16.00 (3.74)	21.22 (5.67)	12.64 (3.26)	16.00 (3.39)	A, D	
Errors on Adult Faces	6.00 (3.74)	8.00 (3.00)	5.18 (1.89)	6.20 (2.28)		
Errors on Adult Paralanguage	10.00 (0.82)	13.22 (3.31)	7.45 (2.58)	9.80 (1.64)	A, D	D
Errors on Happy items	2.25 (0.50)	4.78 (2.22)	2.64 (1.75)	3.80 (1.79)	D	D
Errors on Sad items	3.25 (1.26)	5.11 (2.71)	2.64 (1.57)	4.00 (1.58)		
Errors on Angry items	4.00 (2.45)	5.33 (2.60)	3.09 (1.22)	4.00 (2.45)		
Errors on Fear items	6.50 (1.73)	6.00 (2.45)	4.27 (2.01)	4.20 (2.17)	A	
Errors on High intensity items	5.25 (1.50)	8.67 (4.36)	4.73 (1.90)	7.20 (0.84)	D	D
Errors on Low intensity items	10.75 (2.50)	12.56 (1.74)	7.91 (2.63)	8.80 (3.27)	A	A
Incorrectly identified as Happy	5.50 (4.12)	4.44 (3.01)	4.09 (3.30)	2.80 (2.39)		
Incorrectly identified as Sad	6.25 (1.89)	5.56 (1.42)	3.27 (1.62)	4.20 (1.30)	A	A
Incorrectly identified as Angry	2.00 (1.41)	4.89 (3.62)	2.09 (1.87)	2.40 (1.14)		
Incorrectly identified as Fear	2.25 (0.96)	6.33 (2.35)	3.18 (1.89)	6.60 (2.41)	D	D
CASP						
Number of Errors	9.00 (4.69)	9.11 (3.82)	2.73 (2.97)	3.20 (1.64)	A	A
Emotion (std score)	-1.25 (0.41)	-1.44 (0.51)	-0.55 (0.71)	-0.50 (1.31)	A	
Nonverbal Cues (std score)	-1.50 (0.35)	-1.86 (0.38)	-0.98 (0.85)	-0.95 (0.99)	A	

Note: Dep = depressive symptoms; *i* = before and *ii* = after entering IQ as covariate; A = significant differences between diagnostic groups; D = significant differences between depressive symptoms groups

Table 4

Unadjusted Means (and Standard Deviations) for Children with and without ADHD (and low or high depressive symptoms), and Group Comparisons on the Social Skills Improvement System (SSIS): Child & Parent Versions.

Factor	**Children with ADHD**		**Children without ADHD**		**Effects**	
SSIS - Child	***Low Dep***	***High Dep***	***Low Dep***	***High Dep***	*i*	*ii*
Communication	15.50 (3.00)	12.78 (3.49)	14.45 (3.64)	13.80 (3.42)		
Cooperation	16.50 (6.46)	13.67 (2.50)	18.27 (3.58)	16.00 (2.83)		
Assertion	17.75 (2.22)	13.00 (5.10)	15.45 (4.46)	14.20 (2.59)		
Responsibility	17.75 (5.25)	14.22 (4.97)	17.18 (4.47)	13.00 (4.47)		
Empathy	15.25 (2.75)	11.00 (4.53)	14.00 (4.36)	15.80 (1.92)		
Engagement	19.50 (1.92)	13.22 (4.44)	16.73 (4.56)	16.20 (2.05)	D	
Self-Control	11.75 (7.50)	7.78 (4.09)	13.82 (4.31)	11.20 (5.02)		
Social Skills	111.00 (17.46)	90.89 (14.68)	107.36 (19.76)	100.80 (13.37)		
Externalizing	6.50 (3.32)	14.00 (10.03)	3.45 (3.98)	5.60 (4.72)	A	
Bullying	1.75 (1.50)	4.44 (4.10)	0.82 (1.83)	1.00 (1.23)		
Hyperactivity/Inattention	8.00 (2.58)	12.33 (3.61)	4.55 (5.45)	8.00 (4.64)	A, D	
Internalizing	7.25 (1.50)	15.11 (6.45)	5.45 (4.50)	12.00 (3.94)	D	D
Problem Behavior	98.25 (4.35)	117.44 (12.52)	90.27 (13.98)	102.60 (12.24)	A, D	D

Note: Social Skills and Problem Behavior (in bold) are composite scales and reported in standard scores. Raw scores are reported for the other scales. Dep = depressive symptoms (low or high); Under effects: A = significant differences between diagnostic groups; D = significant differences between low & high depressive symptoms groups; *i* = significant effects before entering covariates; *ii* = significant effects after entering IQ as a covariate.

