

## The Relationship of Asperger's Characteristics and Schizotypal Personality Traits in a Non-clinical Adult Sample

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**Abstract:** The study examines the relationship between Asperger's Disorder (AD) and Schizotypal Personality Disorder (SPD), mutually exclusive but similar diagnoses [*DSM-IV-TR*; American Psychiatric Association (2000). *Diagnostic and statistical manual of mental disorders*. Washington, DC: Author]. The literature and comparison of diagnostic criteria suggest that the two disorders may overlap: AD social impairment with SPD interpersonal problems and AD communication deficits with SPD disorganized features. Questionnaire measures of AD and SPD were administered to a large non-clinical adult sample. Consistent with expectations, the Asperger's and Schizotypal questionnaires were positively correlated. Further, the social-interpersonal and communication-disorganized areas were positively correlated, though the relationship between social-interpersonal areas is particularly strong. Future research should continue to explore the relationship between AD and schizotypy to confirm current findings and improve understanding of distinctions between the disorders.

**Keywords:** asperger's disorder | schizotypal personality disorder | autism spectrum quotient | schizotypal personality questionnaire | autism spectrum disorders | schizophrenia spectrum disorders

### Article:

#### Introduction

The present study assesses characteristics of Asperger's Disorder (AD) and Schizotypal Personality Disorder (SPD) in a non-clinical sample of adults. Specifically, the study examines

the relationship and overlap between features of the two conditions. AD and SPD are mutually exclusive categorical diagnoses that include similar traits in their diagnostic criteria (DSM-IV-TR; American Psychiatric Association, 2000). AD is an Axis I pervasive developmental disorder included within the autism spectrum and usually diagnosed in childhood, although it is a lifelong disorder. SPD is one of the Axis II Cluster A Personality Disorders. It is considered to be a schizophrenia-spectrum disorder, and is diagnosed only after the personality has coalesced, usually after age 18. Both disorders are diagnosed based upon the presence of characteristic symptoms. Since some criteria are similar, clarification of the relationship between the two disorders should improve differential diagnosis.

Table 1 summarizes the current abbreviated diagnostic criteria for AD and SPD (American Psychiatric Association, 2000) across social, communication, repetitive-restricted behavior, and cognitive-perceptual domains. Criterion statements were sorted across the domains based upon their face value for illustrative purposes only, and is not meant to convey the relevance or severity of the symptoms. The first three domains were selected based upon the “triad of impairments” that characterizes the autism spectrum, specifically social difficulties, communication impairments, and repetitive-restricted activities (Wing & Gould, 1979). The cognitive-perceptual domain was added to accommodate symptoms that fit more closely with positive symptoms of schizophrenia (e.g. ideas of reference and hallucinations) and did not fit well within the other domains. The disorders are similar in that AD and SPD criteria require patients to exhibit social and communicative deficits, and odd or restricted patterns of behavior. However, they are also distinct from each other in several ways. In the social skills domain, SPD criteria include social anxiety (related to paranoid fears of mistreatment), whereas no mention is made of this in the AD criteria. In the communication domain, SPD criteria include odd speech that is vague, circumstantial, and metaphorical whereas AD criteria focus on problematic non-vocal communicative behaviors. While both AD and SPD appear to have communication deficits, the modifiers for SPD odd speech (vague, circumstantial, metaphorical, overelaborate) suggest a highly developed, though disordered, expressive vocal repertoire while the AD criteria suggest a disordered repertoire related to understanding body language. However, while AD criteria state that there is no significant delay in language, the communication criteria are moot regarding characteristics of the vocal repertoire of the AD patient. The repetitive-restricted behaviors domain includes verbal behavior in SPD (e.g., stereotyped thinking and speech), whereas AD criteria include stereotypic, repetitive, inflexible, and persistent patterns of behavior without reference to speech or thinking. While similar criteria were found across the first three domains, the characteristics listed in the cognitive-perceptual domain appear to be restricted to SPD. SPD criteria include mild, positive symptoms of schizophrenia (American Psychiatric Association, 2000) while the AD criteria do not. Mild forms of the positive symptoms of schizophrenia include ideas of reference, unusual perceptual experiences, and suspiciousness or paranoid ideation (American Psychiatric Association, 2000).

