Understanding the Interaction of Temperament and Social Skills in the Development of Social Anxiety in Children with Autism Spectrum Disorders

Margaret A. Millea1, Nicole M. Shea1,2 and Joshua John Diehl1*

1Center for Children and Families, University of Notre Dame, 1602 N. Ironwood Drive South Bend, IN, 46635, USA
2Department of Psychology, Syracuse University, 430 Huntington Hall, Syracuse, NY 13244, USA

Abstract

Children with Autism Spectrum Disorders (ASD) often have comorbid psychopathology in addition to social-communication difficulties. Social anxiety is of particular interest because it has been linked to downstream deficits in social functioning. Bellini found a link between social skills, temperament, and the development of social anxiety. The current paper examines whether negative affectivity moderates the relationship between social skills and social anxiety. Twenty-five high-functioning children diagnosed with ASD were administered self and parent report questionnaires measuring pragmatics ability, socialization behaviors, negative affectivity, and social anxiety. High negative affectivity was related to social anxiety, and moderated the relationship between socialization behaviors and social anxiety. Pragmatics ability was not related to social anxiety. Together, these results indicate that negative affectivity is an important factor in the relationship between social skills and social anxiety, and that not all social skills deficits contribute to social anxiety.

Keywords: Autism spectrum disorders; Temperament; Anxiety; Social skills; Socialization

Introduction

There are high rates of comorbid disorders associated with Autism Spectrum Disorders (ASD) including mood disorders, anxiety, and depression [1-5]. Heightened levels of general anxiety are commonly seen in ASD; for example, it has been reported that 49% of the children with ASD had levels of anxiety that were considered clinically high [6], and as many as 42% of individuals with ASD who do not have an intellectual disability meet criteria for an anxiety disorder [5]. It has been suggested that the development of comorbid psychopathologies is a reaction to the core deficits; that is, having ASD causes certain deficits, which are exacerbated by life experiences that occur because of these same deficits [7]. Children with ASD have been shown to have both higher anxiety and more social worries than both typically developing peers and children with communication disorders not resulting from an ASD [8]. However, anxiety does not always predict problems with social functioning. Only when the anxiety is specific to social situations does it correlate with social withdrawal and communication weaknesses [9]. Moreover, this process represents a developmental pathway through which increased social anxiety worsens the core deficits. Therefore, it is important to understand factors that might affect the development of social anxiety.

In typically developing children, social anxiety is related to perceptions of social acceptance and negative evaluation. Research indicates that children with higher fears of negative evaluation, compared to those with lower levels, have lower self-worth and social acceptance [9]. Although it could be argued that children with ASD have difficulties with theory of mind abilities [10], and therefore do not understand social acceptance the same way that typically developing children do, studies suggest that children with ASD actually experience more feelings of loneliness [11]. In a study comparing 22 children with ASD to a group of typically developing children on self-report questionnaires about friendship and loneliness, the children with ASD reported higher scores of loneliness and lower quality friendships [11]. They were also more likely to provide incomplete definitions of loneliness; they were more likely to include the cognitive definition of loneliness and significantly less likely to describe the emotional experience. This indicates that many children with ASD do want social relationships although they may lack a complete understanding of the concepts, or lack the skills to attain successful relationships. Moreover, they do experience loneliness but may not fully understand how they are making mistakes in social interactions or discouraging friendships from forming. Repeatedly having negative peer interactions without understanding the cause would be extremely frustrating, and may be a factor in the development of social anxiety.

