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# Social and language skills in adolescent boys with Asperger syndrome



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**ABSTRACT** Twenty-one adolescent boys with Asperger syndrome and 21 boys matched on age and an estimate of IQ were assessed using standardized measures of social perception (Child and Adolescent Social Perception Measure, CASP), social skills (parent, teacher, and student forms of the Social Skills Rating System, SSRS), number of close friends and frequency of contact (Child Behavior Checklist) and expressive and receptive language (Clinical Evaluation of Language Fundamentals-Revised). There were significant differences between groups on CASP scores, SSRS scores, number of friends, frequency of contact and social competence. There was also a significant difference on receptive language. The clinically and statistically significant differences between the groups on the measures of social skills help us understand the nature of the social deficits in Asperger syndrome and suggest the need to focus on specific deficits. These findings are discussed in relation to diagnostic criteria and intervention.

## KEYWORDS

Asperger  
syndrome;  
language  
skills; social  
skills

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## Introduction

The social interaction deficits of individuals with Asperger syndrome are well recognized (American Psychiatric Association, 1994; Gillberg and Gillberg, 1989; Szatmari et al., 1989; World Health Organization, 1990). They include socially and emotionally inappropriate behaviors, lack of appreciation of social cues, inability to interact with peers or to develop peer relationships, and an impairment in the ability to use non-verbal behaviors to regulate social interaction. Children with Asperger syndrome have also been described as having difficulty comprehending others' facial expressions and understanding the rules governing social interaction (Wing, 1981), sensing the feelings of others (Szatmari et al., 1989), and making adjustments to fit different social contexts or the needs of different listeners

(Tantam, 1988). They lack socio-emotional reciprocity and show marked impairments in non-verbal communication such as tone of voice, facial expression, gesture, gaze and posture (Kerbeshian et al., 1990; Tantam, 1988) as well as speech and language abnormalities (Gillberg and Gillberg, 1989; Kerbeshian et al., 1990, p. 724).

Despite the prominence of social impairments in Asperger syndrome, few studies have used standardized, reliable and valid measures to measure non-verbal social skills. A pilot study by Scott (1985) using a non-standardized measure found that participants with Asperger syndrome did less well than controls on tasks of facial recognition and vocal production and recognition. Davies and colleagues (1994) found that children with Asperger syndrome scored significantly worse than controls in their ability to identify emotion from facial expressions. Ellis et al. (1994) examined the ability to make hypothetical social judgments. Although scoring was somewhat arbitrary, the seven individuals with Asperger syndrome made a higher proportion of errors than 36 adolescents and young adults. Szatmari et al. (1995) also found that children with Asperger syndrome scored well below age norms on the Vineland Adaptive Behavior Scale.

Fein and colleagues (1992) suggest that social cognitive tasks that require the child with pervasive developmental disorders to understand the context in which a given emotion is appropriate would more accurately reflect their 'real-life functional deficits'. Thus, the measures used in studying social skills in Asperger syndrome need to include a contextual component. Another issue in assessing this population is the selection of an appropriate comparison group. Fein and colleagues suggest that the control group should be matched on verbal tasks, as matching on non-verbal tasks serves to overestimate the overall IQ of individuals with PDD, thereby increasing the likelihood of finding differences. However, the study of Klin et al. (1995) of 21 older children and adolescents with Asperger syndrome (mean age = 16.1 years, SD = 8.3) reported that the group's verbal IQ was higher than the performance IQ. Matching may depend upon the nature of the task used to assess social skills.

The precise nature of language deficits in Asperger syndrome is also rather poorly defined in the literature. Although the diagnostic criteria suggest that there are no significant general delays in early language development (American Psychiatric Association, 1994; World Health Organization, 1990), many researchers report that children with Asperger syndrome present with odd speech, including the idiosyncratic use of words (Szatmari et al., 1989; Wing, 1981), poor speech prosody (Wing, 1981), and many other semantic and pragmatic language abnormalities (Bishop, 1989; Howlin, 1998; Tantam, 1991). Only Szatmari and colleagues (1995) have specifically assessed receptive and expressive language abilities in this group

of children (mean age = 68.6 months). The children's scores fell within one standard deviation below the mean in both areas on a variety of different measures. Differences between expressive and receptive language skills were not reported.