**Table 1** Abbreviated diagnostic criteria by domain

Domain	Asperger’s Disorder	Schizotypal Personality Disorder
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Domain	Asperger's Disorder	Schizotypal Personality Disorder
<p>Social deficits</p> <p>SPQ: interpersonal</p> <p>AQ: social skills</p>	<ol style="list-style-type: none"> <li>1. Qualitative impairment in social interaction</li> <li>2. Failure to develop peer relationships appropriate to developmental level</li> <li>3. A lack of spontaneous seeking to share enjoyment, interests, or achievements with other people (e.g., by a lack of showing, bringing, or pointing out objects of interest to other people)</li> <li>4. Lack of social or emotional reciprocity</li> </ol>	<ol style="list-style-type: none"> <li>1. A pervasive pattern of social and interpersonal deficits</li> <li>2. Acute discomfort with close relationships</li> <li>3. Reduced capacity for close relationships</li> <li>4. Lack of close friends or confidants other than first-degree relatives</li> <li>5. Excessive social anxiety that does not diminish with familiarity and tends to be associated with paranoid fears rather than negative judgments about self</li> <li>6. Inappropriate or constricted affect</li> </ol>
<p>Communication deficits</p> <p>SPQ: disorganized</p> <p>AQ: communication</p>	<ol style="list-style-type: none"> <li>1. Marked impairment in the use of multiple non-verbal behaviors such as eye-to-eye gaze, facial expression, body postures, and gestures to regulate social interaction</li> <li>2. No clinically significant general delay in language (e.g., single words used by age 2 years, communicative phrases used by age 3 years)</li> </ol>	<ol style="list-style-type: none"> <li>1. Odd speech (e.g., vague, circumstantial, metaphorical, over-elaborate)</li> </ol>
<p>Repetitive-restricted activities</p> <p>SPQ: disorganized</p> <p>AQ: attention switching, attention to detail,</p>	<ol style="list-style-type: none"> <li>1. Restricted repetitive and stereotyped patterns of behavior, interests, and activities</li> <li>2. Encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or</li> </ol>	<ol style="list-style-type: none"> <li>1. Odd thinking and speech (stereotyped)</li> <li>2. Behavior or appearance that is odd, eccentric, or peculiar</li> </ol>

Domain	Asperger's Disorder	Schizotypal Personality Disorder
imagination	<p>focus</p> <ol style="list-style-type: none"> <li>1. Apparently inflexible adherence to specific, non-functional routines or rituals</li> <li>2. Stereotyped and repetitive motor mannerisms (e.g., hand or finger flapping or twisting, or complex whole-body movements)</li> <li>3. Persistent preoccupation with parts of objects</li> </ol>	
<p>Cognitive-perceptual</p> <p>SPQ: cognitive-perceptual</p>		<ol style="list-style-type: none"> <li>1. Suspiciousness or paranoid ideation</li> <li>2. Ideas of reference (excluding delusions of reference)</li> <li>3. Odd beliefs or magical thinking that influences behavior and is inconsistent with subcultural norms (e.g., superstitiousness, belief in clairvoyance, telepathy, or "sixth sense"; in children and adolescents, bizarre fantasies or preoccupations)</li> <li>4. Unusual perceptual experiences, including bodily illusions</li> </ol>
Other	<p>There is no clinically significant delay in cognitive development or in the development of age-appropriate self-help skills, adaptive behavior (other than social interaction), and curiosity about the environment in childhood</p>	
Rule outs	<p>Criteria are not met for another specific Pervasive Developmental Disorder or Schizophrenia</p>	<p>Does not occur exclusively during the course of Schizophrenia, a Mood Disorder With Psychotic Features,</p>

Domain	Asperger's Disorder	Schizotypal Personality Disorder
		another Psychotic Disorder, or a Pervasive Developmental Disorder

A great deal of effort has been expended attempting to determine whether or not autism and AD are two distinct disorders in children (Mesibov, Shea, & Adams, 2001; Rutter & Schopler, 1987; Szatmari, 2000; Volkmar, Cohen, Hoshino, Rende, & Paul, 1988; Wing, 1991). Likewise, others have hypothesized about the nature of the relationship between Asperger's and schizoid or schizotypal characteristics in children (Wolff, 2000) and adults (Tantum, 1991). It should be noted that, over the years, children who displayed odd–eccentric characteristics have been variously classified using terms including “schizoid psychopathy of childhood” (Ssucharewa, 1926), “autistic psychopathy of childhood” (Asperger, 1944; translated by Frith, 1991), “schizoid personality disorder” (Wolff, 2000), and “schizotypal personality disorder” (Nagy and Szatmari, 1986). It is unclear how these taxonomic variations related to diagnosis of these children when they reached adulthood. However, schizoid personality disorder, as currently defined in the *DSM-IV-TR* (2000), does not include some of the features that may overlap between current criteria for SPD and AD, specifically the repetitive-restrictive features of AD and the disorganized features of SPD (see Table 1).