Table 4 (continued)

Factor	Children with ADHD		Children without ADHD		Effects	
SSIS - Parent	***Low Dep***	***High Dep***	***Low Dep***	***High Dep***	*i*	*ii*
Communication	12.75 (3.50)	12.78 (3.70)	17.73 (1.85)	15.40 (3.44)	A	A
Cooperation	12.75 (3.50)	9.44 (3.75)	15.18 (1.78)	13.40 (2.30)	A, D	A, D
Assertion	13.25 (0.96)	12.33 (3.91)	15.27 (1.85)	13.40 (1.67)		
Responsibility	12.50 (3.11)	11.00 (2.96)	14.09 (2.51)	13.20 (2.95)		
Empathy	12.00 (4.69)	13.33 (4.12)	15.45 (2.12)	14.00 (0.71)		
Engagement	14.00 (4.08)	13.22 (4.89)	16.09 (3.11)	16.20 (3.70)		
Self-Control	8.50 (5.57)	7.11 (4.31)	14.36 (3.08)	11.80 (4.82)	A	A
Social Skills	90.50 (18.70)	85.33 (19.25)	107.91 (8.87)	99.40 (13.28)	A	A
Externalizing	14.75 (4.03)	16.00 (6.04)	5.73 (3.10)	7.40 (3.78)	A	A
Bullying	1.00 (1.16)	3.00 (2.69)	0.64 (0.81)	0.80 (0.84)		
Hyperactivity/Inattention	11.50 (2.52)	12.22 (3.63)	3.91 (2.21)	4.20 (2.17)	A	A
Internalizing	7.00 (6.22)	9.89 (5.35)	3.45 (2.21)	7.20 (4.60)		
Autism	13.00 (6.00)	15.44 (7.44)	5.36 (3.88)	9.20 (6.57)	A	A
Problem Behavior	115.25 (8.81)	124.11 (15.32)	95.36 (6.89)	102.00 (11.47)	A	A

Table 5

Results of Mediation Analyses Examining Emotion Recognition as a Mediator between Children's Diagnostic Status and Parents' Ratings of Children's Social Skills.

Emotion Recognition	**Step**	**Path**	**B**	**95% CI**	**β**	***p***	**Sobel**	***p***
	1	c	17.24	3.07 to 31.41	.51	.02		
Errors on *CASP*	2	a	-6.36	-9.60 to -3.11	-.72	<.01		
	3	b	-0.14	-1.98 to 1.70	-.04	.88		
	4	c'	16.35	-2.27 to 34.97	.48	.08	.16	.88
DANVA2								
Errors on Fear Items	2	a	-3.92	-7.10 to -0.73	-.54	.02		
	3	b	0.05	-1.83 to 1.93	.01	.96		
	4	c'	17.43	1.18 to 33.68	.52	.04	-.05	.96
Incorrectly Identified Item as Sad	2	a	-3.87	-6.56 to -1.18	-.62	<.01		
	3	b	-0.02	-2.24 to 2.20	-.00	.99		
	4	c'	17.16	0.32 to 34.01	.51	.05	.02	.99
Errors on Low Intensity Adult Items	2	a	-2.54	-4.87 to -0.21	-.41	.03		
	3	b	-.80	-3.34 to 1.74	-.15	.52		
	4	c'	15.21	-.54 to 30.96	.45	.06	.62	.53

Note: Path c = relationship between diagnostic status (independent variable) and social skills (dependent variable) (total effect); Path a = relationship between diagnostic status and emotion recognition (variable tested as mediator; e.g. Errors on *CASP*); Path b = relationship between emotion recognition and social skills, adjusting for the effect of diagnostic status; and Path c' = relationship between diagnostic status and social skills, adjusting for the mediator (direct effect).

Table 6

Correlations Between Parents' Composite Scores on the Social Skills Scale of the SSIS and Measures of Emotion Recognition for Children with and without ADHD.

