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Nonverbal Cue Perception and Social Competence in Children with Symptoms of AD/HD

by

Chrystal L. Mansley

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Abstract

Children with Attention-Deficit/Hyperactivity Disorder have consistently been shown to have deficits in social competence. Despite the numerous problems they face, little research has been done to investigate reasons they experience such difficulties. In the context of a social information-processing model, the purpose of this study was to investigate the social perception abilities of children with symptoms of AD/HD. Specifically, the study focused on children's ability to perceive nonverbal cues about emotions. As expected, children with more AD/HD symptoms were rated as less socially competent by their parents. Although children with symptoms of AD/HD were not found to be deficient in their nonverbal cue perception abilities, the results of this study indicate a unique pattern of nonverbal cue perception abilities. Children who were more inattentive were more likely to identify contextual cues. Social competence for children in this sample was not related to their ability to perceive nonverbal cues, but it was related to parent ratings of problematic behavior. Taken together, the findings suggest a deficit at a later stage in social information-processing.

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Introduction

Attention-Deficit/Hyperactivity Disorder (AD/HD) is a childhood disorder characterized by a persistence of inattentive and/or hyperactive-impulsive behaviors that are more severe and frequent than is typical of children the same age and developmental level (American Psychiatric Association, 1994). Although not a diagnostic criterion, problematic social behaviors such as rigid communication patterns (Landau & Milich, 1988) and controlling, dominating interactions (Cunningham, Siegel, & Offord, 1985) are commonly observed in children with AD/HD. In fact, Hinshaw (1992) has asserted that the most disturbing aspect of AD/HD may be the social difficulties such children face. These problems may have negative consequences on the child's social status (Landau & Milich, 1988) and the behavior of other children (Landau & Moore, 1994). Furthermore, both social impairment and a diagnosis of AD/HD have been shown to operate as risk factors for later substance use and conduct disorders (Chilcoat & Breslau, 1999; Greene, Biederman, Faraone, Sienna, & Garcia-Jetton, 1997; Greene et al., 1999).

Approximately 3-5% of elementary students are affected by AD/HD (American Psychiatric Association, 1994), and as many as 19.8% of boys and 12.3% of girls aged 4 to 17 years display enough symptoms to meet DSM-IV Criterion A (Pineda et al., 1999; see Appendix A). Accordingly, there is much cause for concern about the social competencies and deficits experienced by children with symptoms or a diagnosis of AD/HD. Lower levels of socially competent behavior have been linked with deficits in various aspects of social information-processing, including relevant encoding of cues, attributional style, generation of responses, and evaluation of responses (Dodge & Price,

1994). In the context of Crick and Dodge's (1994) social information-processing model, the purpose of this study was to examine the relationship between social competence, nonverbal cue perception skills, and AD/HD symptomatology.

Background

Social Skills and Social Competence

Defining Social Skills and Social Competence

In a review of the literature concerning social skills, Gresham (1997) identified three common definitions. The first commonly used definition was the peer acceptance definition. Many researchers used ratings of peer acceptance and popularity to define levels of social skills. Gresham found this definition to be problematic, because it did not specify which behaviors lead to peer acceptance. The second definition described by Gresham was a behavioral one. In this definition, social skills were considered those behaviors that maximize reinforcement and minimize punishment of social interactions. Although this definition identified specific behaviors, it did not necessarily mean that those behaviors were valued by people who interact with the child. The last definition that Gresham identified is that of "competence-correlates" (p. 235) or social validity. This definition specified social skills as social behaviors that correlate with different criterion measures of social competence. Essentially, social skills were considered those behaviors likely to produce desired social outcomes, such as peer acceptance and socially skilled interactions. The social validity definition of social skills was used for this study.

Although sometimes used interchangeably in the literature, there is an important distinction to be made between social skills and social competence; namely, social skills

are behaviors used to perform competently in social tasks, whereas social competence represents judgements about those behaviors (McFall, 1982). As the current study will examine parent perceptions of children's social skills, social competence will be the focus of the study. However, due to discrepancies in how the terms 'social skills' and 'social competence' are used in the literature, the terminology used in the literature review will reflect the authors' use of the terms.

Another term used in this literature review is that of social adjustment. According to Crick and Dodge (1994), social adjustment has generally been defined as "the degree to which children get along with their peers; the degree to which they engage in adaptive, competent social behavior; and the extent to which they inhibit aversive, incompetent behavior" (p. 82). They indicated that social adjustment has typically been directly indexed by levels of socially competent behavior. As such, although Crick and Dodge's social information-processing model refers specifically to social adjustment, it will be considered equally applicable to the construct of social competence.

The Importance of Social Competence

Factors relating to children's social competence and adjustment have increasingly become the focus for extensive amounts of research (Feldman, Philippot, & Custrini, 1991). Walker, Schwarz, Nippold, Irvin, and Noell (1994) indicated that appropriate social skills allow the child to (1) develop positive social relationships, (2) effectively cope with the behavioral expectations, and (3) communicate their desires, needs, and preferences. Furthermore, they stated that development of social competence is an essential mediator of success in schooling. Indeed, in a comparison of children with

varying levels of sociometric status and educational achievement, Bursuck and Asher (1986) established that children who were rated as lower in sociometric status and lower in academic achievement were more likely to be those children who were rated as having fewer prosocial skills.

Childhood deficits in social competence have been shown to be predictive of poor outcomes in adolescence and adulthood. For example, Green et al. (1997) compared the outcomes of adolescent boys with AD/HD identified as "socially disabled", adolescent boys with AD/HD without social disability, and a comparison group of boys without AD/HD. Social disability in childhood was shown to be a strong predictor of both substance use and conduct disorders in adolescence. Deficits in social competence can also be problematic in adulthood. Lower levels of premorbid social competence have been linked to longer psychiatric hospitalizations in first-admission, nonschizophrenic, state-hospital patients (Glick & Zigler, 1986).

Social Skills and Competence in Children with AD/HD

Although not a criterion for the diagnosis of AD/HD, numerous children with the disorder display co-occurring deficits in social skills and are often considered socially incompetent by parents, teachers, and peers. In a review of social skills deficits in children with AD/HD, Frederick and Olmi (1994) described a number of social difficulties experienced by these children. Among the problems frequently observed were peer rejection, difficulties in teacher and parent interactions, and deficient communication skills.

Merrell and Wolfe (1998) examined the relationship between teacher-rated social skills deficits and AD/HD characteristics of children aged 5-6 years. Participants in the AD/HD group were identified from a larger sample on the basis of having scores in the 95th percentile on a measure of attention problems and overactivity. Results indicated that lower teacher ratings of social skills were correlated with higher teacher ratings of AD/HD symptoms. Furthermore, children with AD/HD were five to six times as likely as matched controls without AD/HD to be rated as having significant social skills deficits. In the same study, a discriminant analysis using social skills ratings of cooperation, interaction, and independence resulted in correct classification of 87% of participants into their respective groups. Of the social skills examined, teacher ratings of social cooperation were found to be the most powerful in predicting group membership. Merrell and Wolfe concluded that young children displaying AD/HD characteristics were at a heightened risk for social skills deficits, particularly in the area of social cooperation. In support of this are the results from Melnick and Hinshaw's (1996) study, in which high-aggressive children with AD/HD were shown to have different goals for social interaction than both low-aggressive children with AD/HD and normal controls. Specifically, high-aggressive AD/HD boys were more likely to report that they weren't afraid of getting in trouble and were less likely to report a social goal of cooperation. In turn, these goals were shown to be predictive of social acceptance as measured by sociometric methods.

One important component of social competence is the way in which children relate to peers (Saunders & Chambers, 1996). Children with hyperactivity are often found to elicit particularly negative responses from peers (Landau & Moore, 1994). Asarnow

(1988) conducted a study of peer status and social competence in psychiatric inpatient children. Low levels of internalizing (e.g., depression, anxiety) and high levels of externalizing symptoms (e.g., hyperactivity, aggression) were found to be predictive of peer rejection during hospitalization. Using sociometric methods, Carlson, Lahey, Frame, Walker, and Hynd (1987) compared the peer status of normal controls to that of ADD children with and without hyperactivity. Their results showed that children with ADD, both with and without hyperactivity, received less "liked most" nominations, more "liked least" nominations, and were less socially preferred by peers than normal controls. In addition, ADD children with hyperactivity were more likely than both ADD children without hyperactivity and normal controls to receive nominations for being the child who "fights most". As children with comorbid disorders were excluded from the study, the findings of this study suggest that the lowered social status of children with ADD is not simply an artefact of the high rate of comorbidity with other disorders.

Another area of social competence in which children with AD/HD experience significant difficulties is social communication. Landau and Milich (1988) compared social communication among boys with or without ADD using a TV talk show role-playing procedure. No differences were found between groups when boys enacted the host role; however, significant differences were observed when boys enacted the role of guest. Specifically, boys without ADD provided more answers in the guest role than in the host role, whereas the number of answers provided by boys with ADD were the same regardless of the role they performed. Therefore, it appears that boys with AD/HD do not

change their communication behaviors according to situational demands, and this may contribute to the social difficulties that children with AD/HD experience.

A Social Information-Processing Model of Social Adjustment

One recently proposed account of children's social adjustment is the social information-processing model presented by Crick and Dodge (1994). According to this model, social information-processing consists of six sequential steps (see Figure 1). The model includes feedback loops, in recognition that children may engage in multiple steps of information-processing at the same time. However, the processing of any particular stimulus generally follows a chronological sequence. Each step in the model is affected by the child's memory and database of social schemas, social knowledge, and acquired rules.

The *first* step in Crick and Dodge's (1994) model is the perception or encoding of internal and external cues. External cues can consist of both verbal and nonverbal components. Nonverbal components may include, but are not limited to, tone of voice, body posture, gestures, physical proximity, and facial expression. The *second* step in the model is the interpretation of those cues. The attributions the child makes about environmental cues are affected by the child's perception of those cues. The *third* step of Crick and Dodge's model is the selection of a goal or outcome for the situation. Next, at the *fourth* step, the child reviews possible responses to the situation based on both previous experiences and immediate social cues. In the *fifth* step of the model, the child evaluates alternative responses and selects the most positively evaluated response for enactment. *Lastly*, the child enacts the chosen behavioral response.

Milch-Reich et al. (1999) asserted that it is the first step, cue perception, that is the most influential, in terms of its effects on the following stages. If the first step in social information-processing is either incomplete or imprecise, later steps may be affected. Consequently, when a child's perception of the situation is incorrect, the child will be more likely to choose actions that are not appropriate to the situation. The second step, interpretation of cues, can also have considerable impact on behavior. Incorrect interpretation of observed cues may also lead to inappropriate behavior. In other words, a child must first accurately perceive and interpret elements of a social situation in order to act accordingly. This is consistent with Feldman, Philippot, and Custrini's (1991) assertion that the "success of the interaction … is predicated on the abilities of the interactants to encode and decode nonverbal behavior appropriately" (p. 329). The perception (encoding) of nonverbal cues is thus a vital component of social information-processing, as is the interpretation (decoding) of those cues. Children's understanding of nonverbal cues about emotion may be particularly important to their social adjustment.

The Role of Emotion

Crick and Dodge (1994) postulated that emotion plays an integral role in their social information-processing model of children's social adjustment. Emotion and cognition can interact at any step in the model. For example, at the second step, the child's understanding of the emotional state of others may have an effect on the child's selection of a goal. Furthermore, the ability to understand emotions has long been thought to be an important component of social competence. In an early review of sensitivity to emotional cues in children and adults, Morrison and Bellack (1981) concluded that both

response and perception deficiencies could play a role in social functioning deficits. The ability to accurately understand one's social environment, including the emotions of others, has been labelled as social perception and seems to play a critical role in children's social adjustment. Social perception abilities, including the ability to recognize and label emotions based on cues, may be important in understanding the social difficulties of children with AD/HD. Norvilitis, Casey, Brooklier, & Bonello (2000) asserted that the difficulties in emotion regulation that are often found in children with AD/HD can be related to problems with emotion appraisal, because "children cannot regulate what they cannot identify" (p. 17).