With the understanding that historically there have been variations in the use of diagnostic terms for children who displayed odd behavior, there currently appear to be two major hypotheses about the classification of odd–eccentric children who could possibly meet AD or SPD criteria, and they are exemplified by the work of Wolff and Rutter. First, Wolff (2000) and Wolff and Cull (1986), who examined historical and current use of diagnostic terms, suggest that the multiple classifications, listed above, do not reflect distinct diagnostic entities; rather, they suggest that odd/eccentric behaviors, including those exhibited by AD and SPD children, exist together on the same continuum with AD being more severe than SPD. Further, Wolff also advocates that *DSM IV-TR* AD criteria require a greater degree of social impairment than many odd/eccentric children meet, and, therefore, leave unclassified many children who warrant a diagnosis (and treatment) due to subtle but important difficulties.

Alternatively, Rutter (1996) concluded that the schizophrenia spectrum disorders are indeed distinct and unrelated to autism spectrum disorders from a biological perspective, with the two spectra resulting from distinctly different genetic factors and different problems in neurodevelopment. It is noteworthy that Tantum (1991) also advocated this view based upon behavioral characteristics. However, Rutter's may be called into questions based upon both physiological and behavioral evidence. Recently, Sporn et al. (2004) questioned Rutter's findings by showing childhood onset schizophrenia, a disorder that is continuous with adult schizophrenia (Nicolson & Rapoport, 1999), did not present a unique clinical pattern when compared to children with pervasive developmental disorders with co-morbid childhood onset schizophrenia on a broad array of clinical and neuropsychological measures. Sporn and colleagues' results also suggested a familial–genetic relationship between autism and childhood onset schizophrenia. Further, in a review of neural correlates of social cognition in autism and schizophrenia, Abdi and Sharma (2004) summarized evidence that implicates similar abnormalities in performance

on emotion perception and theory of mind tasks and similar abnormalities in the neural substrates correlated with those tasks in both disorders. In another study, Konstantareas and Hewitt (2001) compared two groups of adult males, one with high functioning autism and one with schizophrenia, in terms of symptom overlap. They found that the groups were similar in that both displayed negative symptoms of schizophrenia (affective flattening, alogia, avolition-apathy, anhedonia-asociality, and inattention), and were different in that none of the autism patients reported hallucinations or delusions. In addition, they found that if patients with autism also met criteria for schizophrenia, they best fit the disorganized subtype of schizophrenia. Finally, Baltaxe, Russell, D'Angiola, and Simmons (1995) examined the verbal discourse of young adults and adolescents with high functioning autism and SPD, finding qualitative similarities and quantitative differences in the disordered speech of the two groups, primarily in their ability to use cohesive ties of reference. Baltaxe et al.'s findings indicate that disordered odd speech (poor referencing skills which disrupts the smooth flow of discourse) of the person with SPD is similar to the disordered speech of the person with high functioning autism.

Empirical examination of the relationship between the multiple traits of the two disorders should provide additional clarification about the distinctions between the two disorders, thereby improving differential diagnosis. However, studying the relationship between the two disorders in a clinical population is difficult due to low incidence of the disorders and because, until recently, there was no self-administered questionnaire for AD. An alternative is to examine the characteristics of the two disorders in a non-clinical population. Since both AD and SPD are spectrum disorders, it is likely that sub-clinical manifestation (i.e., milder expressions of the behavioral characteristics that do not reach the quantitative or qualitative requirements of the criteria) of both disorders exist in the general population and can be examined in that population. By definition, both the autism and schizophrenia spectrums include a wide swath of symptom severity, from mild to profound. Specifically, AD is on a spectrum that includes mild pervasive developmental disorder, not otherwise specified, on one end and autism on the other, while SPD is on a spectrum that includes mild Cluster A personality disorder traits at the one end and schizophrenia on the other.

Because SPD and AD traits exist in the general population, the large sample survey method could be used to examine their relationship. Comparing responses to questionnaires designed independently as diagnostic tools for each disorder could help provide some insight about the degree to which the personality traits assessed by each are similar.

The present study examines the presence of AD and SPD personality traits in a large sample of adult college students. College students are an appropriate sample to study these constructs because they demonstrate a range of personality characteristics and are able to respond to questionnaires, and because they have been used in previous studies that employed the same measures used herein (e.g., Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001a; Wuthrich & Bates, 2001). It is also appropriate to use an adults sample because AD is typically considered a lifelong disorder and because a diagnosis of SPD is not typically given until after age 18.

This study explores whether the interpersonal and cognitive-perceptual disturbances tapped by the measure of SPD are related to disturbances tapped by the measure of AD. It is hypothesized that when subscales and domains of the SPD and AD measures are compared, positive associations between AD and SPD will be found between the total scores of the measures and between the subscale scores of the measures that assess features which appear similar across the two disorders. More specifically, the AQ social skills domain will be significantly correlated with the SPQ interpersonal factor while the AQ communication domain will be significantly correlated with the SPQ disorganized factors. Further, since the SPQ cognitive-perceptual factor appears to be a proxy factor for positive symptoms of schizophrenia not assessed by the AQ, this factor will not yield a significant correlation with the AQ total score or the AQ domain scores.