Emotion Recognition Measures	***SSIS – Parent***	
CASP	**ADHD**	**Non-ADHD**
Number of Errors	.15	-.36
Emotion (standard score)	-.02	**.69****
Nonverbal Cues (standard score)	-.25	**.50***
***DANVA2* – Composite Scores**		
Total number of errors	-.14	-.07
Errors on Happy items	-.02	-.04
Errors on Sad items	-.14	.13
Errors on Angry items	-.26	-.39
Errors on Fear items	.14	.00
Errors on High intensity items	-.12	-.10
Errors on Low intensity items	-.14	-.03
Incorrectly identified item as Happy	.05	-.06
Incorrectly identified item as Sad	.03	.04
Incorrectly identified item as Angry	-.13	.32
Incorrectly identified item as Fear	-.20	-.20
Child Subtests of *DANVA2*		
Total Errors on Child Subtests	-.03	.16
Total errors on Child Faces	-.07	-.12
Total errors on Child Paralanguage	-.02	**.47***
Errors on Happy Child items	-.12	-.23
Errors on Sad Child items	-.06	.25
Errors on Angry Child items	-.11	.00
Errors on Fear Child items	.19	.19
Errors on High intensity Child items	-.002	.25
Errors on Low intensity Child items	-.05	.07
Incorrectly identified item as Happy	.20	-.03
Incorrectly identified item as Sad	-.14	.35
Incorrectly identified item as Angry	.07	.19
Incorrectly identified item as Fear	-.18	.00

Table 6 (continued)

Emotion Recognition Measures	*SSIS – Parent*	
	ADHD	**Non-ADHD**
Adult Subtests of *DANVA2*		
Total Errors on Adult Subtests	-.22	-.32
Total errors on Adult Faces	-.30	-.39
Total errors on Adult Paralanguage	-.09	-.15
Errors on Happy Adult items	.05	.11
Errors on Sad Adult items	-.20	-.13
Errors on Angry Adult items	-.38	**-.48***
Errors on Fear Adult items	.05	-.17
Errors on High intensity Adult items	-.19	**-.44***
Errors on Low intensity Adult items	-.23	-.10
Incorrectly identified item as Happy	-.10	-.09
Incorrectly identified item as Sad	.30	-.32
Incorrectly identified item as Angry	-.26	.27
Incorrectly identified item as Fear	-.18	-.32

Note: *p < .05 and **p < .01.

Chapter 4: Discussion

One goal of this study was to confirm previous research findings indicating that children with ADHD exhibit impairments in emotion recognition in comparison to children without ADHD. This study also sought to clarify a discrepancy in past findings regarding whether children with ADHD experience a global deficit in emotion recognition or show more limited difficulties in recognizing specific emotions. An important aspect of these goals was to ensure that any observed differences between the emotion recognition of children with and without ADHD could not be attributed to group differences in depressive symptoms, handedness, or the ability to recognize faces. This was important because only two of the previous research studies examining emotion recognition in children with ADHD assessed and accounted for children's depressive symptoms (Cadesky et al., 2000; Williams et al., 2008), and no past studies controlled for the effects of handedness or children's ability to recognize faces.

Preliminary analyses showed that children with and without ADHD did not differ in their performance on measures of handedness or the ability to recognize faces. Children with ADHD reported a significantly greater number of depressive symptoms on the *Child Depression Inventory (CDI)* in comparison to children without ADHD. Due to an interest in understanding how differences in depressive symptoms related to the criterion variables, as well as a desire to avoid confounding the effects of depression with the effects of ADHD on the criterion variables, depressive symptoms was included as a second independent variable in the emotion recognition and social skills analyses. In addition to differences in depressive symptoms, children with ADHD scored significantly lower than children without ADHD on the *Wechsler Abbreviated Scale of Intelligence*

(WASI). To address this group difference, children's full scale IQ was used as a covariate in further analyses.