Research on the Perception of Nonverbal Cues about Emotion

There is a substantial body of research on the perception of nonverbal cues about emotion with various child and adult populations. Nonverbal cues about emotion can include but are not limited to facial expressions, tone of voice, gestures, and proximity. Gerhards (1998) demonstrated that adult patients with psychosomatic gastrointestinal disorders show a reduced ability to recognize facial expressions of emotion. Similarly, hospitalized neuropsychiatric patients and alcoholic patients in residential treatment programs were shown to have difficulties in nonverbal sensitivity compared to a normative group of high school students (Rosenthal & Benowitz, 1986). Deficits in nonverbal cue perception have also been examined in clinical populations such as children with learning disabilities or AD/HD. Children with Oppositional Defiant Disorder (ODD) or Conduct Disorder (CD) have been found to encode fewer social cues and generate fewer alternative responses than normal controls (Matthys, Cuperus, & van

Engeland, 1999). Likewise, children with learning disabilities have been shown to have deficits in nonverbal cue perception in comparison to normal controls (Hall, Peterson, Webster, Bolen, & Sprouse, 1999; Jackson, Enright, & Murdock, 1987). Other factors that may influence perception of affect have also been studied, including age and gender.

Age

A developmental progression in the ability to perceive nonverbal cues about emotion has been observed across a wide range of studies. That is, social perception abilities appear to increase with age (Morrison & Bellack, 1981). Dodge and Price (1994) found that relative to younger children, older children were more skilled in their social information-processing, specifically with respect to relevant encoding of cues. Similarly, Philippot and Feldman (1990) demonstrated that in children aged 3 to 5 years, the ability to recognize emotions in facial expressions increased significantly with age.

A study of children ages 11, 14, and 17 by Jackson, Enright, and Murdock (1987) also demonstrated support for an increase in social perception abilities with age. In children with and without learning disabilities, they found that the ability to understand nonverbal communication about emotion was higher in older children. Nabuzoka and Smith (1995) found similar results. Among children aged 5 to 13 years with learning disorders, accuracy in identifying emotions through facial, postural, and gestural cues increased with age for all measures, and this improvement was replicated in a one year follow-up of a subset of these children. Likewise, Egan, Brown, Goonan, Goonan and Celano (1998) studied children aged 5 to 14 years with externalizing behavioral symptoms and a normal control group. Examining the effects of internalizing and

externalizing behavior ratings, receptive vocabulary, and age, their results indicated that age was the best predictor of the ability to decode angry and neutral emotions in both groups.

Gender

Findings on the relationship between gender and social perception have not been as consistent as those for age. A study of three- to four-year-old children revealed no significant correlations between gender and the identification of emotion through vocal intonation (Baltaxe, 1991). Similarly, Nabuzoka and Smith (1995) detected no overall gender differences in the overall ability to identify emotions through facial expressions and gestures. However, when specific emotions were examined individually, they found that girls tended to be more accurate in identifying facial expressions of disgust and rejecting gestures. In further support of a gender difference in social perception abilities, Philippot and Feldman (1990) presented evidence that the age at which improvement in the ability to correctly label emotions differed as a function of gender: females improved more from three to four years of age, whereas males improved most from four to five years of age.

Learning Disabilities

Many studies have been conducted to examine the emotion perception abilities of children with learning disorders. Jackson, Enright, and Murdock (1986) found that children with learning disabilities scored significantly lower than a group of non-learning-disabled children on measures of nonverbal sensitivity, and this deficit was consistently observed in children ages 11, 14, and 17. A study by Nabuzoka and Smith

(1995) revealed that children with learning disabilities were less proficient at identifying emotions than age-matched children without learning disorders. Furthermore, in a comparison of children with learning disabilities, children with co-occurring learning disabilities and AD/HD, and children with neither disorder, Sprouse, Hall, Webster, and Bolen (1998) demonstrated that children with learning disabilities (with or without comorbid AD/HD) were considerably less adept at identifying facial expressions than normal controls.

AD/HD and Nonverbal Cue Perception

Deficits in nonverbal cue perception pose a unique problem for children with AD/HD, particularly given their difficulties with impulsive behavior and in attentional tasks and social situations. Indeed, in a recent study of children with AD/HD, 71.4% of parents reported problems in nonverbal communication (Clark, Feehan, Tinline, & Vostanis, 1999). To successfully encode and integrate cues requires sustained mental effort and attention (Milch-Reich et al., 1999); therefore, children with AD/HD may in fact be predisposed to making errors in social information-processing, either by inattention to relevant cues or responding based on inadequate or impulsive reasoning (Singh et al., 1998). However, studies on the nonverbal cue perception abilities of children with AD/HD have been sparse and inconsistent.

Research on social perception abilities in children with externalizing behaviors has been less than definitive. A study of preschool children demonstrated that errors in identifying facial emotions were significantly correlated with externalizing behaviors for both boys and girls (Nowicki & Mitchell, 1998). However, Egan et al. (1998) studied

children with externalizing behaviors, including and were unable to establish support for deficits in the ability to correctly identify emotions. Their comparison of a clinical sample of children with externalizing behavior disorders and normal controls revealed no significant differences in emotion identification abilities between the two groups.

Likewise, research on the social perception abilities in children with a diagnosis of AD/HD has been mixed. A recent study of the emotion appraisal skills of children with AD/HD found significant relationships between performance on emotion identification tasks and levels of AD/HD symptomatology; children with more AD/HD symptoms performed worse in some emotion appraisal tasks (Norvilitus, Casey, Brooklier, & Bonello, 2000). Examining the ability to process nonverbal information about affect, Cadesky, Mota, and Schachar (2000) found that children with AD/HD were significantly less accurate than normal controls in interpreting emotions from facial expressions and voice recordings. Furthermore, an analysis of the errors made by children with AD/HD showed their mistakes to be generally random in nature. The pattern of errors demonstrated by children with AD/HD was similar to the pattern of errors demonstrated by normal controls, but children with AD/HD made significantly more errors.

In an examination of the ability to recognize facial expressions of emotion, Singh et al. (1998) determined that children with AD/HD are disadvantaged compared to normal controls. Across all types of emotions studied, children in the general population had a mean accuracy rate of 89%, whereas children with AD/HD had a mean accuracy rate of only 74%. Further, children with AD/HD were significantly less able to correctly identify facial expressions of anger; they demonstrated by a mean error rate of 35%, as

compared to a mean error rate of 11% in the general population. Moore, Hughes, and Robinson (1992) studied the social information-processing abilities of children in grades three and four who were classified as rejected/accepted (operationalized by peer nomination procedures) and hyperactive/non-hyperactive. They found that hyperactive-rejected children recalled fewer social cues than both normal controls and hyperactive-nonrejected peers. One recent study of teacher-rated social perception abilities found that children with both AD/HD and a learning disorder demonstrated increased social perception difficulties when compared to normal education students (Hall et al., 1999).

However, there is also evidence to suggest that children with AD/HD do not have deficits in emotion perception and appraisal. Individual assessments of various social perception abilities in the study by Hall et al. (1999) revealed no difficulties in the ability to perceive gestures, facial expressions, or postures by children with AD/HD or children with both AD/HD and a learning disability compared to regular education peers. Shapiro, Hughes, August, and Bloomquist (1993) asserted that social competence problems in children with AD/HD were not primarily the result of deficits in processing emotional cues. Compared with normal controls, they found children with AD/HD to have similar abilities in facial emotional expression and recognition of affective stimuli. Likewise, Sprouse et al. (1998) found no differences between a group of children with both a learning disorder and AD/HD versus normal controls on teacher ratings of social perception.

Limitations of Previous Research

There are several problems contributing to the inconsistent findings in the existing research in this area. The first of these problems is the lack of consistency with respect to the populations sampled. For example, Egan et al. (1998) used a broader sample than children with only AD/HD: they included children with any type of externalizing behavior disorder. Sprouse et al. (1998) used a group of children with both learning disabilities and AD/HD, but not a group of children with only AD/HD.

A second weakness in the existing literature concerns the range of nonverbal information studied. For the most part, research in this area has been concentrated on the perception of facial expressions of emotion. Although facial expressions are an important component of nonverbal cues, there are others deserving attention. Few studies have examined the larger range of nonverbal cues, including paralanguage (i.e., tone of voice), body posture, gestures, and context. Although some research has tested different components of nonverbal cues separately (e.g., Moore, Hughes & Robinson, 1992), the testing of each type of cue in isolation has limited generalizability. It is important to understand how various nonverbal cues are attended to and utilized when multiple cues are present in the same context.

Another area of concern is that of language abilities. Some studies provided a written list of alternatives from which to choose (e.g., Jackson, Enright, & Murdock, 1987). This procedure introduces a confound for children with reading difficulties or disabilities. In studies that did not provide a list of emotions to choose from, correct labelling of the emotion was required (e.g., Nabuzoka & Smith, 1995; Serra, Jackson, van Geert, & Minderaa, 1998). Incorrect labelling of emotions may be indicative of a

language deficit rather than a perception deficit, thus introducing the child's verbal ability as a confound in these studies. Indeed, Egan et al. (1998) found that verbal intelligence was a significant predictor of the ability to decode facial expressions, even when children were given a list of emotions from which to choose.

Summary

This study was designed in an attempt to explain the deficits in social competence that are often observed in children with AD/HD. These difficulties were examined in the context of a social information-processing model. Specifically, the study was an investigation of the relationship between nonverbal cue perception abilities (the first stage in social information-processing), social competence, and AD/HD symptom severity. One purpose of the study was to address some of previously mentioned limitations of existing research by using a more ecologically valid measure of social perception that was unrelated to language abilities (see Methods section)., There were a number of desirable qualities identified that shaped the choice of measures. It was important that the measure chosen presented multiple types of cues simultaneously, and the range of emotions portrayed in these scenarios extended beyond basic emotions (i.e., happy, angry, sad, fearful) to include a broader range of emotions (e.g. excited, annoyed, confident, proud). Based on results from previous literature, a number of relationships were hypothesized.

Hypotheses

1. The ability to perceive nonverbal cues accurately has been shown to increase with age (Nabuzoka & Smith, 1995). Therefore, it was hypothesized that there would be a

positive correlation between age and performance on a measure of nonverbal cue perception abilities (Child and Adolescent Social Perception Measure, CASP; Magill-Evans, Koning, Cameron-Sadava, & Manyk, 1996).

2. Previous research has found children with AD/HD to have deficits in social skills (Frederick & Olmi, 1994). As such, it was hypothesized that the children in this study meeting DSM-IV Criterion A (APA, 1994) would score lower than the normative sample on a measure of social competence (Social Skills Rating System, SSRS; Gresham & Elliot, 1990).
3. The literature also suggests that children with AD/HD have difficulties in social perception (e.g., Hall et al., 1999; Singh et al., 1998). Consequently, it was predicted that the children in this study meeting DSM-IV Criterion A for AD/HD would score lower than the normative sample for the CASP (Magill-Evans et al., 1996), both in terms of recognizing nonverbal cues and in terms of identifying emotions.
4. Children with AD/HD have been found to have difficulties in social perception (Hall et al., 1999), and previous research has shown a relationship between the level of AD/HD symptom severity and the degree of impairment in emotion appraisal skills (Norvilitus, Casey, Brooklier, & Bonello, 2000). Consequently, the present study hypothesized that there would be a negative correlation between severity of AD/HD symptomatology and nonverbal cue perception abilities.
5. Based on Crick and Dodge's (1994) social information-processing model, the encoding of cues is an important factor in children's social competence. As such, it

was hypothesized that children's nonverbal cue perception abilities would be positively correlated with their social competence ratings.