## **Method**

### **Participants and Procedures**

The participants were 607 college students (472 females, 135 males) enrolled in General Psychology courses at the University of North Carolina at Greensboro during 2003. The mean age of the male participants was 20.2 ( $SD = 5.8$ , Range 17–55) and for females the mean age was 19.0 ( $SD = 3.5$ , Range = 17–49). Ethnicity of the sample was 82% Caucasian, 9% African American, and 9% other for the male participants and 70% Caucasian, 25% African American and 5% other for the female participants. Measures were randomly placed in a packet that was distributed and completed during a large group mass screening session. Participants received course credit for taking part in the study.

### **Measures**

To assess Asperger's and SPD symptoms, the Autism Spectrum Quotient (AQ; Baron-Cohen et al., 2001a; Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001b) and the Schizotypal Personality Questionnaire (SPQ; Raine, 1991) were administered.

### **Autism Spectrum Quotient**

The Autism Spectrum Quotient (Baron-Cohen et al., 2001a, b) is a 50-item, self-administered measure for use with adults with normal intelligence to assess for the presence of traits associated with the autism spectrum (see Table 2 for sample items). The 50 items are split evenly among five domains: social skill, attention switching, attention to detail, communication, and imagination (see Table 1 for their association with diagnostic categories). Each AQ item is a brief statement followed by four possible ratings: definitely agree, slightly agree, slightly disagree, and definitely disagree. Each item is scored as a one (i.e., item was answered in the direction of autism) or a zero based upon whether the item is endorsed in the direction of autism or not, so the highest possible score is 50. Baron-Cohen et al. (2001a) reported that the test-retest reliability assessed after 2 weeks based on data from 17 students was  $r = .70$ . Cronbach's  $\alpha$  was reported to be fair for each of the five domains noted above: communication = .65, social = .77, imagination = .65, local details = .63, attention switching = .67. Eighty percent of individuals diagnosed with AD using DSM-IV criteria scored above the cut-off of 32 out of a

possible 50 total points on the AQ whereas only 2% of controls did. The authors of the AQ suggest that the AQ is sufficiently reliable and valid to be used as a diagnostic screening instrument for AD (Baron-Cohen et al. 2001a, b).

**Table 2** Sample Autism Spectrum Quotient and Schizotypal Personality Questionnaire items

<b>Autism Spectrum Quotient</b>	<b>Schizotypal Personality Questionnaire</b>
Sample social skill items:	Sample interpersonal items:
15. I find my self drawn more strongly to people that to things. Disagree	15. I prefer to keep to myself. Yes
22. I find it hard to make new friends. Agree	24. I am mostly quiet when with other people. Yes
44. I enjoy social occasions. Disagree	43. I am poor at returning social courtesies and gestures. Yes
47. I enjoy meeting new people. Disagree	57. I tend to keep in the background in social situations. Yes
Sample communication items:	Sample disorganized items:
7. Other people frequently tell me that what I've said is impolite, even though I think it's polite. Agree	14. People sometimes comment on my unusual mannerisms and habits. Yes
17. I enjoy social chit-chat. Disagree	34. I often ramble on too much when speaking. Yes
26. I frequently find that I don't know how to keep a conversation going. Agree	67. I am an odd, unusual person. Yes
33. When I am on the phone, I'm not sure when it's my turn to speak. Agree	69. I find it hard to communicate clearly what I want to say to people. Yes
38. I am good at social chit-chat. Disagree	

Note that the direction of the response that endorses the characteristic is indicated after each item

### **Schizotypal Personality Questionnaire**

The Schizotypal Personality Questionnaire (Raine, 1991) is a 74 item, self-report measure designed to be useful in screening for SPD (see Table 2 for sample items). Raine et al. (1994) factor analyzed the SPQ and identified three factors: (1) cognitive-perceptual (from ideas of reference, magical thinking, unusual perceptual experiences, and paranoid ideation subscales), (2) interpersonal (from social anxiety, no close friends, constricted affect, and paranoid ideation subscales), and (3) cognitive-behavioral disorganization (from odd behavior and odd speech subscales; see Table 1 for the association of factors with diagnostic categories). These factors appear to be stable across age and gender (Fossati, Raine, Carretta, Leonardi, & Maffei, 2003). The cognitive-perceptual factor maps on closely to positive symptoms of schizophrenia, while



the interpersonal factor is similar to negative symptoms of schizophrenia which include social withdrawal, poverty of speech, and affective flattening. SPQ items are endorsed as yes or no with a maximum total score of 74. Coefficient  $\alpha$  is high (.91) for the overall measure and was also adequate for the 9 subscales (range .63–.81 across two samples). Test–retest reliability was .82, and discriminate validity and criterion validity were .63 and .68, respectively. Among participants who scored above the high cutoff (41) on the SPQ, 55% were diagnosed with SPD while none who were below the low cutoff were (Raine, 1991). In addition, all those who were high scorers on the SPQ who were not diagnosed with SPD partially met criteria for the disorder (Raine, 1991).