Results indicated that in comparison to children without ADHD, children with ADHD show several critical deficits in emotion recognition that cannot be attributed to group differences in depressive symptoms, handedness, the ability to recognize faces, or IQ. Specifically, they demonstrated a tendency to under-identify *fear* and over-identify *sadness* on the *Diagnostic Analysis of Nonverbal Accuracy 2 (DANVA2)*. Although children with ADHD had difficulty identifying fear that was depicted by both children and adults, their tendency to over-identify sadness pertained primarily to adults' emotions. In addition to over-identifying sadness in adults, the children with ADHD made more errors than the children without ADHD on low intensity adult items. In other words, they had increased difficulty with emotion recognition when the emotions presented by adults were more subtle. They also made significantly more errors than children without ADHD on the *Child and Adolescent Social Perception (CASP)* measure. These results confirm past research findings indicating that children with ADHD exhibit emotion recognition impairments. In addition to this, these findings provide evidence that children with ADHD do not have a global deficit in emotion recognition, but rather demonstrate specific difficulties concerning the emotions *fear* and *sadness.*

Developmental studies have indicated that the abilities to identify fear and surprise emerge after the abilities to indentify sadness and anger, which emerge after the ability to identify happiness (Boyatzis, Chazan, & Ting, 1993; Camras & Allison, 1985; Odom & Lemond, 1972; Philippot & Feldman, 1990). Thus, the difficulty children with ADHD experience identifying the emotion fear may be explained by a developmental

delay in emotion recognition abilities. The tendency of the children with ADHD to over-identify sadness in adults in particular is more puzzling. It is possible that they have a better sense of what happiness and anger are from daily experiences, and so are less likely to confuse these emotions with other emotions. In other words, children with ADHD may have witnessed sadness in adults less frequently (but have observed this emotion in other children), and so they over-identify this emotion because they haven't completely defined the boundaries of what it is versus what it isn't. It is also possible that the opposite is true, and children with ADHD over-identify sadness in testing items due to increased occurrences of this in the real world. This would be the case if others around them were frequently sad, and thus a safe guess when unsure how someone feels would be to assume they're sad.

As previously mentioned, in addition to the above discussed difficulties on the *DANVA2*, children with ADHD made significantly more errors than children without ADHD on the *Child and Adolescent Social Perception Measure (CASP)*. On this task, children were not only required to identify others' emotions, but also to explain how they knew what others were feeling (share the nonverbal cues that helped them to identify emotions). After the children identified an emotion on this task, the examiner prompted for nonverbal cues by asking, "How could you tell that ____ was feeling _____?" An error was counted on the *CASP* if the child gave untrue information regarding what happened in the videotaped scenes. Thus, the children with ADHD showed a greater tendency than the children without ADHD to make up events or nonverbal cues. It was observed during the testing sessions that when this occurred, the children with ADHD presented their unfounded answers in a confident, unwavering manner. The children

without ADHD, on the other hand, typically acknowledged when they did not know an answer, and said they would make a guess. Although the children with ADHD made significantly more errors on the *CASP*, they did not differ from the children without ADHD in the number of correct emotions and nonverbal cues that they identified, after accounting for group differences in IQ. This suggests that when given multiple cues of emotions at the same time (i.e. facial expressions, tone of voice, body language), children with ADHD demonstrate emotion recognition abilities similar to their peers. Their tendency to confidently make up events or nonverbal cues to explain identified emotions, however, informs us that even though they are able to identify as many emotions correctly as children without ADHD, their understanding of these emotions is not the same.

This finding is similar to the results from a study by Berthiaume, Lorch, & Milich (2010), where children with ADHD were found to be more likely than children without ADHD to spontaneously produce inaccurate explanations for story events. In this study, the children with ADHD also rated their confidence of their answers higher in comparison to children without ADHD, even when there was little grounds on which to base this confidence. Children with ADHD may engage in this behavior, filling in gaps of understanding by making up information, as a protective coping method (see Diener & Milich, 1997). This lets the child with ADHD avoid feeling badly about not knowing an answer and having to say this. It is, however, problematic for several reasons. An obvious issue is that if children with ADHD feel highly confident after coming up with erroneous explanations of events, then they are not likely to seek out better understandings of events. If they then base their actions on inaccurate understandings or memories of social

situations, then the likelihood of success is reduced significantly. Another problem with this coping method is that because the children with ADHD present with high confidence, then others with whom they interact (e.g. peers) are not likely to offer further explanations of events. They also may be harder on an individual whom they believe "understood" what happened but chose to act in a way that didn't go along with this. For example, let's say there is a boy who is sad because he does not have someone to play with outside. The child with ADHD is friends with this boy and recognizes that he is sad. Rather then admitting to him that he is not sure why he is sad by asking about this, the child with ADHD might confidently decide that his friend must have gotten a bad grade when the math tests were returned. He then bases his actions on this understanding and decides to give his friend some space so he won't feel badly that others know he got a bad grade. The friend later mentions something to the child with ADHD about feeling sad. The child with ADHD responds in a confident manner demonstrating knowledge of this, and so his friend does not explain further why he is sad and goes away feeling that the child with ADHD must not care.