To understand more about the specific nature of deficits in Asperger syndrome, the first objective of this study was to provide a standardized measurement of the social interaction deficits of adolescent boys with Asperger syndrome by comparing them with age, gender and vocabulary IQ matched controls. We were particularly interested in measuring social perception and general social skills. The ability to make inferences from social cues such as facial expression, gesture, tone of voice and situational references seems to be a critical deficit in this population. It is also important to know if individuals with Asperger syndrome rely more strongly on cues from one particular domain such as facial expression or tone of voice. Measurement of general social skills was completed using a multi-rater approach to include the perspectives of the parent, the teacher and the adolescents themselves. This allowed us to determine the adolescents' awareness of their social deficits. The second objective of the study was to provide data on the expressive and receptive language abilities of adolescent boys with Asperger syndrome and to discuss the relationship of language abilities to social interaction skills.

## Method

### Clinical and community participants

Twenty-one boys aged 12–15 years who met DSM-IV criteria for Asperger syndrome comprised the Asperger group. Participants were drawn from a larger sample ( $N = 31$ ) recruited for a validation study of the Child and Adolescent Social Perception measure (CASP; Koning and Magill-Evans, 2001). Girls were excluded because we did not want to confound results with gender issues and because the diagnosis of Asperger syndrome is much more common in boys than girls (Ehlers and Gillberg, 1993).

Over a 3 year period, psychiatrists referred all the English-speaking adolescent boys (ages 12 to 15 years) in their practice who met the DSM-IV criteria for Asperger's disorder. Boys with a history of delay in development of spoken language were excluded. Boys with a comorbid diagnosis of attention deficit disorder were excluded. Two boys with a comorbid diagnosis of Tourette's disorder were included as Asperger syndrome appeared to be the primary cause of their social deficits and the co-occurrence of Tourette and Asperger syndromes is well documented (e.g. Kerbeshian and Burd, 1986; Marriage et al., 1993).

To verify the diagnosis, psychiatrists completed the 27-item Asperger's Syndrome Screening Questionnaire (ASSQ; Ehlers and Gillberg, 1993) for each participant. The best cut-off score for identification of Asperger syndrome is 13 when parents complete the questionnaire and 22 when teachers complete it (Ehlers as cited in Gillberg et al., 1996). ASSQ scores for participants in this study ranged from 31 to 51 out of a possible 54 ( $\bar{x}$  = 37.1, SD = 5.1). All participants scored at least 10 out of a possible 16 points on the ASSQ items considered most specific to Asperger syndrome (median = 14).

Twenty-one boys who matched the clinical participants on age were recruited from local schools. Teachers were asked to refer students who spoke English as a first language and did not have social skill or peer relationship difficulties but were average and not particularly socially skilled students. The vocabulary subtest of the Wechsler Intelligence Scale for Children-Third Edition (WISC-III; Wechsler, 1991) was used to ensure that boys in both groups had similar vocabulary IQ scores. The vocabulary subtest correlates strongly with full scale IQ ( $r = .79-.85$ ) and with verbal IQ ( $r = .88-.89$ ) for children ages 12 to 15 years old in the normative sample (which includes children with special needs). Matching on the vocabulary subtest was important as the CASP requires verbal responses. The Asperger and comparison groups did not differ in terms of age (AS mean 14.04 years, SD 1.19; control mean 13.82 years, SD 0.67) or WISC-III vocabulary standard scores (AS mean 10.24, SD 3.29; control mean 10.76, SD 2.41). Socio-economic status, as measured by the Socioeconomic Index for Occupations in Canada (Blishen et al., 1987) was also similar (AS mean 40.20, SD 19.40; control mean 41.98, SD 16.52).

## Measures

The Child and Adolescent Social Perception measure (CASP; Magill-Evans et al., 1995) is a standardized, individually administered test designed to assess social perception in children ages 6 to 15 years. The 10 short unrelated videotaped scenes depict children and adolescents in typical social interactions. The scenes are audio filtered (making words unintelligible but retaining vocal tone and prosodic features) so that meaning must be derived from non-verbal and situational cues. After each scene the child describes what happened, how each character was feeling (emotion recognition and labeling), and how they knew the character was feeling that way (cues used to infer the emotion). Answers are checked against a scoring key and two scores calculated: the emotion score (ES: ability to identify the emotions), and the non-verbal cues score (NCS: ability to identify the cues available to infer emotions). The NCS is the sum of facial (expression), body (gestures, body movements), situational (things such as a birthday gift that

may contribute to understanding how the person felt) and voice cues (tone, how something was said). There are significant effects of age with older children scoring higher than younger children and differences between diagnostic groups (Magill-Evans et al., 1995; 1996). Internal consistency coefficients, test-retest reliability and inter-rater reliability are all above .80.