## Results

### AQ Characteristics

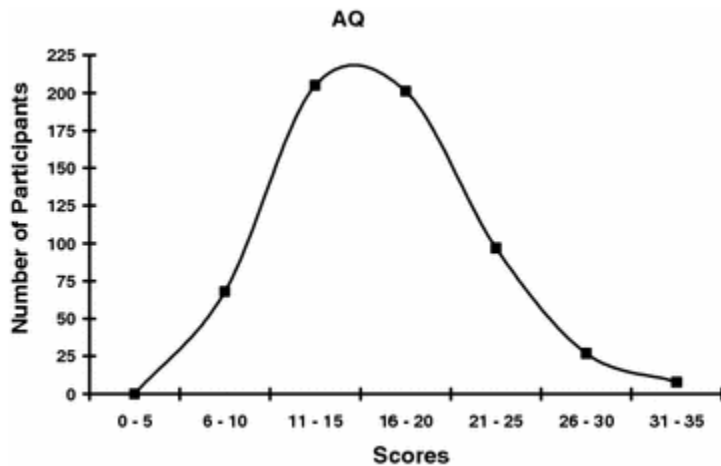
Table 3 presents the AQ total and domain scores separately by sex along with Cronbach’s  $\alpha$  and results of  $t$ -test gender comparisons. Due to the sample size and the large number of analyses computed, the  $\alpha$  level was set conservatively at .001 for all reported analyses in order to minimize Type I error and to reduce the likelihood of reporting statistically significant, but inconsequential findings. No significant sex differences were found for the total AQ total score or the domain scores. The mean AQ total score for males was 16.96 ( $SD = 5.28$ , Range = 6–34), and the mean AQ score for females was 16.59 ( $SD = 5.21$ , Range = 5–34).

**Table 3** Autism Spectrum Quotient and Schizotypal Personality Questionnaire Scale characteristics by gender

Scale	Males ( $n = 135$ )				Females ( $n = 472$ )				
	Mean	$SD$	Range	$\alpha$	Mean	$SD$	Range	$\alpha$	$t$ -test
AQ Total	16.96	5.28	6–34	.67	16.59	5.21	5–34	.67	ns
AQ Soc Skills	2.16	1.95	0–8	.64	2.20	1.97	0–10	.64	ns
AQ Att Switch	4.67	1.94	1–9	.50	4.72	1.84	0–10	.42	ns
AQ Att to Detail	5.21	2.26	1–10	.62	5.10	2.19	0–10	.61	ns
AQ Comm	2.30	1.68	0–7	.44	2.31	1.74	0–8	.49	ns
AQ Imagination	2.61	1.73	0–9	.43	2.26	1.53	0–7	.34	ns
SPQ Total	24.34	13.10	0–57	.93	22.89	12.28	0–57	.92	ns
SPQ F1 Cog-Per	10.84	6.48	0–26	.87	10.74	6.62	0–29	.88	ns
SPQ F2 Interper	10.47	6.68	0–26	.88	9.10	6.37	0–29	.89	ns
SPQ F3 Disorg	4.94	3.34	0–13	.86	4.64	3.11	0–15	.84	ns

*Note:* AQ = Autism Spectrum Quotient; SPQ = Schizotypal Personality Questionnaire; Cog-Per = cognitive perceptual; Interper = interpersonal; Disorg = disorganized

The distribution of all total scores on the AQ was examined for normality (see Fig. 1). The skewness was .48 and kurtosis was .15, indicating that the distribution of AQ scores was normally distributed across this sample of participants.