Another goal of this study was to determine whether the relation between children's diagnostic status and social skills was mediated by performance on the emotion recognition measures. The mediation analyses showed that this was not the case. This is surprising due to the fact that multiple research studies examining emotion recognition in children without ADHD have found that the ability to recognize different emotions is significantly associated with future assessments of children's social competence and peer status (i.e. Hubbard & Dearing, 2004; Izard et al., 2001; Mostow, Izard, Fine, & Trentacosta, 2002; Nowicki & Duke, 1991, 1994). It could be that emotion

recognition was not found to be a significant mediator due to the small sample size and low power. Also, the measure of social skills that was used in the mediation analyses was the parent ratings on the *Social Skills Improvement System (SSIS)*, and it is possible that different results would have been seen with measures of children's social abilities that were based on peers' input. It could be that emotion recognition abilities are in fact important to success in interpersonal relationships; however, other difficulties that children with ADHD experience trump the importance of any emotion recognition impairments in their parents' eyes.

Correlations between children's scores on the emotion recognition measures and parents' ratings of social skills were calculated separately for the groups of children with and without ADHD. Although several scores on the emotion recognition measures were significantly related to parents' ratings of social skills for the group of children without ADHD, no scores on the emotion recognition measures were significantly related to parents' ratings of social skills for the children with ADHD. These results provide support for the hypothesis that parents of children with ADHD do not weigh emotion recognition abilities highly in their conceptualization of their children's social skills, and other factors may be of more importance to them. In contrast, parents of children without ADHD do show the expected linkages.

In addition to examining the emotion recognition of children with and without ADHD, the relation between symptoms of depression in children and emotion recognition was evaluated. Results showed that children categorized as having high depressive symptoms (>49 on the total score of the *CDI*) demonstrated multiple emotion recognition deficits in comparison to children who reported low levels of depressive

symptoms. On the *DANVA2*, they showed a tendency to incorrectly classify both children's and adults' emotions as *fear*. They also had increased difficulties, in contrast to children with low depressive symptoms, correctly identifying *happiness* in adults, emotions on the Adult Paralanguage subtest, and high intensity emotions depicted by adults. Children with high depressive symptoms did not differ from children with low depressive symptoms in their performance on the *CASP*. No interactions were observed between children's diagnostic status (with or without ADHD) and level of depressive symptoms. These findings show us that children with simply a high level of depressive symptoms, not necessarily a diagnosis of depression, demonstrate deficits in emotion recognition, and these deficits are distinct from the problems that children with ADHD experience in emotion recognition.

The difficulties that children with a high level of depressive symptoms showed correctly identifying happiness are consistent with past research studies indicating reduced recognition of sadness and happiness in adults with depression (Bourke, Douglas, & Porter, 2010). This difficulty identifying happiness is concerning because it may lead to continued or potentially increased symptoms of depression. For example, if one infrequently identifies happiness depicted by other individuals, it may seem as if his or her actions rarely please others. This may lead to increased feelings of worthlessness and sadness. Reduced identification of happiness in other individuals also limits one's opportunity to share in this happiness and supports a bleak view of the world in general. The tendency for children with higher levels of depressive symptoms to over-identify *fear* may also play a role in maintaining a negative outlook. People who are depressed commonly engage in catastrophizing or believing worst case scenarios are likely to

happen. If other individuals are frequently viewed as feeling afraid, then this may reinforce the view that bad things are to come. It should be noted that the majority of emotion recognition deficits shown by children with high levels of depressive symptoms pertained to adults' emotions. Thus, it may be useful for parents and other caregivers to verbally label their emotions when interacting with a child who is experiencing depression.

Several other findings of this study are important to review to improve our understanding of the factors related to the social difficulties experienced by children with ADHD. First, results showed that there were no significant differences between the performance of children with and without ADHD on the *Index of Empathy for Children and Adolescents (IECA)*. Furthermore, these results were consistent with both the children's and the parents' responses on the Empathy scale of the *SSIS*. This suggests that it is not necessary to spend time in treatment interventions for children with ADHD working on developing empathy. Due to the fact that at times children with ADHD may not appear to have empathy for others, it may still be useful to work with them on identifying situations where an empathetic response is important to a relationship and/or ensuring that they know how to effectively express empathy they feel to others.