The Social Skills Rating System (SSRS: Gresham and Elliot, 1990) is a questionnaire designed to evaluate skills such as empathy, self-control, cooperation and assertiveness. The parent, teacher and student rate specific skills on a scale of 0 to 2 with higher scores indicating greater competence. This multi-rater approach provides several perspectives on the student's general social skills. Internal consistency coefficients are high and test-retest reliability scores are acceptable (correlations for total scores: .85 for the teacher form, .87 for the parent form and .67 for the self-report form). The SSRS was used by Ozonoff and Miller (1995) to assess the social skills of individuals with autism.

The Social Competence Scale (SCS) of the Child Behavior Checklist (CBCL: Achenbach, 1991) is part of the parent form. Of relevance to this study are the questions about the number of friends and frequency of contact as well as behavior with others.

The Clinical Evaluation of Language Fundamentals-Revised (CELF-R: Semel et al., 1987) is a standardized measure of expressive and receptive language. Receptive language subtests include oral directions, word classes and semantic relationships. Expressive language subtests include formulated sentences, recalling sentences and sentence assembly. The measure does not assess pragmatic language skills. Test-retest reliability ranged from .63 to .79 and inter-rater reliability scores ranged from .82 to .99.

## Procedures

Clinical participants were referred by psychiatrists who confirmed the DSM-IV diagnosis of Asperger's disorder through interviews with parents and participants, chart reviews, and completing the ASSQ (Ehlers and Gillberg, 1993). Participants were tested in a location convenient for them. Informed consent was obtained from the parent and the participant. The vocabulary subtest was administered as WISC-III scores were not available for many participants with Asperger syndrome or for the control group. Each participant then completed the CASP, which was administered by research assistants who had achieved inter-rater reliability of .80 or above. The self-rating form of the SSRS was completed last. A parent completed the SSRS questionnaire and the social competence scale of the CBCL. Participants identified a teacher who knew them well who then completed the teacher form of the SSRS. At a separate time, an experienced speech and language pathologist administered the CELF-R.

**Table 1** Means, standard deviations and *post hoc* tests for CASP scores

Variable	Mean (SD)		<i>t</i>	95% confidence band <sup>a</sup>	
	AS group ( <i>n</i> = 21)	Comparison group ( <i>n</i> = 21)		Lower	Upper
CASP ES <sup>b</sup>	31.52 (6.09)	51.95 (8.36)	-9.05*	-26.53	-14.32
CASP NCS <sup>c</sup>	36.19 (14.83)	64.47 (15.12)			
Body cues	8.86 (5.67)	22.57 (6.67)	-7.19*	-18.88	-8.55
Facial cues	16.67 (5.52)	19.19 (6.92)	-1.31	-7.75	2.70
Situational cues	5.24 (4.32)	11.57 (5.09)	-4.34*	-10.28	-2.39
Voice cues	5.48 (3.74)	11.38 (4.74)	-4.48*	-9.47	-2.34

<sup>a</sup> Multivariate Bonferroni confidence intervals are not significant when bands span zero.

<sup>b</sup> CASP ES, mean = 48.5, SD = 8.6.

<sup>c</sup> CASP NCS, Mean = 56.5, SD = 11.9.

\*  $p < .001$ .

For data analysis, the significance level was set at  $p < .01$  to control for multiple comparisons and multiple correlations. Multivariate analyses of variances (MANOVAs) were done where possible and .95 Bonferroni confidence intervals were examined for all *post hoc* tests.

## Results

Means and standard deviations for all CASP variables are presented in Table 1. A MANOVA for the CASP variables (emotion score, number of facial, body, situational and voice cues reported) revealed significant differences between groups ( $F(5, 36) = 22.42, p < .001$ ). *Post hoc* tests indicated that there were significant differences between groups on all scores except total facial cues. A separate *t*-test was done for the non-verbal cues score as collinearity precluded its inclusion in the MANOVA ( $t(1, 40) = -6.12, p < .001$ ). Nineteen individuals with Asperger syndrome scored more than one standard deviation below the mean on the emotion score (compared with two in the comparison group) and 15 scored more than one standard deviation below the mean on the non-verbal cues score (compared with two in the comparison group).

Participants with Asperger syndrome used facial cues more often than other cues, such as tone of voice, for inferring emotions. While it is not expected that all of the categories of cues be used equally, it is clear that the comparison group focused on facial and body cues proportionately more often than did the Asperger group.