**Fig. 1** Distribution of Autism Spectrum Quotient (AQ) scores for the 607 participants who completed the measure

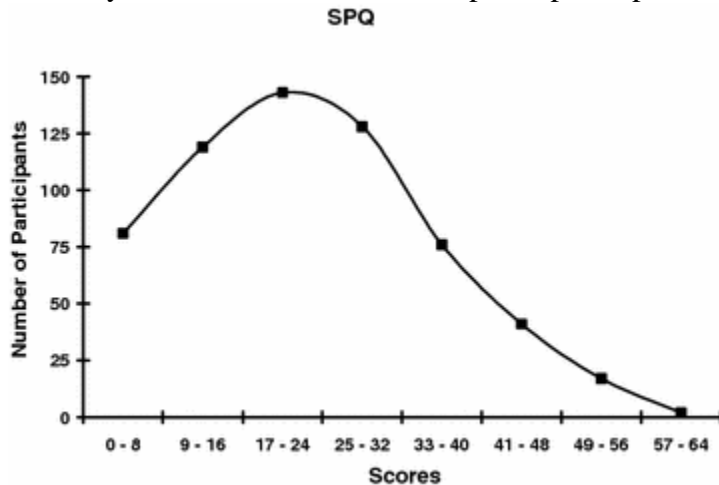
Ten percent of the participants (61) obtained scores  $\geq 24$ . Three participants (<1% of the total participants) had an AQ total score  $\geq 32$ , the score suggested by Baron-Cohen et al. (2001a, b) as the cut score for recommending assessment for possible AD. Cronbach's  $\alpha$  coefficients were computed to assess for internal consistency of the AQ and each of the domains assessed by the scale. For the AQ total, Cronbach's  $\alpha$ s were identical for males and females ( $\alpha = .67$ ). This value indicates a moderate to low level of internal consistency for the AQ on the whole. The domain scores yielded Cronbach's  $\alpha$  values that were at moderate to low levels for both the male and female participants, and the pattern of  $\alpha$  values across the domains was similar for both genders. For males, the  $\alpha$  for domain scores varied between a high of .64 (social skills) and a low of .43 (imagination), and between a high of .64 (social skills) and a low of .34 (imagination) for females. The internal consistency for domain scores was moderate for the social skills and attention to detail domains and low for the attention switching, communication, and imagination domains.

### SPQ Characteristics

Table 3 presents the SPQ total and factor scores separately by sex along with Cronbach's  $\alpha$  and results of *t*-test gender comparisons. No gender differences were detected for the total or factor scores. The mean SPQ total score for males was 24.34 ( $SD = 13.10$ , Range = 0–57), and the mean SPQ score for females was 22.89 ( $SD = 12.28$ , Range = 0–57). Ten percent of the participants (61) obtained scores  $\geq 41$ . Cronbach's  $\alpha$  coefficients were computed for the SPQ and each of its factors. For the SPQ total, Cronbach's  $\alpha$ s were almost identical for males and females ( $\alpha = .93$  for males,  $\alpha = .92$  for females). These  $\alpha$  values indicate a high level of internal consistency for the SPQ total score. Cronbach's  $\alpha$  values for the SPQ factors were also high for both the male and female participants. For males, the  $\alpha$  for the factor scores varied between .88 (Interpersonal) and .86 (Disorganization) and between .89 (Interpersonal) and .84

(Disorganization) for females. The  $\alpha$  values for factor scores suggest that the SPQ factor scales have a high level of internal consistency.

The distribution of all total scores on the SPQ was examined for normality (see Fig. 2). The skewness was .37 and kurtosis was  $-.42$ , indicating that the distribution of SPQ scores was normally distributed across this sample of participants.



**Fig. 2** Distribution of Schizotypal Personality Questionnaire (SPQ) scores for the 607 participants who completed the measure

Of the three participants identified as being above the cut score of 32 on the AQ, one obtained an SPQ score that was greater than one *SD* above the mean (SPQ score = 43). The other two participants obtained SPQ scores of 23 and 22. Fifteen participants (2.5% of the total) were in the high scoring 10% of participants on both the AQ and the SPQ.

### Correlational Analyses

Correlational analyses of the AQ and SPQ were completed separately for males and females and were found to be substantively the same, so males and females were combined for this analysis. Zero order pairwise correlations were completed between the AQ and SPQ total scores and the five AQ domains and the three SPQ factors (see Table 4). As hypothesized, the AQ and SPQ total scores were moderately positively correlated ( $.47, P < .001$ ) and the SPQ total score was more highly correlated with the AQ Social Skills domain than with the other domains. The SPQ Interpersonal Factor was more strongly associated with the AQ total score, the AQ Social Skills domain, and the Communication domain. In addition, all of the AQ domains except the Imagination domain were also positively correlated with the SPQ total score ( $P < .001$  for each correlation coefficient). The SPQ Cognitive-Perceptual Factor, when compared to the AQ domains, was most highly correlated with the AQ Attention to Detail and Communication domains ( $.23$  for both domains,  $P < .001$ ), although there was also a less strong, though significant correlation between the SPQ Cognitive-Perceptual Factor (positive symptoms) and the AQ Attention Switching domain ( $.16, P < .001$ ). The SPQ Interpersonal Factor (negative symptoms) yielded moderate correlation coefficients with the AQ Social Skill, Communication,

and Attention Switching domains (.48, .44, .33, respectively; for all,  $P < .001$ ). In addition, there was a weak, but significant correlation between the SPQ Interpersonal Factor and the AQ Imagination domain (.17,  $P < .001$ ). The SPQ Disorganization Factor was most highly correlated with the AQ Communication domain (.37,  $P < .001$ ), although it was also significantly positively correlated with the AQ Social Skills and Attention to Details domains (.17 and .18, respectively; for both,  $P < .001$ ).