A second telling result involves the lack of awareness demonstrated by children with ADHD regarding their social abilities. On the *SSIS*, children with ADHD gave themselves similar ratings to those of children without ADHD on all social skills scales. Their parents' ratings, however, were significantly lower than the ratings of the parents of children without ADHD on the Social Skills composite scale, the Communication subscale, the Cooperation subscale, and the Self-Control subscale. Thus, the children

with ADHD showed little awareness and/or acknowledgement of the reduced social abilities that their parents reported. This reduced awareness could be related to a lack of feedback from others, and/or due to a protective coping method as previously discussed (Diener & Milich, 1997). Children with ADHD may hear quite often from parents and other caregivers about problematic behaviors (i.e. they need to sit down, calm down, listen/be quiet, pay attention). Regarding peer interactions, however, they may receive limited direct verbal feedback when they do something that others don't like (or don't do something that others would value). Instead, peers may just avoid them in the future or stop playing with them. This lack of direct feedback makes it more difficult to tie together one's actions to the consequences of these actions. Also, if they are frequently given negative feedback regarding problem behaviors, then their sense of self might be saturated from this. Thus, the protective coping method comes to play when other potential difficulties (peer problems) are to be faced. In light of this, it may be useful to promote giving children with ADHD specific constructive feedback during peer interactions and to work on increasing the amount of time spent acknowledging their positive traits and accomplishments.

Limitations and Future Directions

Future studies examining emotion recognition in children with ADHD will benefit from addressing limitations present in this study. First, it would be useful to examine separately the emotion recognition of children with different subtypes of ADHD - predominantly inattentive (ADHD/I) versus combined subtype (ADHD/C). This is not just a limitation of this study, but a limitation of past studies as well. There is reason to believe that these two groups of children may differ in emotion recognition, because they

have been found to differ along important classification dimensions (e.g., demographics, family history, symptom presentation, associated features, comorbid disorders), suggesting children with ADHD/I actually have a distinct disorder and not a subtype of ADHD (Adams, Derefinko, Milich, & Fillmore, in press; Barkley, 2001; Milich, Balentine, & Lynam, 2001). There is also reason to believe these two groups of children might differ in emotion recognition based on the studies that have been conducted thus far.

As has been discussed, previous studies have found conflicting evidence regarding whether children with ADHD demonstrate a global deficit in emotion recognition or difficulties identifying a few specific emotions. It is possible that these discrepant results are a result of sampling different subtypes of ADHD. The results of this study are similar to the findings from the studies by Kats-Gold et al. (2007), Singh et al. (1998), and Williams et al. (2008) in that children with ADHD were found to have difficulties identifying certain emotions. Results from the study by Cadesky et al. (2000); however, differed from these studies and suggested a global recognition deficiency in children with ADHD. In the Cadesky et al. study, children with ADHD and no Conduct Problems were separated from children who had ADHD and Conduct Problems. Interestingly, although the group of children with ADHD and no Conduct Problems made more errors than controls in recognition across all emotions, the group of children with ADHD and Conduct Problems showed more similar results to this study and the studies by Kats-Gold et al., Singh et al., and Williams et al. Due to the fact that there is a lower prevalence rate of conduct problems in children with the inattentive subtype, the two subtypes of ADHD may have been inadvertently separated in the Cadesky et al. study by

dividing the children with ADHD into groups with and without conduct problems. Thus, it is possible that differences between the emotion recognition of their sample of children with ADHD and the samples of other studies (including this one) may be due to the fact that different subtypes of ADHD were being assessed. It would be useful to confirm whether this is the case by examining emotion recognition abilities separately for these two groups of children.

In addition to examining the emotion recognition of children with ADHD/I and ADHD/C separately, it would be useful for future studies to assess children's understanding of the events that caused or led up to emotions and their ideas of how to respond effectively to others based on identified emotions and causes. As reported above, children with ADHD made significantly more errors than children without ADHD when asked to explain how they knew what the actors in the *CASP* videos were feeling. It is possible that a part of this was they were not able to identify or recall the events that caused emotions as well as the children without ADHD. Previous research studies have found that children with ADHD have several weaknesses in story comprehension relative to children without ADHD (i.e. Flake, Lorch, & Milich, 2007). One weakness children with ADHD experience is difficulties understanding causal relations (Lorch et al., 2004). Thus, it would be beneficial to examine further children's understanding of the events causing emotions to determine if children with ADHD experience similar difficulties understanding causal relations in this area.