A MANOVA between groups for the SSRS parent, teacher and student total standard scores also revealed significant differences ( $F(3, 38) = 23.83,$

**Table 2** Means, standard deviations and *post hoc* tests for SSRS scores

Variable	Mean (SD)		<i>t</i>	95% confidence band <sup>a</sup>	
	AS group ( <i>n</i> = 21)	Comparison group ( <i>n</i> = 21)		Lower	Upper
SSRS, parent:					
Total	79.33 (12.71)	102.86 (13.68)	-5.78*	-33.71	-13.34
Assertion	7.95 (3.19)	14.52 (2.40)	-7.55*	-8.33	-4.81
Cooperation	9.00 (3.61)	11.76 (3.39)	-2.56	-4.94	-0.58
Self-control	9.19 (3.74)	13.62 (3.89)	-3.76*	-6.81	-2.05
Responsibility	11.33 (3.47)	16.33 (2.33)	-5.48*	-6.84	-3.16
SSRS, teacher:					
Total	85.67 (10.59)	110.57 (12.64)	-6.92*	-33.89	-15.92
Assertion	7.52 (2.87)	12.52 (3.98)	-4.67*	-7.17	-2.83
Cooperation	12.19 (4.20)	17.24 (3.00)	-4.48*	-7.33	-2.77
Self-control	10.00 (3.08)	15.67 (4.43)	-4.81*	-8.05	-3.29
SSRS, self-rating:					
Total	95.52 (13.00)	108.91 (10.33)	-3.56*	-22.76	-3.40
Assertion	8.48 (3.52)	13.52 (2.46)	-5.39*	-6.94	-3.16
Cooperation	12.95 (2.65)	14.81 (2.68)	-2.26	-3.52	-0.20
Self-control	11.67 (3.60)	11.57 (2.73)	0.10	-1.90	2.09
Empathy	13.00 (3.81)	14.43 (2.44)	-1.45	-3.42	0.57

For total scores, standard score mean = 100, SD = 15. There are no standard scores for subtests.

<sup>a</sup> Multivariate Bonferroni confidence intervals are not significant when intervals span zero.

\**p* < .001, two-tailed.

*p* < .001). *Post hoc* tests found differences between groups for all three respondents (see Table 2). Scores for the comparison group were within 1 SD of the test mean, indicating that these were fairly typical adolescents in terms of social skills. Average group scores for the SSRS parent and teacher scores for the boys with Asperger syndrome were around one standard deviation below the mean.

Individual subtests also revealed significant differences between groups using MANOVA ( $F(11, 30) = 14.63, p < .001$ ). Groups differed on parent scores of assertion, self-control and responsibility; teacher scores of assertion, cooperation and self-control; and self-ratings of assertion. Assertion was an area of common concern for the boys with Asperger syndrome, their parents and teachers. Self-control was seen as a problem by parents and teachers only.

On average, boys with Asperger syndrome rated themselves more competent than did their teachers and parents. Self-ratings in the comparison group were slightly lower than teachers' ratings and slightly higher than



**Table 3** Means, standard deviations and *post hoc* tests for CELF-R scores

Variable	Mean (SD)		t	95% confidence band <sup>c</sup>	
	AS group (n = 21)	Comparison group (n = 20)		Lower	Upper
<i>Expressive language</i>					
Total score <sup>a</sup>	82.71 (15.70)	91.80 (10.64)	-2.16	-17.60	-0.57
Formulated sentences <sup>b</sup>	6.35 (2.85)	8.05 (2.09)			
Recalling sentences <sup>b</sup>	7.55 (2.80)	9.20 (2.46)			
Sentence assembly <sup>b</sup>	8.30 (2.75)	9.30 (2.13)			
<i>Receptive language</i>					
Total score <sup>a</sup>	94.10 (17.17)	110.85 (14.46)	-3.37*	-26.81	-6.70
Oral directions <sup>b</sup>	7.95 (3.36)	11.00 (2.51)	-3.25*	-4.95	-1.15
Word classes <sup>b</sup>	10.10 (3.50)	12.65 (2.52)	-2.60	-4.53	-0.57
Semantic relations <sup>b</sup>	9.70 (3.21)	11.30 (2.74)	-1.70	-3.51	0.31

<sup>a</sup> For total scores, standard score mean = 100, SD = 15.

<sup>b</sup> For subtests, standard score mean = 10, SD = 3.

<sup>c</sup> Multivariate Bonferroni confidence intervals are not significant when intervals span zero.