In his 2006 study, Bellini [1] proposed a model for the development of social anxiety in children with ASD that included the element of negative peer interactions. Bellini proposed that those who lack necessary social skills will have negative peer experiences and tend towards social withdrawal, which then allows fewer opportunities to learn and practice social skills, ensuring more negative peer interactions. He also suggested that temperament plays a role. Temperament is defined as the biologically based individual differences in disposition, including susceptibility to arousal and quality of affectivity [12]. This constitutional construct develops over childhood but remains fairly stable and is highly correlated with adult personality [13]. Temperament is important in socialization in that it predicts the development of social skills, such as language abilities, in typically developing children [14,15]. Bellini stated that children who have temperaments that make them easily aroused by stressful stimuli are predisposed to anxiety. In the Bellini model, social skills deficits and temperament interact, making some children, particularly those low in social skills and high in anxiety, even more anxious when entering into social situations. Thus, the factors of arousal and skill form a reciprocal relationship and cause
the development of social anxiety. The Bellini study had a sample of 41 children with ASD ages 12 to 18, who had average cognitive abilities for their ages. The results showed that children who had more physical symptoms of anxiety—which is related to the temperamental construct of autonomic arousal—scored higher on social anxiety. Furthermore, those who scored low on social skills measures scored higher on measures of social anxiety, providing support for a portion of model. The study also found that empathy, a critical social skill which means one can take the perspective of others, and assertiveness, a social skill associated with prioritizing one’s own needs and approaching others, were negatively correlated with social anxiety.

Although Bellini [1] investigated the role that autonomic arousal plays in social anxiety in children with ASD, the study did not consider all aspects of temperament. Temperament can be understood as two sides of a coin, determining both an individual’s ability to self-regulate emotional arousal, and the type and strength of affect that is the typical response to stimuli [16].

In other words, an individual’s temperament explains: (a) the regulation of the arousal the individual experiences in response to a stimulus, and (b) the tendency for a particular valence of affect. The former relates to the construct of arousal that was measured by Bellini [1], whereas the latter refers to the construct of emotionality. The current study aims to add to the Bellini model by investigating the role of emotionality.

Emotionality can be understood as the tendency to react with negative or positive affectivity. Thus, an individual high in negative affectivity is prone to experiencing negative emotions, such as distressed limitations, sadness, fear, and discomfort, in response to stimuli [16]. Negative affectivity is correlated with the adult personality factor of Neuroticism [12], which has been linked to anxiety and other mood disorders [17]. Furthermore, negative affectivity is correlated with difficulty with social interactions [18-20]. It is, therefore, important to consider the role of this aspect of temperament in social anxiety, particularly in ASD. It is reasonable to assume that a child who is rejected by peers and has a temperament consistent with negative affectivity would experience even greater unpleasant emotions. The child may then be deterred from seeking more social opportunities and learning social skills, making him or her more prone to social anxiety. In this way, the emotionality element of temperament explains the mechanism in the Bellini [1] model by which negative peer interactions predict high social anxiety, at least for those children who are high on negative affectivity.

Another factor in Bellini’s [1] model that warrants further exploration is the role of social skills in the development of social anxiety. The Bellini model addressed the importance of social skills in the development of social anxiety, specifically empathy and assertiveness. A next step would be to examine variations of the broad social skills construct, such as pragmatic language use or the adaptive use of social skills. Pragmatic language use has been shown to be a deficit common in ASD [21,22]. Pragmatics ability is defined as having the knowledge of when to say what, and how much, to whom [22]. This is difficult for children with ASD because these children already have difficulties with theory of mind, paying attention to contexts, and understanding prosody, which are necessary in order to have pragmatic abilities [10,23-25]. Furthermore, pragmatics ability is intuitively predictive of negative peer interactions. If a child lacks the knowledge of how to have a normal conversation, every conversation has the potential to be an awkward and negative experience. Therefore, pragmatic ability may be more proximally related to the development of social anxiety than the skills of empathy or assertiveness.

Another possible variation on the Bellini [1] study would be to study the relationship between social anxiety and the adaptive (or applied) use of social skills. For example, adaptive behavior measures such as the Vineland Adaptive Behavior Scale (VABS) [26] measure skills that are conceptually similar to pragmatics skills, but specifically as they are performed in adaptive settings. Therefore, this measure of social skills might also be more proximally related to the development of social anxiety, because it measures how well the child puts his or her skills into practice.