6. Research by Merrell and Wolfe (1998) suggested that teacher ratings of deficits in social skills tended to be related to teacher ratings of AD/HD symptoms. Furthermore, children with AD/HD were five to six times as likely as matched controls without AD/HD to be rated as having significant social skills deficits. Based on these results, it was hypothesized that there would be a negative correlation between severity of AD/HD symptomatology and social competence.
7. As previously mentioned, research has shown a relationship between AD/HD symptomatology and deficits in social skills (Merrell & Wolfe, 1998). Further, nonverbal cue perception abilities are an important part of social perception (Moore, Hughes, & Robinson, 1992), and children with AD/HD symptomatology are often lacking in emotion perception and identification abilities (see hypothesis 3). Therefore, it was hypothesized that a significant amount of the variance in both social competence and nonverbal cue perception abilities would be predicted by AD/HD symptomatology.
8. Further, because nonverbal cue perception abilities are only one component of social competence (Crick & Dodge, 1994), it was hypothesized that AD/HD symptom severity would predict a larger amount of variance in social competence than nonverbal cue perception ability.

Methods

Participants

Forty-seven children aged 6 to 12 with symptoms or a diagnosis of AD/HD and their parents were recruited using multiple sources. A portion of the sample was recruited from the subject pool database of the Behavioral Research Unit at the Alberta Children's Hospital. The database consists of children who have either completed an initial screen indicating a likelihood of AD/HD or a diagnosis of AD/HD and have previously participated in research. Parents in the database were telephoned and introduced to the study using a brief script (see Appendix B). Participants were also recruited using posters at a rural school in southern Alberta and at various physician offices and community agencies (see Appendix C for a list of agencies). The poster used to recruit participants consisted of an advertisement for the study as well as forms and an envelope for interested parties to leave contact information (see Appendix D). Interested parties were contacted by telephone, and the study was introduced using the script previously mentioned. Finally, participants were also recruited using a short classified advertisement in a local newspaper (Appendix E).

Measures

Primary Variables

AD/HD Symptomatology. The Conners' Rating Scales – Revised (CRS-R; Conners, 1997) is a collection of rating scales used primarily for the assessment of AD/HD. Informants completing the rating scale are given a list of difficulties children may experience. Using a 4-point Likert scale ranging from 0 (not at all true) to 3 (very much true), informants are asked to rate how much of a problem each difficulty has been for the child in the last month. Parents of participating children completed the Conners'

Parent Rating Scales: Long Form - Revised. The parent long form contains 80 items and takes approximately 15 to 20 minutes to complete. Examples of difficulties queried on the CPRS-R:L can be found in Appendix F.

Although the parent rating scales contain numerous subscales useful for clinical assessment and diagnosis of AD/HD, only the DSM-IV Symptoms Subscales (DSM-SS) were used in this study. The DSM-SS include two further subscales: Inattentive and Hyperactive/Impulsive. A composite score including ratings on both subscales was used as a general index of AD/HD symptomatology. The DSM-SS have excellent internal consistency (alphas ranging from 0.88 to 0.93 for the parent form) and adequate test-retest reliability (correlations from 0.67 to 0.76 for the parent form; Conners, 1997; Conners, Sitarenios, Parker, & Epstein, 1998). In addition to having acceptable levels of internal consistency and test-retest reliability, the CRS-R is considered to be the most comprehensively normed questionnaire for the assessment of attention and activity (Blondis, Accardo, & Snow, 1989). Finally, the CRS-R also included several Canadian sites in testing the normative sample.

The CPRS:L-R also has sufficient detail to permit subtyping children into Primarily Inattentive, Primarily Hyperactive/Impulsive, and Combined types according to DSM-IV criteria. Although this study was not an investigation of subtypes, the sample was scored and divided into subtypes for examination.

Social Competence. The Social Skills Rating System (SSRS; Gresham & Elliot, 1990) is a broadband, multi-rater assessment of social behaviors. Informants are given a list of statements about socials skills and asked to rate the child on both frequency and

importance. Ratings are based on a 3-point Likert scale ranging from 0 (never, not important) to 2 (very often, critical). Parents of participating children completed the Parent form, which contains 55 items and takes approximately 20 to 25 minutes to complete. Examples of statements used on the SSRS Parent form can be found in Appendix G.

Although the SSRS is constructed to investigate three different domains (Social Skills, Problem Behaviors, and Academic Competence), only the Social Skills domain was a primary focus in this study. The Social Skills scale has very good internal consistency ($\alpha = 0.87$ for the parent form and $\alpha = 0.94$ for the teacher form) as well as test-retest reliability ($\underline{r} = 0.87$ for the parent form and $\underline{r} = 0.85$ for the teacher form). The Social Skills scale contains four subscales: Cooperation, Assertion, Responsibility, and Self-Control. These subscales have good internal consistency (alphas ranging from 0.65 to 0.80 for the parent form) as well as test-retest reliability (correlations from 0.77 to 0.84 for the parent form).

Nonverbal Cue Perception. The Child and Adolescent Social Perception measure (CASP; Magill-Evans, Koning, Cameron-Sadava, & Manyk, 1995, 1996) is an evaluation intended to measure a child's ability to perceive and interpret nonverbal cues as well as to make inferences about the emotional states of others based on those cues. The CASP includes 10 videotaped scenarios lasting from 19 to 40 seconds ($\underline{M} = 29$ seconds). The scenes take place in different settings and depict a wide variety of emotions. To ensure that children watching the scenes attend only to *non*verbal cues, verbal content in all of the scenes has been masked by way of audio filtering. Although word content has been

removed, tone of voice, rate of speech, and loudness can still be heard. The measure takes an average of 41 minutes to administer (range = 20-85 minutes). Ceiling and basement effects were not observed in the normative sample, which consisted of 212 children from 6-15 years old representative of the general population in Edmonton, Alberta. The CASP yields two non-additive scale scores: Total Emotion and Total Cues. Internal consistency for the CASP is excellent, with an alpha of 0.88 for Total Emotions and 0.91 for Total Cues. Test-retest reliability was also very good (r = 0.83 for Total Emotions and r=0.87 for Total Cues). Examples of scenarios on the CASP can be found in Appendix H.

As per the administration protocol of the CASP (Magill-Evans, Koning, Camera-Sadava, & Manyk, 1996), scenes were presented to children one at a time, after which the examiner asked a series of questions. To elicit responses to the videotaped scene, the child was first asked to relay to the examiner what happened in the scene. If the child was unable to describe the events in the scene (indicating that they may not have been attending), the scene was rewound and replayed once. To be consistent with the procedures used in the normative sample, only one scene per child was replayed. Following the child's description of the scene, the child was asked what each of the people in the scene were feeling and how they could tell the character was feeling this way.

Responses were scored for identification of emotions, as well as mention of facial, body, voice, and contextual cues. Emotions were scored on a scale of 0-2. No marks were given for emotions that were not mentioned, wrongly identified, or too vague. A score of one was given when the emotion was only partially identified or mimicked because of an

inability to label. To avoid the confound of verbal abilities, children were not required to correctly label the emotion as long it was clear what they meant. For example, if the emotion expressed in the scene was confidence, a child's response of "happy because he thinks he did well on the test" was counted as correct (Magill-Evans et al., 1996). A score of two was given when the emotion was correctly identified or accurately implied. In terms of nonverbal cues, children received a score of one for correctly identifying each type of cue present in the scene. Children received no marks if they did not mention the cue, mentioned a cue that wasn't present, or mentioned a cue that was related to a different emotion than the one they were describing. To establish interrater reliability, 14% (n=6) of the protocols were audiotaped and scored by a second rater.

Mediating Variables

Given previous findings, there are a number of possible mediating variables that needed to be examined. Characteristics of the sample were examined in the following variables: gender, AD/HD subtype, medication status, and learning disability status.

Medication Status. The effects of medication on the emotion appraisal and behavior of children with AD/HD has not reached an acceptable level of agreement in the literature. Ullmann and Sleator (1985) researched the effects of stimulant medications on attention, activity level, social skills, and aggressive behavior. Although they found statistically significant differences in social skills ratings of children while on and off medication, the authors indicated that these differences were not large enough to be of much clinical importance. For this reason, they concluded that Ritalin was unsatisfactory as a therapeutic intervention for social skills and oppositional behaviors. However,

stimulant medication was shown to produce important differences in the children's attention and hyperactivity levels. Cunningham, Siegel, and Offord (1985) found that while there were no significant effects of methylphenidate on behavior during free play, there were effects for classroom situations. Specifically, Ritalin had the effect of reducing controlling, negative, and dominating exchanges with peers. With respect to the ability to perceive nonverbal cues, two studies have found no differences between on- and off-medication conditions (Schwean, Gulka-Tiechko, & Saklofske, 1994; Hall et al., 1999).

Given the lack of agreement concerning the effects of AD/HD on social skills and nonverbal cue perception as well as findings that medication does indeed increase attention to tasks, medication status could present a confound in this study. As such, parents of children who were currently taking short-acting stimulant medications (e.g., methylphenidate) were asked if they would be willing to withhold the dose immediately preceding the administration of the CASP. Thirteen parents of the 15 children taking methylphenidate (not including sustained release) agreed to withhold the dose. These children, in addition to children not taking medication, were noted for comparison with those children on both short-acting and long-acting medications at the time of testing.

Learning Disabilities. Although a comprehensive assessment of intelligence and achievement to determine the presence or absence of a learning disability is beyond the scope of this study, it is nonetheless important to determine whether the presence of a learning disability affects nonverbal cue perception. Therefore, parents of children in the study were asked whether their child had ever been identified as having a learning disability or had ever received educational assistance for a learning disability. Those

children with learning disabilities were noted for comparison with non-learning disabled children.

Procedure

Participants were given the choice of participating in their own home, at the Alberta Children's Hospital, or the University of Calgary. Three participants chose to be tested at the University of Calgary, and the remaining 44 participants chose to be tested in their homes. All assessments were conducted by the primary researcher or a research assistant. Parents were first given a brief introduction to the study and informed of their rights (withdrawal, confidentiality, etc.). They were then asked to read and sign the informed consent form. Children were also asked to provide their consent to participate and sign the informed consent form. Parents were then asked to complete the two parent measures (Conners Parent Rating Scales: Long Version - Revised and Social Skills Rating System). While the parent completed the measures, the child was introduced to the Child and Adolescent Social Perception measure videotape and given the opportunity to ask any questions they might have. Whenever possible, the interviews were audiotaped for analysis of interrater reliability. The CASP was then administered in a quiet area of the home. Most parents chose to complete their forms in a different room than the child was being tested. At the end of the test administration, parents and children were again given the opportunity to ask questions. An information letter outlining the degree of difficulties noted by parents was provided to all participants. Included with this letter was an "Honorary Scientist" certificate for each child (Appendix I).