**Table 4** Table of zero order correlations of Autism Spectrum Quotient and Schizotypal Personality Questionnaire scores based upon the total scores and domain/factor scores for each measure for the total sample

	1	1a	1b	1c	1d	1e	2	2a	2b	2c
1. AQ Total	–									
a. AQ Social Skills	.69*	–								
b. AQ Attention Switching	.59*	.28*	–							
c. AQ Attn to Detail	.41*	.02	–.03	–						
d. AQ Communication	.69*	.49*	.29*	.05	–					
e. AQ Imagination	.43*	.15*	.14*	–.08	.16*	–				
2. SPQ Total	.47*	.35*	.27*	.19*	.43*	.06	–			
a. SPQ Factor 1 (Cog-Per)	.25*	.09	.16*	.23*	.23*	–.04	.86*	–		
b. SPQ Factor 2 (Interper)	.53*	.48*	.33*	.09	.44*	.17*	.86*	.60*	–	
c. SPQ Factor 3 (Disorg)	.32*	.17*	.13	.19*	.37*	.02	.78*	.68*	.47*	–

*Note:* AQ = Autism Spectrum Quotient; SPQ = Schizotypal Personality Questionnaire; Cog-Per = cognitive perceptual; Interper = interpersonal; Disorg = disorganized

\* Indicates pairwise correlations with  $P < .001$

No relationship was found between the SPQ Cognitive Perceptual and Disorganized factors when compared to the AQ Social Skills and Imagination domains. There was also no correlation found between the SPQ Interpersonal Factor and the AQ Attention to Detail domain.

### Semi-partial Correlations

Although Table 4 indicates strong overlap among AQ and SPQ scales, these correlations do not assess the independent contributions of other variables aside from the two included in the

correlation. To account more clearly for the shared variance of the SPQ and the AQ, semi-partial correlations were computed between each SPQ factor and the AQ domains, controlling for the variance accounted for by the other SPQ factors. In each case, the semi-partial correlation was computed for one of the SPQ factors and one of the AQ domains, while partialing out the variance associated with the other two SPQ factor scores. Thus, the contributions of other SPQ scales other than the scale under question were eliminated. Table 5 presents the semi-partial  $r^2$  for each of the domains of the AQ. In essence, this creates an “equal horse race” between each of the domains, while controlling for the other domains. As hypothesized, the SPQ interpersonal factor accounted for a significant increment in the variance of the AQ total score, and in the Social Skills, Attention Switching, Communication, and Imagination domain scores (the  $\beta$ s were all positive). We hypothesized little relationship between the SPQ Cognitive-Perceptual factor (a proxy of positive symptoms) and AQ domains. As hypothesized, the SPQ Cognitive-Perceptual factor accounted for modest increment in the variance associated with the Attention to Detail AQ domain. Further, there were significant, but small, increments in the variance accounted for by the SPQ Cognitive-Perceptual factor and the Social Skills, Communication, and Imagination AQ domains, separately, and all of these  $r^2$ s had negative  $\beta$  values. The SPQ Disorganized factor accounted for a significant increment in the variance of the AQ total score and in the AQ Communication domain (the  $\beta$ s were positive).

**Table 5** Semi-partial  $r^2$  of the Schizotypal Personality Questionnaire factors and Autism Spectrum Quotient Domains with remaining Schizotypal Personality Questionnaire factors partialled out

Schizotypal Personality Questionnaire	Autism Spectrum Quotient					
	Total	Social skills	Attention switching	Attention to detail	Communication	Imagination
F1 (Cog-Per)	.025* (-)	.070* (-)	.001	.022* (+)	.033* (-)	.026* (-)
F2 (Interper)	.209* (+)	.275* (+)	.082* (+)	.005	.120* (+)	.056* (+)
F3 (Disorg)	.023* (+)	.009	.000	.003	.065* (+)	.001

*Note:* Each value represents the semi-partial  $r^2$  of an AQ domain score and one SPQ domain score with the variance associated with the other two scores partialled out. Where the change is significant, the sign of the  $\beta$  value is indicated with a “-” or “+” sign. SPQ = Schizotypal Personality Questionnaire; AQ = Autism Spectrum Quotient; Cog-Per = cognitive-perceptual; Interper = interpersonal; Disorg = disorganized