### Purpose of the Study

The current study investigated the elements of negative affectivity and social skills in the context of the Bellini [1] model of the development of social anxiety in children with ASD. First, we conducted an analysis of the relationship between pragmatics ability and social anxiety. We predicted that lower pragmatic skills would be related to higher social anxiety. Second, we conducted an analysis between adaptive social skills and social anxiety. We predicted that lower adaptive social skills would be related to higher social anxiety. However, we also predicted that the temperament construct of negative affectivity would be positively associated with social anxiety. An individual with this type of temperament would be prone to more negative emotions and worry in response to difficult social situations. We, therefore, predicted that negative affectivity would moderate each relationship between social skills (pragmatics, adaptive social skills) and social anxiety (Figures 1 and 2).

### Methods

#### Participants

The participants were 28 children and adolescents with ASD between the ages of 9 and 15. They were recruited from the community through local parent groups, service agencies, and pediatrician’s offices (Table 1 for demographic information). The participants were 25 boys and 3 girls. This demographic nearly reflects the ratio of diagnosis of ASD, which is 4 to 8 times higher in boys than girls [27].

The participants had previously received a diagnosis of an ASD, and the diagnosis was confirmed during the visit using the Autism Diagnostic Observation Schedule (ADOS) [28,29] given by

| Characteristic          | Statistics          |
|-------------------------|---------------------|
| Age in years            | Mean: 12.34         |
|                         | SD: 1.93            |
|                         | Range: 9.45-15.83   |
| Cognitive Test Index Score | Mean: 107.89    |
|                         | SD: 17.57           |
|                         | Range: 78-142       |
| Race/Ethnicity          | African American: N=0 |
|                         | White American: N=25 |
|                         | Asian American: N=3 |
|                         | Hispanic American: N=0 |
| Sex                     | Male: N=25          |
|                         | Female: N=3         |

N=28 children with ASD

Table 1: Participant information and demographics.
aADOS trained/reliable examiner, the Lifetime Form of the Social Communication Questionnaire (SCQ-L) [30], and the clinical judgment of a clinical psychologist (with extensive diagnostic experience related to ASD) based on criteria from the Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition, Text Revision [2] for Autistic Disorder, Asperger's Disorder, or Pervasive Developmental Disorder, not otherwise specified. They also were administered the Wechsler Abbreviated Scale of Intelligence (WASI) [31] to ensure that they were able to understand the self-report questionnaires. All the children included in the study had Full Scale IQs that were within two standard deviations of the mean for their ages, M=107.89, SD=17.57 (Table 1). Given this exclusion criteria, our sample would sometimes be labeled as high-functioning, although there are no definitive criteria that define this subgroup of ASD [32]. In total, 36 participants attempted to complete the diagnostic, cognitive, and research battery, but eight participants were excluded from the study. Four participants did not meet diagnostic criteria for an ASD despite a previous diagnosis, one participant had an IQ score below the threshold we set, and three participants were not able to finish the questionnaires.

**Measures**

**Social anxiety:** The Social Anxiety Scale for Children-Revised (SASC-R) [33,34] and the Adolescent Adaptation (SAS-A) [9] were administered to the participants to measure social anxiety. The SAS is the same as the SASC-R except some wording is changed to be appropriate for adolescents. The SASC-R is a self-report questionnaire with 22 descriptive statements that the participants rate on a 5 point Likert scale from (1) not at all to (5) all the time. Statements include items such as-I worry about being teased or it's hard for me to ask other kids to play with me. This measure has been shown to be between a second and third grade reading level according to Flesch-Kincaid formula [35].

**Social skills:** Two measures of social skills were used. First, to measure pragmatic ability, part of the Clinical Evaluation of Language Fundamentals-Fourth Edition (CELF-4) was administered [36]. The CELF is widely used to diagnose language disabilities. Because this study is concerned only with pragmatic ability, parents were only asked to fill out the Pragmatics Profile section, which is a one page 22 item questionnaire. The Pragmatics Profile (and more generally, the construct of pragmatic ability) was chosen because it encompasses a representative variety of social skills. The profile includes statements such as: I maintain eye contact, appropriate body language during conversations, tells/understands jokes/stories that are appropriate to the situation, or uses appropriate strategies for getting attention. The parents responded on a Likert scale of (1) never to (4) always. The clinical cutoffs vary by age; a nine-year-old would be classified as having clinical concerns if they scored 132 or lower, whereas a 15-year-old has a higher cutoff score (142 or lower).