Results

Sample Characteristics

Forty-seven children and one of their primary caregivers participated in the study. Six participants were excluded from the analysis due to a large amount of missing data (n=2) and incomplete CASP protocols (n=4). In all four cases, incomplete CASP protocols were a result of the child's decision to discontinue participation at some point during the administration. The final sample consisted of 41 children, ranging in age from six years, zero months to twelve years, eleven months (Mean=9.84, SD=2.05). Of the 41 children, 31 (75.6%) were male and 10 (24.4%) were female. A chi-square was conducted to determine whether the gender ratio of this sample was significantly different from population estimates as reported by Gomez, Harvey, Quick, Scharer, and Harris (1999). Results indicated that the gender ratio in this sample (3.1:1) was not significantly different from parent-rated population estimates in the Gomez et al. sample (2.5:1 ; χ^2=0.35, p=.55). As reported by parents, the sample consisted of 33 children of Caucasian heritage (80.5%). The remainder of the sample consisted of native (n=1), black (n=1), Asian (n=1), Hispanic (n=1), other ethnic heritages (n=3). One parent chose not to report ethnicity. Six children in the sample had no siblings. The remaining 35 children had a median of two siblings (range=0-5). Of those children with siblings, 16 (45.7%) parents reported at least one sibling to have symptoms of AD/HD.

Eleven children in this sample had been diagnosed with a learning disability (LD; 26.8%), and 21 children had received educational assistance for an LD (51.2%). Learning disability status was operationally defined by having a diagnosis of *or* receiving educational assistance for an LD, resulting in a total of 24 children with learning

disability status (58.5%). A chi-square analysis indicated that the proportion of children with and without an LD did not differ significantly by gender (χ^2=0.40, p=0.53; frequencies are reported in Table 1).

Twenty-six children were taking medication for AD/HD (63.4%; Ritalin n=15, Ritalin SR n=1, Dexedrine n=8, Wellbutrin n=1). An examination of medication by gender indicated that males and females were equally likely to be taking medication for AD/HD symptoms (χ^2=3.13, p=0.08; frequencies are reported in Table 2). Medication status at the time of testing was operationally defined as follows. Children on longer acting medications (i.e., Ritalin SR, Dexedrine, and Wellbutrin) were considered to be on medication at testing. Children on shorter acting medication (i.e., Ritalin) were considered to be on medication at testing if they had received a dose of Ritalin in the previous 5 hours. Children not taking medication for AD/HD were designated as off medication at testing. Using these operational definitions, 10 children in the sample were on medication at the time of testing (24.4%). An examination of medication status at testing by gender indicated that no females were on medication at testing, whereas ten males were on medication at testing. This difference was significant (χ^2=4.27, p=0.04; frequencies are reported in Table 3).

AD/HD diagnosis and subtype were examined using three different operational definitions. Method 1 used a count of the number of DSM-IV symptoms on the CPRS:L-R endorsed with a value of three (very much true), as recommended by the Conners manual (Conners, 1997). Method 2 used less strict criteria: a count of the number of DSM-IV symptoms endorsed with a value of either two (pretty much true) or three (very

much true). Lastly, as an exploratory procedure, Method 3 used a cutoff score of 18 for the overall severity of hyperactive/impulsive symptoms and a cutoff score of 18 for the overall severity of inattentive symptoms to determine diagnosis and subtypes. The cutoff scores were determined on the basis of an average score of three on six of the nine symptoms (3 x 6 = 18) for both the DSM-IV hyperactive/impulsive and DSM-IV inattentive subscales. Classifications using each method can be found in Table 4. Examination of classification by gender indicated the number of children classified in each category did not differ significantly by gender using Method 1 (χ^2=2.96, p=0.40). However, using methods 2 or 3, the number of children classified in each category was significantly different depending on gender (method 2 χ^2=11.98, p=0.01, method 3 χ^2=10.72, p=0.01). Boys were more likely to be of the mixed subtype, whereas girls were more likely to be of the primarily inattentive subtype. As each definition resulted in a different number of children classified in each category, diagnosis and subtype variables were considered insufficiently stable to be used in further analyses.

Validity and Reliability

Internal consistencies for the main scales of the three measures (CPRS:L-R, SSRS, and CASP) are presented in Table 5, showing their similarity to the internal consistencies for the same scales in the normative sample. Interscale correlations for the CPRS:L-R and the SSRS can be found in Tables 6 and 7. Data presented in these tables show a fairly high level of consistency between correlations found in this sample and those demonstrated in the normative samples. The Total Emotion Score and Total Nonverbal Cues scores on the CASP in this sample were also significantly correlated (r=0.85,

$p<.001$), as they were in the normative sample ($r=0.88$, $p<.001$). Taken together, these results suggest that this sample was not significantly different than the normative samples with respect to measures of internal consistency and interscale correlations.

Scores standardized by age and sex were examined to determine the degree of difficulties reported in this sample compared to the normative samples for each of the measures (see Table 8). An examination of z-scores on the DSM-IV hyperactive/impulsive, inattentive, and total subscales showed that the sample scored from 2.32 to 2.84 standard deviations above the mean of the normative sample. This sample was reported to have more DSM-IV AD/HD symptoms than the normative sample, as standardized by age and sex. Furthermore, children in this sample scored between the 84^{th} and 100^{th} percentile on parent ratings of symptom severity ($\underline{M} = 95.83$, $\underline{SD} = 4.70$). These results suggested that the sample for the current study were observed to have clinically significant degrees of AD/HD symptoms.

Construct validity was examined by visual inspection of correlations between related constructs (see Tables 9 through 14). With few exceptions, related constructs were consistently and significantly correlated at moderate to high levels. As such, variables used in this study were considered to be valid measurements of the underlying constructs.

Interrater reliability for scores on the CASP was assessed for six protocols using Cronbach's alpha for each of the 10 scenes. A Pearson correlation was considered inappropriate for the analysis, as it does not take into account any systematic bias between raters (Streiner, 1995). Cohen's kappa was considered inappropriate, as it can only handle dichotomous variables (Streiner, 1995), and emotion scores on the CASP

were rated from 0-2. As such, the intraclass correlation coefficient (ICC) was considered a better measure of rater reliability. Cronbach's alpha is one version of the ICC and can be used as an index of rater agreement for both dichotomous and continuous variables (Shrout & Fleiss, 1979; Streiner, 1995). Table 15 shows interrater reliabilities for each scene, which ranged from 0.61 to 0.99. Overall, the interrater reliability was good (Mean Cronbach's $\alpha = 0.87$), although Cronbach's alpha for a few of the scenes demonstrated poor interrater agreement (e.g., Scene 1 Total Emotions $\alpha = 0.62$). Because interrater reliability was less than excellent, a consensual scoring procedure was implemented. Using this procedure, both raters came to agreement through discussion on each item of every CASP administration.

Planned Analyses

Hypothesis 1: There will be a positive correlation between age and nonverbal cue perception abilities.

As was expected, a one-tailed Pearson correlation between age and nonverbal cues scores was strong and significant, $r = 0.70$, $p < 0.01$. Older children were better able to recognize nonverbal cues, as measured by the CASP.

Hypothesis 2: Children meeting DSM-IV Criterion A will score lower than the normative sample on the SSRS Social Skills scale.

To classify participants as meeting Criterion A of the DSM-IV (APA, 1994), Method 3, as previously outlined, was employed. A cutoff score of 36 on the DSM-IV Total subscale was used, which requires an average score of 3 on 12/18 symptoms (6/9 inattentive and 6/9 hyperactive/impulsive). Using this method, 29 participants were used

in the analysis. To account for effects of age and sex, SSRS Social Skills scores were standardized using data from the normative sample. The mean SSRS Social Skills z-score in this group was –1.50 (SD=1.17), indicating that this group demonstrated lower parent-rated social skills than the normative sample. Further analysis including all participants in the study showed similar results, but with a smaller degree of impairment. For the entire sample, the mean SSRS Social Skills z-score was –1.19 (SD= 1.23), indicating that the full sample also demonstrated lower parent-rated social skills than the normative sample.

Hypothesis 3: Children meeting DSM-IV Criterion A will score lower than the normative sample for the CASP, in terms of both recognizing nonverbal cues and identifying emotions.

The same group of participants as in Hypothesis 2 was used to determine the degree of differences between this sample and the normative sample for the CASP. Scores on the Total Nonverbal Cues (TCS) scale and the Total Emotion Score (TES) scale were standardized by age and sex using the normative sample, in order to control for the effects of those variables. The mean TCS z-score for this group was –0.12 (SD=0.84), indicating that children in this sample did not score lower than the normative sample for the CASP in terms of nonverbal cues perceived. Similarly, the mean TES z-score for this group was 0.23 (SD=0.76), indicating that this group did not score lower than the normative sample in terms of emotions identified.

Hypothesis 4: There will be a negative correlation between AD/HD symptom severity and nonverbal cue perception abilities.

A one-tailed Pearson correlation was conducted to examine the relationship between AD/HD symptom severity and nonverbal cue perception abilities. The correlation between scores was negative but not significant, $r = -0.07$, $p = 0.67$.

Hypothesis 5: Nonverbal cue perception abilities will be positively correlated with parent ratings of social competence.

The relationship between nonverbal cue perception abilities and social competence was examined using a one-tailed Pearson correlation. Results indicated that the scores for nonverbal cues and social competence ratings were not significantly related, $r = 0.07$, $p = 0.68$.

Hypothesis 6: There will be a negative correlation between severity of AD/HD symptoms and the degree of social competence.

An examination of the DSM-IV Total scale and the SSRS Social Skills scale showed there to be a significant negative relationship, $r = -0.50$, $p < 0.01$. Children with higher degrees of AD/HD symptom severity were more likely to show deficits in social competence. Interestingly, this correlation was lower once the effects of age and gender were taken into consideration, $r = -0.32$, $p = 0.04$. This may related to the finding that hyperactive/impulsive symptoms decreased significantly with age, $r = -0.40$, $p = 0.01$.

Hypothesis 7: AD/HD symptom severity will predict a significant amount of variance in both social competence and nonverbal cue perception abilities.

Before analyses were carried out, scores on all three measures (i.e., Conners DSM Total subscale, SSRS Social Skills scale, and CASP Total Nonverbal Cues scale) were standardized by age and sex of their respective samples. This was done in order to

maximize power of the analyses, by removing two of the predictors (i.e., age and sex). Prior to conducting the planned regression analyses, the data were inspected to ensure there were no outliers and assumptions of normality, constant variance, and linearity were met. Examinations of boxplots and normal Q-Q plots found two univariate outliers (one on social skills z-score and one on AD/HD severity z-score), which were removed from further analyses. Examinations of the standardized residuals versus the predicted values in the remaining 39 participants indicated no multivariate outliers. Skewness and kurtosis values (see Table 16), in addition to the normal probability plots, indicated the assumption of normality was met. Visual inspection of scatterplots was used to determine that the assumptions of constant variance (heteroscedacicity) and linearity were met.

Two hierarchical linear regressions were performed to determine the amount of variance in social skills z-score and in nonverbal cues z-score that could be attributed to AD/HD symptomatology. For both regressions, medication status and learning disability status were entered into the first step of the regression, and AD/HD symptom severity was entered into the second step. In the first regression, predicting the social skills z-score, the models were not significant at either step (see Table 17). This indicated that medication status, learning disability status, and AD/HD symptom severity were not significant predictors of social competence once age and sex had been taken into account. In the second regression, which predicted nonverbal cues z-score, the models were also nonsignificant at both steps (see Table 18) indicating that medication status, learning disability status, and AD/HD symptomatology were not significant predictors of nonverbal cue perception ability, after age and gender effects were removed.

Hypothesis 8: AD/HD symptom severity will predict a larger amount of variance in social competence than in nonverbal cue perception abilities.