Another limitation of this study is that children's social competence was not assessed. Future studies could address this by including measures like peer ratings or peer nominations to assess children's success in peer interactions. In this study, results showed

that performance on the emotion recognition measures did not mediate the relation between children's diagnostic status and parent ratings on the *SSIS*. It would have been interesting to see, however, if this would have been the case if peer ratings/nominations had been used instead of parent ratings on the *SSIS*. It may be that parents of children with ADHD don't see problems in emotion recognition as playing a large role to their children's success in peer relationships, but this could be more important to peers of children with ADHD. It would also be interesting to see whether differences in understanding emotions and responding to emotions mediate the relation between children's diagnostic status and success in peer interactions. It could be that being able to identify emotions is not as critical as understanding causes or responding to those emotions.

This study was also limited by the modest sample size and therefore low power to identify significant group effects. Post hoc power analyses were run using G*Power 3 (Faul, Erdfelder, Lang, & Buchner, 2007). For the present sample (N =29) with $\alpha = .05$, the power to detect a large effect size ($f = .40$) was .54 for the ANCOVA analyses. The power to detect a medium effect size ($f = .25$) was .25, and the power to detect a small effect size ($f = .10$) was .08. Replicating this study with a larger sample would be beneficial in determining whether there are other significant group differences in emotion recognition than those that were observed. Additionally, it should be noted that a large number of statistical tests were conducted which increases the likelihood of finding an untrue effect. Finally, all the children scored lower than would be expected on the *CASP*, which could have also played a part in not finding significant group differences on this measure. The *CASP* was the last task that the children completed in this study, and so

their limited performance may be due to being tired and anxious to finish the testing. Also, several of the children focused on factors in the videos that were outdated or that they could not identify with (i.e. a scene where a child was playing the original Nintendo) rather than the task at hand. Thus, it would be helpful to account for order effects in future work and if possible use more up-to-date videos of social interactions.

Despite the above limitations, results from this study have several pertinent clinical implications. One key finding in this study was that children with ADHD demonstrated specific difficulties in emotion recognition on the *DANVA2* concerning the emotions *fear* and *sadness.* In the clinical setting, therapists could work directly on improving recognition of fear and sadness by reviewing nonverbal cues of these emotions and having children with ADHD practice identifying these emotions. They could also simply pay more attention to instances where children with ADHD are confronted with others' fear and sadness (i.e. when working with parents or in group settings). They can highlight these instances to enhance children's memories for experiences of these emotions and/or assist recognition by pointing out nonverbal cues of these emotions in vivo if needed. Also, therapists can enlist help from parents and other caregivers (teachers) by asking them to pay attention to times where these emotions are present as well and engaging in the same actions as described above. Similar strategies could be used when working with children with depression; except for targeting the emotions with which they experience difficulties (under-identifying happiness and over-identifying fear).

A second key finding of this study was that children with ADHD made significantly more errors on the *CASP* than children without ADHD, indicating they have

a tendency to make up information when trying to explain how they knew what others were feeling. If future studies confirm that children with ADHD engage in this behavior due to problems identifying or retaining information from social situations, then interventions can focus on improving these abilities. As this has not been confirmed to be the case yet, at this point, therapists can address this limitation by challenging times when they observe children using this strategy and teaching parents and other caregivers to do this as well. Therapists can also work with children with ADHD on increasing their perceived importance and positive feelings related to being able to admit when they do not know an answer. They can walk children with ADHD through what happens when information is made up to fill in the gaps (i.e. discuss potential consequences). Also, as mentioned previously, therapists can encourage caregivers to give children with ADHD specific constructive feedback during peer interactions and to work on increasing the amount of time spent of acknowledging children's positive traits and accomplishments.