Second, to measure applied social skills, the VABS was administered [26]. The VABS provide a measure of the child's skill levels within adaptive settings. They are dependent on the expectations of others or the standards of the social context, and they can improve or deteriorate over time.

Importantly, adaptive behavior scores reflect the individual's typical performance, rather than his or her ability to do the skill. The scale yields scores in the domains of communication, socialization, and daily living. In the current study, the socialization domain was used to measure adaptive social skills, which is a standard score with a mean of 100 and a Standard Deviation (SD) of 15. For this measure, a score of 1-2 SDs below the mean is considered moderately low, and an SD of 2 or lower is considered low. This domain is made up of three subdomains: interpersonal relationships, play and leisure time, and coping skills, but for the current study, only the overall score was utilized.

**Temperament:** The Early Adolescent Temperament Questionnaire-Revised (EATQ-R) [37] short form was administered to assess temperament. The EATQ-R is a 65 item self-report questionnaire intended for children ages 9 to 15. Participants responded to statements such as-I find it hard to shift gears when I go from one class to another. Participants responded to statements such as-I find it hard to shift gears when I go from one class to another. The SAS is the Adolescent Adaptation (SASC-R) [33,34] and the Adolescent Adaptation (SAS-A) [9] were administered to the participants to measure social anxiety. The SAS is the Adolescent Adaptation (SASC-R) except some wording is changed to be appropriate for adolescents.

**Distress General:** For the current study, the overall score was utilized. A score of 50 or above on the SASC-R or SAS-A signifies a clinical level of social anxiety. Cronbach's alpha was calculated for the sample for the nineteen items comprising the Negative Affectivity subscale of the EATQ-R and it was reliable (α=0.78).

**Procedure**

All portions of the study took place at a university center located in the community. All aspects of the study were approved by the University of Notre Dame Institutional Review Board and treatment of patients was in accordance with the ethical standards of the American Psychological Association. Participants completed consent/assent forms, and then completed the diagnostic and IQ evaluation. Children then filled out two self-report questionnaires: the EATQ-R and the SASC-R/SAS-A (depending on which form was age appropriate), with time for breaks and snacks. Meanwhile, parents filled out the Pragmatics Profile and the Vineland Adaptive Behavior Scale in a separate room. Trained research assistants were available as monitors, to give basic instructions or pronounce any confusing words, but did not direct the children or parents in how to answer.

**Data Analysis Plan**

The study investigated the hypothesis that negative affectivity would moderate the relationship between pragmatics ability and social anxiety. In order to accomplish the investigation, a number of statistical analyses were conducted. First, a linear regression was conducted with social anxiety (SAS-A/SASC-R) as the dependent variable and Pragmatics Profile and negative affectivity (EATQ-R) as the independent variables. Age was entered in the first step as a predictor, because the Pragmatics Profile scores are expected to be higher for older children. Then, in order to test whether applied social skills predicted social anxiety, another linear regression was computed which was identical to the first, except with the socialization domain of the VABS as a predictor instead of pragmatics ability (Figure 2). Since the VABS measures adaptive social behaviors, it was considered a proxy for applied social skills.
Results

The current study examined social anxiety in children with ASD by collecting data via self-reports and parent reports from children diagnosed with ASD. As expected, the respondents with ASD showed scoring trends on these measures that were different from those of typically developing populations. Notably, participants scored low on the Pragmatics Profile with 24 of the 28 participants below the criterion score for his or her age, signifying a communication deficit in the area of pragmatics ability. On average, the sample’s scores on the SASC-R and SAS-A were slightly below the clinical threshold of 50 for these measures ($M=45.86, SD=13.71$). Of the 28 participants, 10 were above this clinical cutoff. Overall, all of the variables exhibited variation across the sample (Table 2 for descriptive statistics).