Although AD/HD severity was not a significant predictor of social skills or nonverbal cue perception abilities, the model F-values for both steps were examined to determine whether AD/HD severity predicted a significant amount of variance in social skills and nonverbal cue perception abilities. Results indicated that AD/HD severity did not predict a significant amount of variance in either value (see Tables 17 and 18). However, the standardized coefficients (β-weights) and R^2 change for AD/HD severity z-score were larger in the prediction of social skills z-scores ($R^2 = 0.083$) than in nonverbal cue z-scores ($R^2 = 0.000$). Thus, although the amount of variance predicted was nonsignificant, AD/HD symptomatology did predict a greater amount of variance in social skills than in nonverbal cue perception abilities, after taking into account the effects of age and sex.

Exploratory Analyses

Analysis 1

As the regression using AD/HD symptom severity to predict social skills approached significance, the relationship between these two variables was further explored. A third hierarchical regression using standardized scores was conducted to determine whether each type of symptom (i.e., hyperactive/impulsive and inattentive) was more predictive of social skills when examined separately. As in the previous regressions, learning disability status and medication status were entered in the first step of the regression. The second step of this regression included separate variables for

inattentive symptom severity and hyperactive/impulsive symptom severity. These scores were based on the Inattentive and Hyperactive/Impulsive subscales of the CPRS:L-R and were standardized by age and gender. Prior to running the analysis, these two variables were examined for outliers, normality, heteroscedacicity, and linearity. Examination of boxplots, normal Q-Q plots, scatterplots, and skewness and kurtosis values showed that all assumptions were met (see Table 19 for skewness and kurtosis values). Results showed that the models for steps 1 and 2 were nonsignificant (see Table 20). Thus, when AD/HD symptom severity was examined using inattentive and hyperactive standardized scores separately to predict standardized social skills scores, the resulting model was still nonsignificant. These results suggest that neither inattentive nor hyperactive/impulsive symptom severity predicted a significant amount of variance in social competence.

Analysis 2

Examination of the correlations showed a significant moderate relationship between Social Skills scale z-scores and Problem Behaviors scale z-scores. To further examine this relationship, another regression was conducted in which only variables with significant correlations to standardized social skills were used. As such, the model for this regression included standardized AD/HD symptom severity scores, medication status, and standardized problem behavior scores (correlations can be found in Table 21; regression model can be found in Table 22). The resulting model was significant, $F(2,36) = 6.19$, $p < 0.01$, accounting for a significant amount of variance ($R = 0.589$, $R^2 = 0.346$). Further examination showed that only problem behaviors emerged as a significant predictor of social skills, $t = -3.64$, $p < 0.01$. After taking into account the effects of age

and sex, AD/HD severity, medication status, and learning disability status were not predictive of parent-rated social skills. However, higher levels of problematic behavior were predictive of lower social competence.

Analysis 3

An examination of the types of cues showed that children in this sample were most likely to identify context cues to infer emotions, followed by facial cues. Children in this sample were least likely to use body and voice cues to infer emotions. Proportions of cues identified can be found in Table 23. To further elucidate the relationship between type of cue and AD/HD symptom, correlations between types of cues and AD/HD total symptoms, inattentive symptoms, and hyperactive/impulsive symptoms were examined. Interestingly, there was a significant correlation between degree of AD/HD inattentive symptoms and the amount of context cues identified, $r = 0.41$, $p < 0.01$. Children who were more inattentive were more likely to identify context cues to infer emotions.

Analysis 4

Observation during scoring indicated that children in this sample sometimes identified cues in the situation that they did not utilize to infer emotion. That is, children would often identify cues in the situation which were relevant to an emotion other than the one being described. To further examine this pattern, a new variable was created for these extraneous descriptions. Mean values for each type of extraneous cue are presented in Table 24. Children were most likely to identify extraneous body and context cues and were least likely to identify extraneous facial and voice cues. An examination of relationships between these extraneous cues and the types of correctly identified cues (see

Table 25) showed a significant correlation between the number of extraneous body cues identified and the number of relevant voice cues identified, $r = 0.39$, $p = 0.01$. Children who correctly identified more voice cues were more likely to identify body cues irrelevant to the emotion being described. Interestingly, there was also a significant correlation between the number of relevant voice cues identified and the number of relevant body cues that were identified $r = 0.56$, $p < 0.01$. Thus, children who identified more voice cues were more likely to identify body cues, both relevant and extraneous.

Discussion

This study attempted to elucidate the relationship between AD/HD severity, nonverbal cue perception abilities, and social competence. Results showed that the sample had a significant degree of AD/HD symptom severity, as well as a significant degree of impairment in social skills. AD/HD severity was significantly related to social skills, but this relationship was no longer present after age and gender were taken into account. However, children in this sample did not appear to have any difficulties in the ability to perceive nonverbal cues or in the ability to infer emotions based on those cues. Further, a significant relationship between nonverbal cue perception abilities and social competence was not observed in this sample. Exploratory analyses showed that social skills were not differentially predicted by inattentive or hyperactive/impulsive symptoms. However, a significant amount of variance in social competence was accounted for by problem behaviors. In terms of nonverbal cues, children in this sample were most likely to identify contextual and body information as cues for inferring emotions. There was a significant relationship between inattentive symptoms and the amount of contextual cues

identified. In addition, children in this sample often identified nonverbal cues that were extraneous to the emotion being described. Most often, these extraneous cues were related to body and contextual information.

Examination of Hypotheses

As was expected in Hypothesis #1, there was a significant relationship between nonverbal cue perception abilities and age. Older children identified more nonverbal cues when inferring emotional states. This is consistent with results from many other studies (e.g., Nabuzoka & Smith, 1995).

Children meeting symptom criteria (Criterion A) of the DSM-IV showed significant deficits in social competence when compared to the normative sample (Hypothesis #2). Consistent with previous research, children with clinically significant levels of AD/HD symptomatology demonstrated significant social skills deficits (for a review see Frederick & Olmi, 1994).

Contrary to what was predicted in Hypothesis #3, children meeting symptom criteria for a diagnosis of AD/HD did not show significant deficits in the ability to perceive nonverbal cues or to infer emotions from those cues. Although this seems to contradict some recent research (e.g., Hall et al., 1999), it is not entirely inconsistent with existing literature in the area. Several other studies have demonstrated that children with AD/HD do not have deficits in their abilities to perceive emotional cues. For example, Sprouse et al. (1998) found no differences between children with both AD/HD and a learning disability compared with normal controls in the ability to identify emotions on the basis of facial expressions. The results in this sample are consistent with the assertion

by Shapiro et al. (1993) that the social competence deficits observed in children with AD/HD are not primarily attributable to deficits in emotion perception.

In keeping with the above finding, the severity of AD/HD symptoms was not related to the ability to perceive nonverbal emotional information (Hypothesis #4). Again, this finding is consistent with some previous research. For example, Norvilitus et al. (2000) found no relationship between AD/HD severity and the ability to recognize facial expressions of emotions. Thus, neither the presence of a significant amount of AD/HD symptoms nor the severity of those symptoms were related to nonverbal cue perception abilities in this sample. There are several explanations as to why this relationship was not observed. First, there may have been a problem with restricted range, as all participants scored high on percentile rankings of symptom severity. There also may have been problems related to the measure of nonverbal cue perception abilities. As norms were available only for total scores, scores on individual types of cues could not be examined. Children with AD/HD symptoms may be impaired in specific types of cues and not others. Lastly, the structure of the CASP did not permit an examination of different types of emotions. Children in this sample may have been impaired in their abilities to perceive only certain types of cues. For example, perhaps they have difficulties with positive emotions, but no difficulties with negative emotions.

This study also hypothesized a relationship between nonverbal cue perception abilities and social competence (Hypothesis #5), but this relationship was not observed in this sample. This finding is somewhat puzzling and inconsistent with results of a study by Koning and Magill-Evans (2001b), which found a significant correlation of 0.52 between

parent SSRS social skills ratings and nonverbal cues perception in a combined sample of normal controls and children with Asperger's Disorder. As previously mentioned, there may have been a problem with restricted range of AD/HD symptom severity. It may be the case that social competence in children with AD/HD is more strongly related to other factors unique to these children, such as problem behaviors, which will be discussed later. In relation to the social information-processing model (Crick & Dodge, 1994), this finding indicates that impairments in social competence among children with AD/HD may be more strongly related to later stages in the model. For example, these children may have difficulties with the response construction stage as a result of impulsively choosing to enact the first response that comes to mind, rather than coming up with a list of alternative responses and evaluating those responses. Another stage at which such children may be impaired is the enactment of behavior. Children with AD/HD may know what the appropriate response is, but be unable to inhibit behaviors that interfere with that response.

As was hypothesized (#6), the degree of AD/HD symptoms observed by parents was moderately related to social skills observed by parents. Children with higher AD/HD symptom severity demonstrated lower social skills. However, this relationship appears to be mediated by age and gender. When AD/HD severity and social competence scores were standardized by age and gender, the relationship was smaller. In support of this finding, there was a significant negative correlation between age and hyperactive/impulsive symptoms. Older children demonstrated less hyperactive/impulsive symptoms. It appears that the relationship between severity of

AD/HD symptoms is mediated by age and gender of the child, although such a relationship was not formally assessed in this study.

After the effects of age and gender were taken into account, AD/HD severity, medication status, and learning disability status did not significantly predict social competence or nonverbal cue perception abilities (Hypothesis #7). Medication status and learning disability status were examined because some previous research has shown a relationship to social competence (e.g., Bramlett, Smith, & Edmonds, 1994; Gresham & Macmillan, 1997) and nonverbal cue perception abilities (e.g., Murphy, Pelham, & Lang, 1992; Sprouse, Hall, Webster, et al, 1998). However, the results of this study were not consistent with these findings. Findings in the current study did not support learning disability status or medication status as predictors of social competence, after the effects of age and gender were removed from social competence and AD/HD symptom severity variables. This is consistent with other research that has shown no relationship between medication and nonverbal cue perception (e.g., Schwean, Gulka-Trechko, & Saklofske, 1994). As previously discussed, there also exists a body of research which has not found support for a relationship between AD/HD and nonverbal cue perception (e.g., Shapiro, et al., 1993). It may be that the relationships previously observed were mediated by age and gender. In addition, although children in this sample scored high in percentile rankings, they may have demonstrated less severe symptoms than children with a confirmed diagnosis of AD/HD. Alternatively, social competence in children with AD/HD may be mediated by other factors that are independent of AD/HD severity, medication, and learning disabilities.

Although the amount of variance predicted in social competence and nonverbal cue perception by AD/HD severity was not significant, the severity of AD/HD symptoms did predict more variance in social competence than nonverbal cue perception abilities (Hypothesis #8). This finding supports the notion that nonverbal cue perception may only be one component of social competence. However, social competence in this sample appears to consist of factors other than nonverbal cue perception abilities.

Exploratory analyses were carried out to clarify whether other factors were predictive of social competence in this sample. Indeed, a regression including medication status, AD/HD severity, and problem behaviors accounted for a moderate amount of the variance in social competence. Of the three predictors, only problem behaviors emerged as a significant predictor. The Problem Behaviors scale included difficulties such as fighting with other children, having low self-esteem, and disturbing ongoing activities. Problem behaviors appear to be an important variable in explaining differences in social competence among children with AD/HD. In this way, children with AD/HD may be qualitatively different from other children. It may be the case that problematic behaviors interfere in other stages of social information-processing, such as goal selection or enactment of behavior. For example, a child exhibiting problematic behavior may have social goals that are inconsistent with others' perception of socially competence behavior. Indeed, Melnick and Hinshaw (1996) found high-aggressive boys with AD/HD to be less likely than normal controls to report a goal of cooperation.