\*  $p < .01$ , two-tailed.

parents' ratings. These differences between raters were tested using a two-way ANOVA. There were significant group ( $F(1, 125) = 87.54, p < .001$ ) and rater differences ( $F(2, 125) = 8.70, p < .001$ ), with no interaction effects. Self-ratings for the Asperger group were significantly higher than parents' and teachers' reports, while self-ratings did not differ from parents' or teachers' reports for the comparison group. Correlations between raters for the group with Asperger syndrome were low and negative (parent with teacher,  $r = -.10$ ; parent with adolescent,  $r = -.01$ ; teacher with adolescent,  $r = -.08$ ). Values for the comparison group (parent with teacher,  $r = .39$ ; parent with adolescent,  $r = .39$ ; teacher with adolescent,  $r = .26$ ) appear similar to those reported by Gresham and Elliot (1990) for parent with teacher ( $r = .33$ ) and parent with adolescent ( $r = .36$ ) but different for teacher with adolescent ( $r = .41$ ). For the group with Asperger syndrome, the best subtest correlation was for self-control (parent with teacher,  $r = .22$ ; parent with adolescent,  $r = .46$ ) although adolescents and teachers did not agree ( $r = .03$ ). Teachers and adolescents had the highest correlation on the assertion subtest.

In the area of language, there were again significant group differences (MANOVA,  $F(3, 36) = 4.41, p < .01$ ). *Post hoc* tests revealed significant differences on receptive but not expressive language scores (see Table 3). Both groups had higher receptive than expressive language scores. However, seven boys with Asperger syndrome had a receptive language score more than 1 SD below the mean. Fourteen had an expressive language

**Table 4** Means, standard deviations and univariate *F*-tests for scores on CBCL social variables

Variable	Mean (SD)		<i>F</i> <sup>a</sup>
	AS group ( <i>n</i> = 20)	Comparison group ( <i>n</i> = 21)	
Number of friends	0.25 (0.55)	1.42 (0.69)	39.81*
Frequency of contact	0.55 (0.69)	1.68 (0.48)	31.12*
Social competence	0.80 (1.15)	3.11 (1.05)	43.23*

<sup>a</sup> For *F*-tests, d.f. are (1, 40).

\* *p* < .001.

score within 1 SD below the mean. On the CELF-R receptive subtests, there were significant differences between groups ( $F(3, 36) = 4.35, p = .01$ ). The only significant *post hoc* difference was on the oral directions subtest. This subtest assesses the interpretation, recall and execution of increasingly complex oral directions (Semel et al., 1987).

Given the significant difference between groups on receptive language scores, there were concerns that the differences on social skills may have been due to language skills. For the sample as a whole there were three significant but low correlations and these were between receptive language scores and the parent SSRS score ( $r = .45$ ), the self-rating SSRS score ( $r = .41$ ) and the CASP non-verbal cues score ( $r = .41$ ). However, when the MANOVAs for the CASP scores and the SSRS scores were rerun with the receptive language score as a covariate, the differences between groups were still significant. Thus, the large differences between groups on the social measures (SSRS, CASP scores) could not be simply explained by differences in receptive language. It is of interest that receptive language and non-verbal cues scores were correlated as both may measure different aspects of the same ability to receive and attend to information in the environment.

A MANOVA was completed for the number of friends, frequency of contact with friends, and social competence scores ( $F(3, 36) = 39.41, p < .001$ ). The univariate *F*-tests were significant for all three variables (Table 4). Nine adolescents with Asperger syndrome had no close friends and seven had one close friend compared with one control adolescent with no friends and one with one friend.

## Discussion

The results of this study confirm that adolescent boys with Asperger syndrome have significant deficits in social skills generally, and group

differences in social perception scores were particularly marked. Thus, while individuals with Asperger syndrome may be able to infer the affective state of others when labeling still photographs or matching contextual and facial expressions, difficulties become apparent when dealing with the *simultaneous* presentation of facial, voice, body and situational cues. Because the CASP video scenarios were intended to portray the types of situations that children and adolescents might commonly encounter, it is likely that these adolescents experience the same deficits in dealing with everyday social interactions. The relationship of social perception as measured by the CASP and social perception in real-life tasks needs to be examined in much greater detail.

Overall, adolescents with Asperger syndrome reported using fewer of the available cues to infer emotional state than did adolescents in the comparison group. Both groups made frequent use of facial cues, but the Asperger syndrome group showed far less use of other cues. Attending only to facial cues would make it very difficult to understand more complex interactions, such as those involving sarcasm. However, because the verbal content has been filtered out of the CASP, it is not clear if the Asperger group also relies strongly on verbal content. Their relative reliance on different communication channels including verbal content needs to be examined in future studies to lay the groundwork for intervention strategies.