When testing the model that negative affectivity would moderate the relationship between pragmatics ability and social anxiety (Figure 1), it was found that after controlling for age, the overall model was significant, $F(4, 23)=4.49, p=0.008$ (Table 3). The model accounted for a large portion of the variance in scores on the SASC-R/SAS-A (adjusted $R^2=0.34$). Also, the subscale for Negative Affectivity was a significant predictor of social anxiety ($\beta=-0.56$, $p=0.006$). However, the Pragmatics Profile scores were not a significant predictor in the model ($\beta=-0.08$, $p=0.62$), nor was the interaction term a significant predictor ($\beta=-0.15$, $p=0.42$). This indicated that the moderation hypothesis was not confirmed.

When testing the model that negative affectivity would moderate the relationship between VABS Socialization and social anxiety (Figure 2), this version of the model was significant overall, $F(3, 24)=10.04, p<0.001$ (Table 4). The model accounted for an even greater portion of the variance than the previous model ($R^2=0.50$). EATQ-R=Early Adolescent Temperament Questionnaire-Revised [37]. Variables were entered into the model in two steps. Only age was entered in the first step. $R^2=0.44$; Adjusted $R^2=0.34$ EATQ-R=Early Adolescent Temperament Questionnaire-Revised [37]. $p<0.001$

Table 3: Summary of linear regression predicting social anxiety from Pragmatics Ability and Negative Affectivity.

![Moderation model](image)

Figure 2: Moderation model for the relationship between social anxiety and the VABS measure of socialization. The ovals denote the main relationship and the rectangle denotes the moderator, negative affectivity. VABS=Vineland Adaptive Behavior Scale [26].

| Measure | EATQ-R Negative Affectivity | Pragmatics Profile | VABS-Socialization | SAS-A/SASC-R |
|---------|---------------------------|-------------------|-------------------|-------------|
| Statistic Type | M SD | M SD | M SD | M SD |
| Statistic | 51.21 | 11.87 | 118.22 | 20.41 | 85.93 | 13.52 | 45.86 | 13.71 |

$M=$Mean; $SD=$Standard Deviation; EATQ-R=Early Adolescent Temperament Questionnaire-Revised [37]; SAS-A=Social Anxiety Scale for Adolescents [9]: SASC-R=Social Anxiety Scale for Children–Revised [33,34]; VABS=Vineland Adaptive Behavior Scale [26].

Table 2: Descriptive statistics by measure.

![Moderation model](image)

Figure 1: Moderation model for the relationship between social anxiety and the social skill of pragmatics ability. The ovals denote the main relationship and the rectangle denotes the moderator, negative affectivity.
interaction between socialization scores and negative affectivity

situations outside of the family. For this analysis, there was a significant how well the child puts his or her skills into practice, particularly in

specifically as they are performed in adaptive settings. In other words,

Pragmatics Profile scores. The Socialization domain was chosen because

into the developmental framework, a second model was run, using the

negative affectivity. The cell means were computed using the program ModGraph-I [42].

Negative Affectivity is based on a subscale of the EATQ-R=Early Adolescent

Temperament Questionnaire-Revised [37]; VABS=Vineland Adaptive Behavior

Scale [24]; SAS-A=Social Anxiety Scale for Adolescents [9]; SASC-R=Social

Anxiety Scale for Children-Revised [33,34].

In order to better understand how different social skills sets fit

into the developmental framework, a second model was run, using the

socialization domain of the Vineland Adaptive Behavior Scale instead of

Pragmatics Profile scores. The Socialization domain was chosen because

it measures skills that are conceptually similar to pragmatics skills, but

specifically as they are performed in adaptive settings. In other words,

the parent reports not on whether the child is capable of a skill, but on

how well the child puts his or her skills into practice, particularly in

situations outside of the family. For this analysis, there was a significant

interaction between socialization scores and negative affectivity scores related to social anxiety. These findings support and extend the

Bellini [1] model which suggests that social skills are associated with

the development of social anxiety. These findings extend this theory by indicating that certain skills are more important to social anxiety than others. Furthermore, the findings suggest that having the skills to interact socially is not the most accurate predictor of social anxiety. Rather, how often the child puts skills into practice across various situations is relevant to social anxiety. Bellini suggested that having more skills would mean that the child has more positive interactions, less likely to avoid social situations, and therefore encounters more opportunities to practice and learn social skills and that this is protective against social anxiety development. It is logical that a measure of social skills in adaptive settings is more accurate, because it necessarily means the skill is being applied and the child is therefore encountering more social opportunities and learning opportunities.