\*  $P < .001$

## Discussion

The present study sought to assess clinical characteristics of AD and SPD in a non-clinical sample of adults. The primary goal was to examine the relationship and overlap between features of the two conditions. Consistent with earlier results (Baron-Cohen et al., *2001a*; Raine, *1991*) the characteristics of the two conditions were found to be normally distributed among participants. As hypothesized, SPD and AD characteristics, on the whole, were significantly positively correlated, as were the AQ Social Skills domain with the SPQ Interpersonal factor and the AQ communication domain with the SPQ disorganized factor. These results indicate that there is an overlap between Asperger and Schizotypal traits in the expected areas; i.e., social overlaps with interpersonal and communication overlaps with disorganized. Results of the semi-partial  $r^2$  analysis show that the strong positive relationship between the SPQ Interpersonal factor and the AQ Social Skills domain clearly stands out from all other possible combinations of domains and factors, including the modest relationship between the SPQ Cognitive-Perceptual factors and all of the other AQ domains except for the AQ Attention Switching domain which was unrelated to the SPQ Cognitive-Perceptual factor. In addition, the SPQ Disorganized factor relates only to the Communication domain of the AQ, and this relationship appears to be modest and less strong than the relationship between the AQ Communication domain and the SPQ Interpersonal factor.

These results should be interpreted with the caution because the internal consistency of the AD domains was relatively low and was not as strong as that found by Baron-Cohen et al. (*2001a*).

## Clinical Significance of Findings

### Diagnosis of AD

The diagnosis of AD in adults is typically and appropriately based on multiple sources of information, including early developmental history, information from informants, performance on formal assessments [e.g., the Adult Diagnostic Observation Schedule (Lord et al., *1989*)], and patient interview. The AQ, earlier identified as a screening instrument by Baron-Cohen et al. (*2001a*), was found here to have only moderate to low internal consistency with our sample of US college students. This level of internal consistency is inconsistent with previous findings with UK college students (Baron-Cohen et al., *2001a*). This leads to an important caveat with respect to its clinical utility, at least with respect to its use in the US, as a screening tool. Specifically, those who use the AQ to screen potential AD patients should use it with extreme caution. It is possible that cultural influences could account for the discrepancies between the current findings and those of Baron-Cohen et al. (*2001a*), but future research is needed to answer this question. Despite the psychometric properties of the AQ in our sample, our findings, based on descriptive similarities we identified in the DSM (see Table 1), empirically demonstrate that there is overlap between AD and SPD. Assessment (screening) measures such as the SPQ and AQ, used together, may provide more reliable differential diagnostic information by assessing both overlapping and non-overlapping traits. Regardless of the exact methods used in assessment, our results would suggest that when evaluating an individual for possible AD, the practitioner should assess for positive symptoms of schizophrenia as part of the differential diagnostic routine.

## **Implications**

### **The Relationship Between AD and SPD**

These findings have implications for conceptualizing schizophrenia and autism spectrums; i.e. whether or not they exist on distinct or separate spectra. While both AD and SPD are considered separate diagnoses, they share traits at a descriptive level (see Tables 1, 2) and according to our semi-partial correlations (see Table 5). This relationship has clinical implications if considering whether there are actually two distinct spectra. Consider, first, what would be the case if the two disorders, usually thought of as being members of two distinct spectra, were members of the same spectrum. If so, it may be that the behavioral phenotypes as described in the *DSM IV* would in fact be one and the same although they come to appear different when positive symptoms emerge in some cases. Consider, on the other hand, what would be the case if the disorders actually do come from two different spectra. If so, it may be that at some point in the developmental course of the two disorders, they may appear almost identical, and in fact, individuals on the two spectra who become “stuck” within this behaviorally similar period may never be able to be differentiated based upon behavioral tests, alone.

### **Future Directions**

While this study sought to compare behavioral traits of AD and SPD, additional comparisons of AQ performance with performance on other measures of schizotypy would be helpful in determining the validity of the findings reported here. In addition, research that compares other portions of the schizophrenia spectrum (e.g., schizoid traits) to AD, could be useful in further clarifying distinctions between the two disorders. Our comparison of AD and SPD showed that the relationship between their social skills dimensions, as measured by the AQ and SPQ, was not perfect. Thus, an analysis of the specific kinds of social skill deficits associated with each disorder may lead to better specification of those differences. Our comparison also revealed a low relationship between the AQ Attention Switching and Attention to Detail domains and the SPQ factors, it would be important to determine the relationship between these domains and behavioral measures of attention that relate not only to AD but to other aspects of schizophrenia spectrum disorders not measured by the SPQ. Finally, if research continues to demonstrate overlap between AD and schizophrenia spectrum disorders, it is likely that a more comprehensive assessment of the relationship between the autism and schizophrenia spectra using multiple methods will eventually be warranted (i.e., a multi-trait, multi-method research approach that could culminate in the comparison of clinical samples from both spectra) to not only to improve upon the distinction between the two disorder but to improve our conceptions of the schizophrenia and autism spectra.

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