There are a few other interesting findings that are worth mentioning. First, children in this sample were most likely to identify contextual cues (such as physical

aspects of the situations), and facial cues when inferring emotions. This finding is different from results reported by Koning and Magill-Evans (2001a), which found a normal comparison group to be best at identifying body and facial cues using the CASP. Children in this study had the most difficulties with voice and body cues. This is consistent with results reported by Norvilitus et al. (2000), which demonstrated that children with more AD/HD symptoms performed worse on a measure of auditory emotional sensitivity. An examination of contextual cues showed a significant relationship to inattentive, but not hyperactive/impulsive symptoms. Children who were more inattentive were *more* likely to identify contextual cues.

The finding that inattentive severity was related to an increased ability to attend to contextual cues is consistent with early research on incidental learning. Ceci and Tishman (1984) found that compared with normal controls, children with hyperactivity were equally likely to attend to central aspects of the tasks with which they were presented. However, children with hyperactivity were more likely to attend to non-central aspects of the situation. Thus, hyperactive children were more likely than non-hyperactive children to perceive aspects of the situation that were not relevant to the main task, such as the color of the board on which words were presented. These findings may also help explain some of the reasons why nonverbal cue perception was not found to be deficient in this sample. Ceci and Tishman found that the attentional diffusion in children with hyperactivity was significantly related to the ability to identify extraneous cues; however, this attention to extraneous cues was not at the expense of attention to central cues *in low demand tasks*. Only when the task was *highly demanding* (e.g., requiring rapid

processing) did attention to irrelevant cues appear to interfere with attention to central cues. As children were given ample time to observe the situations in this study (i.e., 19-40 seconds), and the time allowed to describe emotions and nonverbal cues was essentially unlimited, the CASP may not be sufficiently demanding to allow attention to irrelevant cues to interfere with the processing of central cues. Children with AD/HD may indeed demonstrate deficits in nonverbal cue perception when the task presents higher demands, such as time limitations or ongoing interaction in, rather than mere observation of, social situations. Further, Ackerman (1987) has suggested that attention to context can increase recall due to interactive conceptual processing. In the case of children with AD/HD, attention to context may actually be an adaptive mechanism that compensates for deficits in the ability to perceive facial, body, and voice cues.

Consistent with Ceci and Tishman's (1984) research on incidental learning, children in this sample often identified aspects of the situation that were not relevant to the cue being described. For example, when describing the feeling of being interested, one child mentioned the body cues of the character having her head down and playing with her fingers. Although these body cues are present in the scene, they are related to a later emotion: being polite and wanting another character to leave. Another example occurred when a child described the boy as feeling upset and then mentioned that the voice cue sounded like the boy was asking a question. Although the questioning voice did occur in the scene, it was related to a previously displayed emotion of being expectant and eager, rather than the emotion of being annoyed. Personal communication with one of the CASP authors (Koning) indicated that the identification of non-central cues was

not a common occurrence in normative samples. Children in this sample were most likely to identify extraneous body and context information. Because deficits in nonverbal cue perception were not noted in this sample, it appears that attention to this extraneous information was not at the expense of attention to relevant information. Children who identified more relevant voice cues were more likely to identify bodily cues, both extraneous and central. It may be the case that children who attend to voice cues are also more likely to attend to body information displayed, regardless of the relevance of that information.

Limitations

There are a number of limitations to this study that bear consideration. First, the sample size was relatively small. Interrater reliability for CASP assessments was less than excellent. However, difficulties with interrater reliability may have resulted from the poor quality of the audiotapes rather than differences between raters, as both raters noted significant difficulties hearing the child's responses on the audiotapes. There are also some limitations related to the design of the study. Measures used to reflect social competence and AD/HD severity were based solely on parent ratings. Several studies (e.g., Mandal, Olmi, & Wilczynski, 1999) have found that parent and teacher ratings show only moderate correspondence. It may be that some difficulties in social competence and symptoms of AD/HD may only be noticeable in classroom situations. Furthermore, there was no attempt to confirm a diagnosis of AD/HD, nor did it investigate different subtypes of the disorder. The present study did not screen for comorbid psychiatric disorders. Some children with other psychiatric disorders, such as

Conduct Disorder, have been shown to have deficits in social information-processing (Crick & Dodge, 1994). Further, the analysis was based on normative data, rather than comparing performance with a control group. As such, it was impossible to determine if there may have been any systematic bias in administering and scoring the CASP for this sample as compared to the normative sample. The design also precluded an examination of the effects of age and gender.

Strengths

Although a number of limitations were noted, this study also demonstrated a number of strengths. The sample size for this study (n=41) was sufficient for the types of analyses utilized. The measures used to represent levels of social competence and AD/HD symptoms (i.e., SSRS and CPRS:L-R) were well-normed, comprehensive, and had good-to-excellent reliability and validity. Further, it was demonstrated that the children in this sample had a significant degree of problems with inattention and hyperactivity, as measured by the Conners Parent Rating Scales. As such, the sample is likely representative of children diagnosed with AD/HD.

The CASP, which was used to determine nonverbal cue perception abilities, was closely related to "live" emotional processing tasks. Fabes, Eisenberg, Nyman, & Michealieu (1991) criticized laboratory studies of emotion perception on the basis that available cues regarding others' emotional states outside the laboratory are likely to be greater in quantity and variety. Scenarios in the CASP showed multiple emotions for each character, and different types of cues (i.e., facial, body, voice, and context) were portrayed simultaneously for each emotion. There was also an extremely wide range of

emotions depicted in the scenes, which went beyond the more basic emotions of happy, sad, angry (e.g., excited, amused, neutral, disappointed, concerned, annoyed, etc.). Children had to generate their own responses rather than choose from a list, which again closely resembled real world requirements for emotion perception. In addition, the CASP included contextual cues, which appear to be an important and often neglected component of social perception (Magill-Evans et al., 1996). Interrater reliability for the CASP was good. Further, the CASP was demonstrated to have no relationship to expressive language abilities (Magill-Evans et al., 1996), so verbal abilities should not have affected scores on the CASP.

Implications

Perhaps the most important implication of this study pertains to social skills training for children with AD/HD. A recent meta-analysis of social skills interventions for children with emotional and behavioral disorders showed that effect sizes for social skills interventions, although significant, were quite low (ES=0.199), indicating that much needs to be done to improve social skills training (Magee Quinn, Kavale, Methhius, Rutherford, & Forness, 1999). The results of the current study did not support the notion that children's abilities to perceive nonverbal cues and to infer emotions based on those cues were impaired. Instead, support was found for an effect of problem behaviors on social skills. Taken together, these results point to a performance, rather than a knowledge, deficit. As such, it may be more important to focus on problematic behavior than on emotion understanding when trying to improve social skills of children with AD/HD.

Other implications of this study relate to the assessment of social skills in children with AD/HD symptoms. First, because AD/HD symptom severity was not a significant predictor of social competence, children with AD/HD should not be assumed to have social competence deficits. There may be a subgroup of children who experience such difficulties to a greater extent. For example, Melnick and Hinshaw (1996) found aggression to play an important role in social skills. They found that high-aggressive children with AD/HD were more likely than non-aggressive children with AD/HD to report that they weren't afraid of getting in trouble and less likely to choose a goal of cooperation. Secondly, children's knowledge about emotions may not be impaired, and it is therefore important that later stages in information-processing be investigated. Assessment must go beyond a child's knowledge of emotions and appropriate responses, since they may correctly identify emotions and know appropriate responses but have difficulties using that information to guide behavior. Assessment should extend to performance, possibly by observing the child's actual behaviors in social situations. Ultimately, it is the behavior of the child that will have consequences for the child's success in social situations.

Children with symptoms of AD/HD appeared to have different strengths and weaknesses relative to the type of cue being perceived (i.e. facial, voice, body, and context). In terms of the CASP, it would be beneficial to investigate the viability (e.g., reliability, internal consistency) of subscale scores based on each type of cue. If subscale scores are found to be valid and reliable, normative data on each type of cue would also be useful. Although the large range of emotions in the CASP precludes an examination of

exactly which types of emotions a child has difficulty identifying, it may be useful to create subscales based on classifying the emotions as positive, neutral, or negative valence. The addition of subscales for type of cue and type of emotion could provide useful clinical and intervention information.

Future Directions

Based on the results of this study, it appears that children with AD/HD may not be impaired in their ability to perceive nonverbal cues. However, future research should address the limitations in the current study. For example, to examine the effects of age and sex as well as to rectify the problem of restricted range, a larger sample including broader range of AD/HD symptoms could be used. Furthermore, it may prove useful to include a group of normal controls for comparison. Children's abilities with respect to the different types of cues could reveal difficulties and strengths that are different from a normal population. Specifically, future research should investigate the role of contextual cues in compensating for deficits in perceiving other types of cues.

The results of this study also suggest that deficits in social information-processing among children with AD/HD may occur at later stages of processing rather than at the encoding or interpretation stages. Research designed to clarify the stage of social information-processing at which children with AD/HD are deficient would be particularly helpful. The results of this study also suggest an important role of problem behaviors in children's social competence. Therefore, future research could also examine the role of problem behaviors in social information-processing. This line of inquiry would have important implications for structuring social skills interventions for children with

AD/HD. For example, if children with AD/HD are impaired at the response selection stage due to impulsive responding (i.e., choosing the first behavior that comes to mind), social skills training could focus on teaching the child to stop and think before acting.

Summary and Conclusions

In the context of Crick and Dodge's (1994) social information-processing model, this study examined nonverbal cue perception abilities as one factor contributing to the deficits in social competence exhibited by children with AD/HD. Children with symptoms of AD/HD do not appear to be impaired in their nonverbal cue perception abilities, when all types of cues are presented simultaneously and considered as one composite score. However, these children may compensate for deficits in the perception of voice and body cues by increased use of contextual cues. In addition, social competence in this group of children does not appear to be related to nonverbal cue perception abilities, but instead may be compromised by deficits at different stages in social information-processing. In addition, problem behaviors appear to be one factor interfering with the production of socially skilled behavior. The results of this study may have implications for treatment and assessment of children with AD/HD, but more research is needed to establish whether these children have difficulties with specific types of cues and emotions and to determine the stage(s) of social information-processing at which they are deficient.

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Table 1

Number of Participants by Learning Disability Status and Gender.

	Learning Disability	
Gender	Yes	No
Male	19	12
Female	5	5

Table 2

Number of Participants by Medication and Gender.

	Medication for AD/HD	
Gender	Yes	No
Male	22	9
Female	4	6

Table 3

Number of Participants by Medication Status at Testing and Gender.

	Medication at Testing	
Gender	Yes	No
Male	10	21
Female	0	10

Table 4

Number of Participants by Gender and Subtypes Using 3 Different Methods.