As expected, the current study found that negative affectivity moderates the relationship between social skills and social anxiety. Bellini [1] suggested that lower levels of social skills would be associated with higher levels of social anxiety. The current study’s findings indicate that this is true for children high on negative affectivity. Those with high negative affectivity and low social skills had the highest scores of social anxiety. This could be explained by the fact that these children, who typically experience more frustration and distress than their peers would be particularly affected when they have negative interactions due to their low skills and this may lead to the development of social anxiety. In contrast, for children with ASD who were low on negative affectivity, higher levels of social skills were associated with higher social anxiety. An explanation for this is that these easygoing children who do not typically worry or get upset may develop social anxiety because their higher skill level makes them more aware of negative interactions and of rejection. Therefore, those with low negative affectivity and low social skills had the lowest scores of social anxiety. These interaction effects reveal that negative affectivity does moderate the relationship between social skills and social anxiety.

This finding is consistent with the literature that indicates a relationship between negative affectivity and general anxiety in typically developing adults [17]. The current study extends relationship to a specific type of anxiety, namely social anxiety, in the special population of children with ASD. Furthermore, Clark and Watson [38] proposed a theory of anxiety in typically developing adults and psychiatric patients in which there is a component of autonomic or physiological arousal and a distress factor. Similarly, Bellini [1] found that the tendency in children with ASD to experience autonomic hyper-arousal was associated with higher levels of social anxiety. The current study’s findings indicate that this distress factor or temperamental factor of negative affectivity is similarly related to social anxiety in children with ASD.

Clinical Implications

These findings bear clinical implications. First, when working with a child with ASD, the child’s temperament may provide insight into how his or her peer interactions, and reactions to these peer interactions, are affecting the development of social skills. Clinicians providing therapy for social anxiety and/or social skills should consider measuring temperament to better individualize an intervention plan. Second, this study reiterates the importance of focusing on specific skills since some skill sets are more relevant than others to social anxiety. Findings indicate that therapy that targets applying skills in adaptive settings would be beneficial for alleviating social anxiety. Therefore, a focus should be not only on knowing how to act in a given situation, but being encouraged to do so with greater frequency. Interventions should
target practicing skills with individuals outside of the family.

Limitations and Future Directions

Although the study has strong implications, it is also limited in its scope. The limitations of this study include its small sample size and relatively homogeneous demographic. There were only three girls in the sample. Although this is nearly an 8:1 ratio, and the ratio expected based on diagnosis rates is between 4:1 and 8:1 [27,39] for males to females, it is still important to study larger samples of females to rule out gender effects. Also, all of the participants had IQ index scores above 70; as such, our sample of individuals with ASD could be considered on the high-functioning end of the autism spectrum. This subset of individuals with ASD constitutes a majority of individuals with the diagnosis, and a much higher proportion than previously thought [32,40,41]. Still, approximately 38% of children with ASD have IQ scores below 70 [42], which mean that these findings cannot be generalized to the entire population of children with ASD. Finally, we did not use the Social Skills Rating System, which was used in the original Bellini [1] study. That study found that the subscales of Empathy and Assertiveness on the Social Skills Rating System were related to social anxiety. Although we were not able to directly replicate their finding, we were able to identify subtle differences in the relationship between social skills and the development of social anxiety.