In summary, the results from this study confirm previous research findings that children with ADHD demonstrate emotion recognition impairments, as well as provide additional evidence that this population has difficulties recognizing specific emotions and does not have a global recognition impairment. Although the difficulties that the children with ADHD experienced on the emotion recognition measures did not show a significant relation to their social skills as rated by parents, limitations of this study need to be addressed first in future studies, before we can determine whether emotion recognition impairments in children with ADHD relate to their social difficulties. This is crucial due to the multiple negative immediate and future outcomes associated with the social difficulties that children with ADHD experience. Thus, it is of high importance to

determine if impairments in emotion recognition and/or related deficits are areas that need to be included to enhance the efficacy of current treatment interventions for children with ADHD.

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Vita

January 2013

REBECCA FLAKE ALDEA

Personal History

Date of Birth: February 17, 1977 Place of Birth: Little Rock, Arkansas

Education

Years	*Institution*	*Degree or Title*
2002-2005	University of Kentucky Lexington, KY	M.S. in Clinical Psychology, December 2005
1999-2002	University of Arkansas at Little Rock Little Rock, AR	B.A. in Psychology, May 2002
1995-1999	Tufts University Medford, MA	B.A. in Child Development, May 1999
1992-1995	The Baylor School Chattanooga, TN	High School Diploma, May 1995

Clinical Experience

2010-2012	Psychological Examiner at the Arkansas State Hospital.
2009-2010	Psychology Intern at the Arkansas State Hospital.
2003-2008	Outpatient therapist at the Jesse G. Harris, Jr. Psychological Services Center.
2006-2007	Practicum student at Eastern State Hospital.
2005-2006	Practicum student at the University of Kentucky Counseling and Testing Center.
2004-2005	Practicum student at the Jesse G. Harris, Jr. Psychological Services Center.
2003-2004	Practicum student at Amend Psychological Services, PSC.
2001-2002	Volunteer for Mark Edwards, Ph.D. and Eldon Schultz, M.D. at the Dennis Developmental Center.
2000-2002	Volunteer for Charles Feild, M.D. at the Dennis Developmental Center.
1999-2000	Mental Health Technician at the Elizabeth Mitchell Adolescent Center at the Centers for Youth and Families.

Research Experience

2002-2006	Research assistant for Rich Milich, Ph.D. and Betty Lorch, Ph.D. at the University of Kentucky.
2000-2002	Research assistant to John Chelonis, Ph.D. in laboratories at both the Arkansas Children's Hospital and the University of Arkansas at Little Rock.

Teaching Experience

2006 Spring Semester	Teaching Assistant – Undergraduate Statistics University of Kentucky Lexington, KY

2005 Fall Semester	Teaching Assistant – Graduate Psychological Assessment University of Kentucky Lexington, KY
2002-2003 Fall & Spring Semesters	Teaching Assistant – Undergraduate Statistics University of Kentucky Lexington, KY

Publications

Lorch, E.P., Milich, R., Flake, R.A., Ohlendorf, J., & Little, S. (2009). A developmental examination of story recall and coherence among children with ADHD. *Journal of Abnormal Child Psychology, 38* (3), 291-301.

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Chelonis, J. J., Flake, R. A., Baldwin, R. L., Blake, D. J., & Paule, M. G. (2004). Developmental aspects of timing behavior in children. *Neurotoxicology and Teratology, 26* (3), 461-476.

Convention Presentations

Flake, R., Lorch, E., Milich, R., & Trauth, D. (2005, April). Free recall of televised stories in children with and without ADHD. Poster presented at the Society for Research in Child Development, Atlanta, GA.

Flake, R. A., Lorch, E. P., Milich, R., Estis, M., & Colby, C. (2003, August). Differential impact of story structure on recall in ADHD children. Poster presented at the American Psychological Association, Toronto, Canada.

Flake, R. A., Chelonis, J. J., Baldwin, R. L., Edwards, M. C., Feild, C. R., & Paule, M. G. (2002, May). The effects of methylphenidate on time production in children with attention deficit hyperactivity disorder. Poster presented at the Association for Behavior Analysis, Toronto, Canada.

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Other Employment and Volunteer Work

1998-1999	Volunteer Peer Leader Tufts University Medford, MA
1998 Summer	Preschool Teacher (substitute) Easter Seals Little Rock, AR
1996-1998	Volunteer Boston Children's Hospital Boston, MA
1996 Summer	Telephone interviewer Market Insights Little Rock, AR
1996 Summer	Support staff in Medical Records St. Vincent's Health System Little Rock, AR
1995-1996	Volunteer Massachusetts General Hospital Boston, MA
1993-1994	Volunteer Erlanger Hospital Chattanooga, TN