The significant differences between groups on the CASP scores and on receptive language indicate that at least some adolescents with Asperger syndrome have impairments in their ability to receive and interpret both verbal and non-verbal language, relative to the comparison group. The significant though low correlation between the receptive language score and the non-verbal cues score of the CASP suggests that these two measures may tap a common deficit. However, the results in the area of language are difficult to interpret for a number of reasons. The comparison group scored above the normative mean for the receptive language score and below the mean for the expressive language score, although both scores were still within the average range. For those with Asperger syndrome, their mean receptive language score was within the lower end of the normal range, unlike their mean score on expressive language which was more than one standard deviation below the test mean, yet not significantly different from the scores of the comparison group. It is not clear if the pattern of group differences would be the same if different criteria were used to identify the comparison group or if different measures were used to assess language skills. Studies using other measures of language with larger samples matched on different criteria are needed to confirm these results, as there is little research using standardized language measures with this age group.

The difference between groups in terms of SSRS self-ratings suggests

that adolescent boys with Asperger syndrome are aware of some of their deficits. Wing (1992) has suggested that awareness of their social difficulties may predispose persons with Asperger syndrome to depression, and clinicians need to be sensitive to these issues. In this study, adolescents were most aware of their differences in assertiveness which included behaviors such as asking for information, responding to the actions of others, and meeting new people. Their parents and teachers also scored assertion lower than did parents and teachers of the comparison group. Intervention programs focusing on improving their ability to initiate interactions and seek assistance or information in a socially appropriate manner may therefore be needed by many individuals with Asperger syndrome.

It is also interesting that the adolescents with Asperger syndrome rated themselves significantly higher than did their teachers and parents on total scores. Thus, while they were aware of their difficulties in assertion they were less aware of difficulties in other areas, and, as a group, were still relatively positive about their general social skills. This lack of awareness may have resulted in the negative and low correlations between raters for the Asperger group. However, the low correlations between the scores of parents and teachers in the Asperger group (but not the control group) also require explanation. It may be that in the more structured setting of the school, teachers do not see the full range of social deficits that parents observe across a variety of unstructured settings. Whatever the explanation, the different perceptions may make it difficult for goal-setting in intervention programs as the adolescent, their parent and their teacher may feel that different areas need to be addressed. Similarly, using the SSRS as an outcome measure in intervention studies might fail to identify changes in underlying skills (e.g. Ozonoff and Miller, 1995) as it would be difficult to determine who should be reporting.

Sixteen of the adolescents with Asperger syndrome reported having virtually no friends. This finding is not surprising given their social difficulties with peers and the heavy emphasis on social skills during the adolescent period. However it cannot be assumed that a lack of friends is simply due to poor general social skills and poor social perception. One must consider also whether they all have the motivation to make friends or to interact with peers on a regular basis. Nevertheless, the prospects for developing age-appropriate social skills without frequent social interaction with typically developing peers would seem to be poor. These deficits in social perception and general social skills in adolescent boys may be confounded by a lack of opportunity to interact with appropriate role models and the lack of experience of interacting with peers. Again, research examining the roles of motivation, opportunity to interact, and experience as contributing factors to social perception and general social skills is necessary.

Identification of specific social interaction deficits may allow clinicians to target intervention goals and strategies. Strategies aimed at teaching the child with Asperger syndrome social perception skills have already been suggested (Klin and Volkmar, 1996; Williams, 1995). The CASP may be valuable in monitoring improvements in social perception in children and adolescents with Asperger syndrome. Alternatively, the environment may be altered to compensate for specific social deficits. This may be particularly true in the school environment where a more structured, success-oriented approach to peer interaction can be organized to accommodate social perception deficits. It may be just as important to help peers to understand behaviours that are unusual (Howlin, 1998) as it is to work on specific social perception and other social skills with the person with Asperger syndrome.

One of the limitations of this study was matching participants using the vocabulary subtest of the WISC-III. In future studies, matching using the complete verbal and performance IQ scores would address some possible confounding cognitive factors. Very little is known about the relationship of cognitive skills, impairments in social attentiveness, motivation and problem-solving abilities to the social perception abilities of individuals with Asperger syndrome. The roles of age and gender are also uncertain. Future research requires larger and more heterogeneous samples in order to identify the many different possible factors associated with social impairments, and the strategies that may be valuable in overcoming these deficits.

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