Further research is needed to clarify which social skills are most important to social anxiety development. Also, it seems that negative social interactions may be the negative stimuli that are related to hyper-arousal and frustration. Future research should look at the role that negative interactions, particularly with peers, play in the development of social anxiety. Potential protective factors such as positive interactions with peers or peers who are accepting of friends with ASD should be considered as well to determine if they are negatively associated with social anxiety. Additionally, the current study measured the variables at one time point. Longitudinal studies would be useful to understand the direction of the relationships of these factors in the development of social anxiety, and to understand when interventions would be most helpful. Finally, this study did not examine the influence of therapy (e.g., social skills therapy, cognitive-behavioral therapy) on any of our variables. An important consideration for future research would be to examine how a therapy addressing one area (e.g., anxiety) might have downstream effects on other areas (e.g. social skills) during development.

In conclusion, the current study examined factors that may predict social anxiety, which is associated with downstream deficits in social functioning [9]. The study’s findings advanced the understanding of which types of social skills are associated with social anxiety. The study introduced negative affectivity as an important moderator of social anxiety in children with ASD. Further investigation is needed in order to understand when and how the many factors of social anxiety interact in children with ASD.

References

1. Bellini S (2006) The development of social anxiety in adolescents with autism spectrum disorders. Focus Autism Other Dev Disabil 21: 138-145.
2. American Psychiatric Association (2000) Diagnostic and Statistical Manual of Mental Disorders: DSM-IV-TR®, (4thedn), American Psychiatric Association, Washington, DC.
3. Kim JA, Szatmari P, Bryson SE, Streiner DL, Wilson FJ (2000) The prevalence of anxiety and mood problems among children with autism and Asperger syndrome. Autism 4: 117-132.
4. Mazefsky CA, Oswald DP, Day TN, Eack SM, Minshew NJ, et al. (2012) ASD, a psychiatric disorder, or both? Psychiatric diagnoses in adolescents with high-functioning ASD. J Clin Child Adolesc Psychol 41: 516-523.
5. Soussana M, Sunyer B, Pry R, Baghdadi A (2012) Anxiety in children and adolescents with pervasive developmental disorder without mental retardation: review of literature. Encephale 38: 16-24.
6. Bellini S (2004) Social skill deficits and anxiety in high-functioning adolescents with autism spectrum disorders. Focus Autism Other Dev Disabil 19: 78-86.
7. Tantam D (2000) Psychological disorder in adolescents and adults with Asperger syndrome. Autism 4: 47-62.
8. Gillott A, Furniss F, Walter A (2001) Anxiety in high-functioning children with autism. Autism 5: 277-286.
9. La Greca AM, Lopez N (1998) Social anxiety among adolescents: Linkages with peer relations and friendships. J Abnorm Child Psychol 26: 83-94.
10. Baron-Cohen S (1997) Mindblindness: An essay on autism and theory of mind. MIT Press, Cambridge MA.
11. Bauminger N, Kasari C (2000) Loneliness and friendship in high-functioning children with autism. Child Development 71: 447-456.
12. Rothbart MK, Ahadi SA, Evans, DE (2000) Temperament and personality: Origins and outcomes. J Pers Soc Psychol 78: 122-135.
13. Rothbart MK, Ahadi SA, Hershey KL, Fisher P (2001) Investigations of temperament at three to seven years: The children’s behavior questionnaire. Child Dev 72: 1394-1408.
14. Sanson A, Hemphill SA, Smart D (2004) Connections between temperament and social development: A review. Soc Dev 13: 142-170.
15. Sameroff AJ, Lewis M, Miller SM (2000) Handbook of developmental psychopathology. (2ndedn), Kluwer.
16. Putnam SP, Rothbart MK, Gartstein MA (2008) Homotypic and heterotypic continuity of fine-grained temperament during infancy, toddlerhood, and early childhood. Infant and Child Development 17: 387-405.