Diagnosis & Subtype	Method 1			Method 2			Method 3		
	M	F	Total	M	F	Total	M	F	Total
PI	4	3	7	5	7	12	4	6	10
PHI	5	0	5	5	0	5	4	0	4
Combined	4	1	5	15	1	16	14	1	15
No Diagnosis	18	6	24	6	2	8	9	3	12

Note. M= Male; F=Female; PI = Primarily Inattentive; PHI = Primarily Hyperactive/Impulsive

Table 5

Cronbach's Alpha for Major Scales of Three Measures

Measure	Scale	This Sample	Normative Sample
Conners	DSM-IV Inattentive	0.86	0.93
	DSM-IV Hyperactive/Impulsive	0.86	0.89
	DSM-IV Total Symptoms	0.89	0.94
SSRS	Social Skills	0.89	0.87
	Problem Behaviors	0.84	0.87
CASP	Total Emotion Score	0.79	0.88
	Total Nonverbal Cues Score	0.85	0.91

Table 6

Intercorrelations between Scales on the Conners Parent Rating System: Long Form - Revised for This Sample and the Normative Sample

Scale	1		2		3		4		5	
1. Oppositional	-									
2. Cog Probs	0.29	(0.52)	-							
3. Hyperactivity	0.75**	(0.56)	0.25	(0.50)	-					
4. Anxious/Shy	0.39*	(0.38)	0.20	(0.30)	0.33*	(0.38)	-			
5. Perfectionism	0.53**	(0.14)	0.13	(-0.02)	0.33*	(0.15)	0.53**	(0.25)	-	
6. Social Problems	0.63**	(0.46)	0.33*	(0.45)	0.49**	(0.37)	0.49**	(0.39)	0.38*	(0.15)
7. Psychosomatic	0.14	(0.40)	0.42**	(0.38)	0.19	(0.27)	0.14	(0.32)	0.01	(0.14)
8. ADHD Index	0.47**	(0.63)	0.66**	(0.87)	0.66**	(0.72)	0.35*	(0.40)	0.14	(0.05)
9. CGI – RI	0.68**	(0.66)	0.34*	(0.66)	0.87**	(0.86)	0.33*	(0.41)	0.33*	(0.14)
10. CGI – Emot	0.72**	(0.72)	0.19	(0.43)	0.53**	(0.58)	0.58**	(0.51)	0.36*	(0.20)
11. CGI – Prob	0.78**	(0.74)	0.32*	(0.64)	0.83**	(0.84)	0.47**	(0.49)	0.38*	(0.17)
12. DSM - Inatt	0.40**		(0.60)	0.88**	(0.92)	0.47**	(0.63)	0.28	(0.35)	0.15
13. DSM - HI	0.71**	(0.58)	0.18	(0.55)	0.96**	(0.93)	0.37*	(0.36)	0.30	(0.15)
14. DSM - Total	0.67**	(0.65)	0.61**	(0.82)	0.86**	(0.84)	0.38*	(0.39)	0.27	(0.08)

Note. Cog Probs = Cognitive Problems/Inattention; CGI = Conners Global Index; RI = Restless/Impulsive; Emot = Emotional Lability; Prob = Problematic Behavior; Inatt = Inattentive; HI = Hyperactive/Impulsive. Numbers in brackets represent correlations in the normative sample.

Table 6 (continued)

Scale	6		7		8		9		10	
6. Social Problems	-									
7. Psychosomatic	0.20	(0.33)	-							
8. ADHD Index	0.40**	(0.47)	0.34*	(0.39)	-					
9. CGI – RI	0.53**	(0.45)	0.20	(0.34)	0.78**	(0.86)	-			
10. CGI – Emot	0.54**	(0.39)	0.22	(0.41)	0.50**	(0.58)	0.55**	(0.62)	-	
11. CGI – Prob	0.60**	(0.47)	0.23	(0.40)	0.76**	(0.84)	0.93**	(0.96)	0.81**	(0.82)
12. DSM – Inatt.	0.43**	(0.46)	0.46**	(0.38)	0.86**	(0.93)	0.61**	(0.76)	0.35*	(0.52)
13. DSM - HI.	0.45**	(0.39)	0.19	(0.28)	0.64**	(0.74)	0.82**	(0.81)	0.50**	(0.58)
14. DSM – Total	0.52**	(0.47)	0.37*	(0.37)	0.89**	(0.93)	0.85**	(0.86)	0.50**	(0.60)

Note. CGI = Conners Global Index; RI = Restless/Impulsive; Emot = Emotional Lability; Prob = Problematic Behavior; Inatt = Inattentive; HI = Hyperactive/Impulsive. Numbers in brackets represent correlations in the normative sample.

*p<0.05. **p<0.01

Table 6 (continued)

Scale	11		12		13	
11. CGI – Problematic Behavior	-					
12. DSM - Inattentive	0.58**	(0.74)	-			
13. DSM - Hyperactive/Impuls.	0.79**	(0.80)	0.43**	(0.65)	-	
14. DSM – Total	0.81**	(0.85)	0.83**	(0.93)	0.86**	(0.89)

Note. CGI = Conners Global Index; RI = Restless/Impulsive; Emot = Emotional Lability; Prob = Problematic Behavior; Inatt = Inattentive; HI = Hyperactive/Impulsive. Numbers in brackets represent correlations in the normative sample.

*p<0.05. **p<0.01

Table 7

Intercorrelations between Scales on the Social Skills Rating System for This Sample and the Normative Sample

Scale	1		2		3		4	
1. Cooperation	-							
2. Assertion	0.40**	(0.33)	-					
3. Responsibility	0.42**	(0.41)	0.67**	(0.51)	-			
4. Self-Control	0.44**	(0.50)	0.50**	(0.38)	0.64**	(0.48)	-	
5. Externalizing	-0.18	(-0.34)	-0.36*	(-0.15)	-0.41**	(-0.20)	-0.73**	-0.57
6. Internalizing	-0.05	(-0.24)	-0.30	(-0.40)	-0.31*	(-0.20)	-0.40*	-0.34
7. Hyperactivity	-0.19	(-0.35)	-0.17	(-0.21)	-0.24	(-0.27)	-0.41**	-0.47
8. Social Skills	0.70**	(0.75)	0.80**	(0.71)	0.82**	(0.78)	0.84**	0.79
9. Problem Behaviors	-0.18	(-0.37)	-0.37*	(-0.30)	-0.43**	(-0.27)	-0.69**	-0.55

*p<0.05. **p<0.01

Table 7 (continued)

Scale	5		6		7		8	
5. Externalizing	-							
6. Internalizing	0.42**	(0.43)	-					
7. Hyperactivity	0.44**	(0.63)	0.34*	(0.57)	-			
8. Social Skills	-0.56**	(-0.42)	-0.34*	(-0.39)	-0.33*	(-0.44)	-	
9. Problem Behaviors	0.84**	(0.81)	0.77**	(0.80)	0.70**	(0.88)	-0.55**	(-0.50)

*p<0.05. **p<0.01

Table 8

Mean Scores for DSM Symptom Severity Standardized by Age and Sex

Scale	Mean	Standard Deviation
Total	2.76	1.14
Inattentive	2.32	1.19
Hyperactive/Impulsive	2.84	1.20

Table 9

Intercorrelations between Major Constructs of Interest

Scale	1	2	3	4	5	6	7
1. Age	-						
2. Conners DSM Inattentive	0.17	-					
3. Conners DSM Hyperactive/ Impulsive	-0.40	0.43**	-				
4. Conners DSM Total	-0.15	0.83**	0.86**	-			
5. SSRS Social Skills	0.10	-0.42**	-0.43**	-0.50**	-		
6. SSRS Problem Behaviors	-0.31	0.28	0.45**	0.44**	-0.55**	-	
7. CASP – Emotions	0.75*	0.21	-0.21	-0.01	0.07	-0.18	-
8. CASP – Nonverbal Cues	0.70**	0.13	-0.23	-0.07	0.07	-0.18	0.85**

*$p<0.05$. **$p<0.01$

Table 10

Correlations between Scales Related to Inattention

Scale	1	2	3
1. Conners - DSM Inattentive	-		
2. Conners - DSM Total	0.83**	-	
3. Conners - AD/HD Index	0.86**	0.88**	-
4. SSRS - Internalizing	0.28	0.26	0.21

**$p<0.01$

Table 11

Correlations between Scales Related to Hyperactivity

Conners Scales	1	2	3	4	5	6
1. Conners – CGI Restless/Impulsive	-					
2. Conners – Hyperactivity	0.87**	-				
3. Conners – DSM Hyperactive/Impulsive	0.82**	0.96**	-			
4. Conners - DSM Total	0.85**	0.86**	0.86**	-		
5. Conners - AD/HD Index	0.78**	0.66**	0.64**	0.88**	-	
6. SSRS - Externalizing	0.28	0.34*	0.28	0.20	0.08	-
7. SSRS - Hyperactivity	0.63**	0.67**	0.71**	0.67**	0.52**	0.44**

Note. CGI = Conners Global Index

*p<0.05. **p<0.01

Table 12

Correlations between Scales Related to Internalizing Problems

Scale	1	2	3
1. Conners – Anxious/Shy			
2. Conners - Perfectionism	0.53**		
3. Conners - Emotional Lability	0.58**	0.36*	
4. SSRS - Internalizing	0.48**	0.28	0.45**

*p<0.05. **p<0.01

Table 13

Correlations between Scales Related to Externalizing Problems

Scale	1	2	3
1. Conners – Oppositional			
2. Conners - Problematic Behavior	0.78**		
3. SSRS - Externalizing	0.61**	0.42**	
4. SSRS - Problem Behaviors	0.64**	0.55**	0.84**

**p<0.01

Table 14

Correlations between Scales Related to Social Skills and Problematic Behaviors

Scale	1	2	3
1. Conners – Social Problems	-		
2. Conners - Problematic Behavior	0.60**	-	
3. SSRS - Social Skills	-0.65**	-0.51**	-
4. SSRS - Problem Behaviors	0.44**	0.55**	-0.55**

**p<0.01

Table 15

Interrater Reliability of CASP Scales Using Cronbach's Alpha

Scene	Emotion Score	Nonverbal Cues Score
1	0.62	0.97
2	0.90	0.99
3	0.82	0.99
4	0.73	0.85
5	0.94	0.94
6	0.61	0.91
7	0.91	0.86
8	0.79	0.97
9	0.93	0.68
10	0.97	0.95

Table 16

Skewness and Kurtosis of Regression Variables

Variable	Skewness	Kurtosis
DSM Total Symptoms z-score	0.00	-0.61
Social Skills z-score	-0.24	0.39
Nonverbal Cues z-score	0.15	0.03

Table 17

Regression Model Summary Predicting Social Skills Z-score

Model	Variable	B	SE B	β	Model R	Model R^2	R^2 Change	F Change	Sig. F
1[a]	Meds	-0.312	0.439	-0.118	0.128	0.017	0.017	0.302	0.741
	LD	-0.086	0.373	-0.039					
2[b]	Meds	-0.351	0.426	-0.118	0.315	0.100	0.083	3.226	0.081
	LD	-0.014	0.364	-0.133					
	ADHD	-0.312	0.174	-0.290					

Note. SE = Standard Error; Meds = Medication Status at Testing; LD = Learning Disability Status; ADHD = Standardized ADHD Symptom Severity.

[a] Model 1 $F(2,36) = 0.302$, $p = 0.741$.

[b] Model 2 $F(3,35) = 1.289$, $p = 0.293$.

Table 18

Regression Model Summary Predicting Nonverbal Cues Z-score

Model	Variable	B	SE B	β	Model R	Model R^2	R^2 Change	F Change	Sig. F
1[a]	Meds	0.107	0.384	0.045	0.249	0.062	0.062	0.185	0.317
	LD	-0.501	0.326	-0.250					
2[b]	Meds	0.107	0.390	0.045	0.249	0.062	0.000	0.000	0.996
	LD	-0.500	0.333	-0.249					
	ADHD	0.001	0.159	-0.001					

Note. Meds = Medication Status at Testing; LD = Learning Disability Status; ADHD = Standardized ADHD Symptom Severity.

[a] Model 1 $F(2,36) = 1.185$, $p = 0.317$.

[b] Model 2 $F(3,35) = 0.768$, $p = 0.519$.

Table 19

Skewness and Kurtosis of Regression Variables in Exploratory Analysis

Variable	Skewness	Kurtosis
DSM Inattentive Symptoms z-score	0.44	-0.04
DSM Inattentive Symptoms z-score	-0.20	-0.31
Social Skills z-scores	-0.24	0.39

Table 20

Regression Model Summary Predicting Social Skills Z-scores with Standardized Inattentive and Hyperactive/Impulsive Z-scores.