17. Clark LA, Watson D, Mineka S (1994) Temperament, personality, and the mood and anxiety disorders. J Abnorm Psychol 103: 103-116.
18. De Pauw SS, Mervielde I, Van Leeuwen KG, De Clercq BJ (2011) How temperament and personality contribute to the maladjustment of children with autism. J Autism Dev Disord 41: 196-212.
19. Schwartz CB, Henderson HA, Inge AP, Zahka NE, Coman AC, et al. (2009) Temperament as a predictor of symptomatology and adaptive functioning in adolescents with high-functioning autism. J Autism Dev Disord 39: 842-855.
20. Rapin I, Dunn M (2003) Update on the language disorders of individuals on the autistic spectrum. Brain Dev 25: 166-172.
21. Young EC, Diehl JJ, Morris D, Hyman SL, Bennettlo L (2005) The use of two language tests to identify pragmatic language problems in children with Autism Spectrum Disorders. Lang Speech Hear Serv Sch 36: 62-72.
22. Pride J, Holmes J (1971) Sociolinguistics. Penguin, Baltimore MD.
23. Diehl JJ, Bennettlo L, Watson D, Gunlogson C, McDonough J (2008) Resolving ambiguity: A psycholinguistic approach to understanding prosody processing in high-functioning autism. Brain Lang 108: 144-152.
24. Kerbel D, Grunwell P (1998) A study of idiom comprehension in children with semantic-pragmatic difficulties. Part II: Between-groups results and discussion. Int J Lang Commun Dis 33: 23-44.
25. Baron Cohen S, Tager-Flusberg H, Cohen DJ (1993) Understanding other minds: Perspectives from autism. Oxford Academy Press.
26. Spanrow SS, Cicchetti DV, Newmark CS (1989) The Vineland Adaptive Behavior Scales. Major Psychological Assessment Instruments 2: 199-231.
27. Kogan MD, Blumberg SJ, Scheive LA, Boyle CA, Perrin JM, et al. (2007) Prevalence of parent-reported diagnosis of autism spectrum disorder among children in the US, 2007. Pediatrics 124: 1395-1403.
28. Lord C, Risi S, Lambrecht L, Cook EH, Leventhal BL, et al. (2000) The autism diagnostic observation schedule-generic: a standard measure of social and communication deficits associated with the spectrum of autism. J Autism Dev Disord 30: 205-223.
29. Gotham K, Risi S, Pickles A, Lord C (2007) The Autism Diagnostic Observation
Schedule: Revised Algorithms for Improved Diagnostic Validity. J Autism Dev Disord 37: 613-627.
30. Rutter M, Bailey A, Lord C (2003) The Social Communication Questionnaire (SCQ). Western Psychological Services, Torrance, CA.
31. Wechsler D (1999) Wechsler Abbreviated Scale of Intelligence™ (WASI™). Pearson Education Inc, San Antonio, TX.
32. Volkmar FR (2013) Encyclopedia of autism spectrum disorders. Springer Publishing, New York.
33. La Greca AM, Stone WL (1993) Social anxiety scale for children-revised: factor structure and concurrent validity. J Clin Child Psychol 22: 17-27.
34. La Greca AM, Dandes SK, Wick P, Shaw K, Stone WL (1988) Development of the Social Anxiety Scale for Children: Reliability and concurrent validity. J Clin Child Psychol 17: 84-91.
35. Schuyler MR (1982) A readability formula program for use on microcomputers. Journal of Reading 25: 560-591.
36. Semel E, Wiig EH, Secord WA (2003) Clinical Evaluation of Language Fundamentals. (4th edn), Harcourt Assessment, Inc, San Antonio TX.
37. Capaldi DM, Rothbart MK (1992) Development and validation of an early adolescent temperament measure. J Early Adolesc 12: 153-173.
38. Clark LA, Watson D (1991) Tripartite model of anxiety and depression: psychometric evidence and taxonomic implications. J Abnorm Psychol 100: 316-336.
39. Volkmar F, Szatmari P, Sparrow SS (1993) Sex differences in pervasive developmental disorders. J Autism Dev Disord 23: 579-591.
40. Centers for Disease Control (2012) Prevalence of autism spectrum disorders-Autism and developmental disabilities monitoring network, 14 sites, United States, 2008. MMWR 61: 1-19.
41. Rice ML, Warren SF (2004) Developmental language disorders: From Phenotypes to Etiologies. Psychology Press.
42. Jose PE (2008) ModGraph-I: A programme to compute cell means for the graphical display of moderational analyses: The internet version, Version 2.0. Victoria University of Wellington, Wellington, New Zealand.