Model	Variable	B	SE B	β	Model R	Model R^2	R^2 Change	F Change	Sig. F
1[a]	Meds	0.107	0.384	0.045	0.249	0.062	0.062	1.185	0.317
	LD	-0.501	0.326	-0.250					
2[b]	Meds	0.049	0.401	0.123	0.273	0.075	0.075	0.234	0.792
	LD	-0.489	0.335	-0.244					
	Inattentive	-0.091	0.165	-0.104					
	Hyperactive	0.103	0.170	0.112					

Note. Meds = Medication Status at Testing; LD = Learning Disability Status; Inattentive = Inattentive Symptom Severity; Hyperactive = Hyperactive/Impulsive Symptom Severity.

[a] Model 1 $F(2,36) = 1.185$, $p = 0.317$.

[b] Model 2 $F(3,35) = 0.768$, $p = 0.519$.

Table 21

Correlations between Constructs for Exploratory Analysis 3

Scale	1	2
1. Conners AD/HD Symptom Severity z-score	-	
2. SSRS Problem Behavior z-score	0.31*	-
3. Medication Status	-0.11	0.34**

*$p<0.05$. **$p<0.01$

Table 22

Regression Model Summary Social Skills Z-scores with Problem Behavior Z-Score.

Variable	B	SE B	β	T	Sig. T	Model R	Model R^2	Model F	Sig. F
ADHD	-0.128	0.156	-0.119	-0.819	0.418	0.589	0.346	6.186	0.002
Prob Bhv	-0.669	0.184	-0.595	-3.637	0.001				
Meds	0.400	0.416	0.152	0.962	0.343				

Note. ADHD = Standardized ADHD Symptom Severity; Prob Behavior = Standardized Problem Behaviors z-score; Meds = Medication Status at Testing.

Table 23

Means and Percentages of Relevant Cues Identified

Type of Cue	Total Possible Cues	Cues Identified		Percentage Cues Identified	
		M	SD	M	SD
Context	20	10.07	3.16	50.3	15.3
Facial	43	14.29	6.86	33.2	16.0
Voice	27	5.07	2.83	18.8	10.5
Body	45	6.63	4.73	14.7	10.5

Table 24

Mean Number of Extraneous Cues Identified for 41 Children in 10 Scenarios

Type of Cue	Mean	Standard Deviation
Context	0.39	0.74
Facial	0.24	0.58
Voice	0.29	0.46
Body	0.49	0.71

Table 25

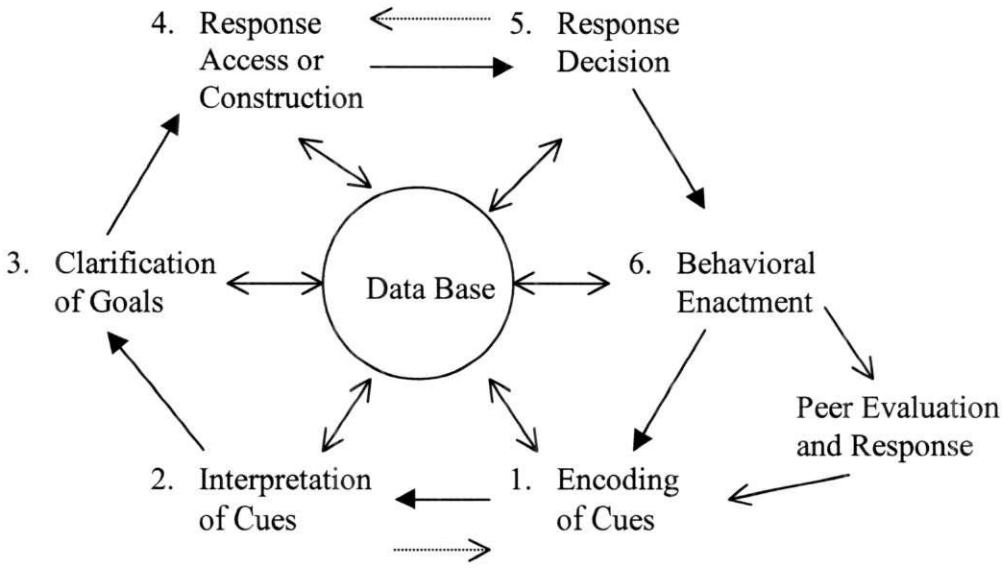
Correlations between Relevant Cues and Extraneous Cues

	1	2	3	4	5	6	7
1. Extraneous Face	-						
2. Extraneous Body	-0.17	-					
3. Extraneous Voice	-0.18	-0.07	-				
4. Extraneous Context	0.12	0.01	0.17	-			
5. Relevant Face	0.23	0.10	-0.22	0.05	-		
6. Relevant Body	0.08	0.11	-0.19	0.01	0.30	-	
7. Relevant Voice	0.16	0.39*	-0.17	0.19	0.31	0.56**	-
8. Relevant Context	0.00	0.01	-0.10	0.26	0.38*	0.32*	0.41**

*$p<0.05$. **$p<0.01$

Figure Caption

Figure 1. Crick & Dodge's (1994) Reformulated Social Information-Processing Model



Appendix A

DSM-IV Criterion A for AD/HD

Either (1) or (2):

(1) Six (or more) of the following symptoms of inattention have persisted for at least 6 months to a degree that is maladaptive and inconsistent with developmental level:

Inattention

(a) often fails to give close attention to details or makes careless mistakes in schoolwork, work, or other activities
(b) often has difficulty sustaining attention in tasks or play activities
(c) often does not seem to listen when spoken to directly
(d) often does not follow through on instructions and fails to finish schoolwork, chores, or duties in the workplace (not due to oppositional behavior or failure to understand instructions)
(e) often has difficulty organizing tasks and activities
(f) often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (such as schoolwork or homework)
(g) often loses things necessary for tasks or activities (e.g., toys, school assignments, pencils, books, or tools)
(h) is often easily distracted by extraneous stimuli
(i) is often forgetful in daily activities

(2) Six (or more) of the following symptoms of hyperactivity-impulsivity has persisted for at least 6 months to a degree that is maladaptive and inconsistent with development level:

Hyperactivity

(a) often fidgets with hands or feet or squirms in seat
(b) often leaves seat in classroom or in other situations in which remaining seated is expected.
(c) often runs about or climbs excessively in situations in which it is inappropriate (in adolescents or adults, may be limited to subjective feelings of restlessness)
(d) often has difficulty playing or engaging in leisure activities quietly
(e) is often "on the go" or often acts as if "driven by a motor"
(f) often talks excessively

Impulsivity

(g) often blurts out answers before questions have been completed
(h) often has difficulty awaiting turn
(i) often interrupts or intrudes on others (e.g., butts into conversations or games)

Appendix B

Telephone Script for Recruiting from the Behavioral Research Unit Database

My name is _____, and I'm calling from the U of C about research on children with symptoms of AD/HD. We're doing two new studies on strengths and weaknesses in social skills in children with AD/HD. Would now be a good time to talk?

We're looking for families with children aged 6 – 14 who have symptoms of AD/HD (like inattention, impulsivity, and hyperactivity). Do you have a child in this age range? No – I'm sorry to have bothered you! Yes – Great! How old are they?

My study looks at AD/HD and a different aspect of social skills. Participation involves a face-to-face meeting, where I will give you 2 questionnaires to complete. While you are completing the questionnaires, I will show (your child) a video of some kids in social situations and ask (him/her) some questions. It takes about 45 minutes, and can be done at the university, ACH, or if you prefer, I can arrange home visit.

Do you have any questions? Would you like to participate? Okay, well, I need to get some information from you and then arrange a time to meet.

Appendix C

List of Agencies Used to Recruit Participants

1. Alberta Children's Hospital - Calgary, Alberta
2. Boys and Girls Club Community Services - Calgary, Alberta
3. Calgary SCOPE Society - Calgary, Alberta
4. Children and Adults with Attention Deficit Disorders (CHADD) - Calgary, Alberta
5. Children's Link Society - Calgary, Alberta
6. Foothill's Academy - Calgary, Alberta
7. Gordon Townsend Elementary School – Innisfail, Alberta
8. Inter-faith Youth & Family Service Society - Calgary, Alberta
9. Kaleidescope Pediatric Consultants - Calgary, Alberta
10. Peter Lougheed Centre - Calgary, Alberta
11. Providence Children's Services - Calgary, Alberta
12. Provincial Mental Health Board - Calgary, Alberta

Appendix D

Poster Used to Recruit Participants from Agencies

Research on Attention Deficit Hyperactivity Disorder

Parents and children wanted!

To participate in a study on

social skills in children with ADHD

Research suggests that many, but not all, children with ADHD have a variety of social difficulties, such as

- trouble making or keeping friends
- conflict resolution problems
- difficulty cooperating with peers

Our study looks at social skills in children with ADHD, as well as their ability to understand nonverbal cues like gestures, facial expressions, and tone of voice.

We are looking for parents and children (1 parent and 1 child from each family) to participate. Children must be aged 6 to 12 years and have *symptoms* of ADHD.

Time Commitment:
Approximately 1 hour in your home or at the University of Calgary.

Activities involved:
Parents: Answering some questions about your child's ADHD symptoms and social skills.
Children: Watching a videotape and answering some questions about that videotape.

If you would like to hear more about the study, please call Chrystal Mansley at 220-4964.

Thank You!

Chrystal Mansley
Department of Psychology, University of Calgary

Bonnie Kaplan, Ph.D.
Department of Pediatrics, University of Calgary

Appendix E

Classified Advertisement Used to Recruit Participants

Parents and children wanted to participate in a study of ADHD. Children should be 6-12 and show attention, hyperactivity, or impulsivity problems. Contact Chrystal at cmansley@ucalgary.ca or 220-4964.

Appendix F

Examples of Items on the Conners Parent Rating Scales: Long Form – Revised

Example items used to assess DSM-IV inattentive symptoms

1. Does not seem to listen to what is being said to him/her
2. Has difficulties organizing tasks and activities
3. Easily distracted by extraneous stimuli

Example items used to assess DSM-IV hyperactive/impulsive symptoms

1. Is always "on the go" or acts as if driven by a motor
2. Fidgets with hands or feet or squirms in seat
3. Blurts out answers to questions before the questions have been completed

Appendix G

Examples of Items on the Social Skills Rating System

Example items from Cooperation Scale

1. Helps you with household tasks without being asked
2. Keeps room clean and neat without being reminded
3. Gives compliments to friends or other children in the family

Example items from Assertion Scale

1. Joins group activities without being told to
2. Invites others to your home
3. Starts conversations rather than waiting for others to talk first

Example items from Responsibility Scale

1. Answers the phone appropriately
2. Asks permission before using another family member's property
3. Attends to speakers at meetings such as in church or youth groups

Example items from Self-Control Scale

1. Receives criticism well
2. Controls temper when arguing with other children
3. Avoids situations that are likely to result in trouble

Appendix H

Examples of Scenarios on the Child and Adolescent Social Perception Measure

(Taken from Magill-Evans et al., 1996, p. 1-2.)

Birthday Gift

A woman and teenage girl are sitting on a sofa. The woman is pleased about giving the girl a gift. The girl is excited in anticipation of receiving the gift. On opening the gift, her expression momentarily changes to disappointment which she quickly masks with false gratitude.

Nintendo

A girl is seated playing a video game with concentration. Another girl enters, sits on the floor next to the plug of the Nintendo, watches with interest, and then accidentally bumps the plug for the game out of the electrical outlet. The girl playing the game becomes annoyed and accusing, and the other girl responds with an apologetic demeanor.

Boy and Mom

A mother is working in the kitchen. Her son enters, telling an exciting story. As the mother listens, she becomes shocked as the story unfolds. She rebukes the boy who becomes subdued.

Appendix I

Honorary Scientist Certificate Given to Child Participants