MMPI-2 Personality Profiles of High-Functioning Adults With Autism Spectrum Disorders

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The Minnesota Multiphasic Personality Inventory–Second Edition was administered to 20 adults with autism spectrum disorders (ASD) who fell in the average to above average range of intelligence and 24 age-, intelligence-, and gender-matched college students. Large group differences, with the ASD group scoring higher, were found on the L validity scale, Clinical Scales 2 (D) and 0 (Si), Content scale Social Discomfort (SOD), Supplementary scale Repression (R), and Personality Psychopathology Five (PSY-5) scale INTR (Introversion). The proportion of ASD adults scoring in the clinical range on these scales was between 25% and 35%. High scores on these scales are consistent with the clinical picture of Asperger syndrome and high-functioning autism in adulthood. Future directions and implications for identifying adults in need of a specialized autism assessment are discussed.

Keywords: personality; MMPI-2; autism; Asperger syndrome; diagnosis

This study explored personality and psychopathology in adults diagnosed with autistic disorder or Asperger disorder. Autism involves impairments in social interaction, communication, and behaviors and interests. In the social domain, symptoms may include impaired use of nonverbal behaviors (e.g., eye contact, facial expression, gestures) to regulate social interaction, failure to develop age-appropriate peer relationships, little seeking to share enjoyment or interests with other people, and limited social-emotional reciprocity. Communication deficits include delay in or absence of spoken language, difficulty with conversational reciprocity, idiosyncratic or repetitive language, and imitation and pretend play deficits. In the behaviors and interests domain, there are often encompassing, unusual interests, inflexible adherence to nonfunctional routines, stereotyped body movements, and preoccupation with parts or sensory qualities of objects (American Psychiatric Association, 2000). To meet criteria for autistic disorder, an individual must demonstrate at least 6 of these 12 symptoms, with at least 2 coming from

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the social domain and 1 each from the communication and restricted behaviors/interests categories; symptoms or delays must be present before 3 years of age. Some individuals who meet criteria for autistic disorder function intellectually in the average or better range; this subgroup is typically referred to as high-functioning autism (HFA).

The second diagnosis relevant to this article is Asperger disorder. This condition shares the social deficits and restricted, repetitive behaviors of autism, but language abilities are well developed and intellectual functioning is always average or better. The symptoms of Asperger disorder are identical to those just listed for autism, except that there is no requirement that the individual demonstrate any difficulties in the second category, communication. The main point of differentiation from autistic disorder, especially HFA, is that those with Asperger disorder do not exhibit significant delays in the onset or early course of language development. Communicative use of single words must be demonstrated by age 2 and meaningful phrase speech by age 3. Autistic disorder and Asperger disorder are the focus of this article; they will be referred to collectively as autism spectrum disorders (ASD).

Very little is known about the personality traits associated with ASD. Over the past several decades, the social, communication, and repetitive behavior deficits associated with ASD have been well described, and research continues to expand in these areas. The neuropsychological phenotype of ASD has also been carefully studied, and although questions remain regarding the core dysfunctions in this realm, the profile of assets and difficulties is fairly clear (Dawson, 1996; Happe & Frith, 1996). In contrast, little is known about the personality traits of individuals with ASD and their clinical or prognostic significance. Adult outcome in ASD is poor (Howlin, Goode, Hutton, & Rutter, 2004), but the factors predictive of outcome, especially in the higher-functioning end of the spectrum, are not well understood. Although variants of normal personality have been empirically associated with specific forms of psychopathology for many years (indeed, it is the basis on which the Minnesota Multiphasic Personality Inventory [MMPI] was developed), it is not clear how this may be applied to ASD. As one example of the potential of this approach, Nigg and colleagues (2002) used the self-report version of the NEO-PI-R to examine the links between personality traits and symptoms of attention deficit hyperactivity disorder (ADHD). They found that low Conscientiousness and low Agreeableness (two domains of the Big Five dimensions of personality; Costa & McCrae, 1990) were significantly associated with the ADHD symptoms of inattention-disorganization and hyperactivity-impulsivity (Nigg et al., 2002). Others have suggested relationships between personality and temperament traits (Rothbart & Ahadi, 1994; Rutter, 1987), indicating potential relevance to other behavioral dimensions with origins early in development, such as ASD.

The lack of empirical research using standard tests of personality with individuals who have ASD puts practitioners at a disadvantage when asked to conduct psychological assessments with this population. Little is known about how the symptoms of ASD are manifest on personality tests, making profile interpretation quite difficult. Only two studies with relevant data have been published. In one, the Temperament and Character Inventory, a self-rated personality questionnaire based on Cloninger's (1987) model of personality, was given to 31 adults with Asperger syndrome (Soderstrom, Rastam, & Gillberg, 2002). Relative to age- and sex-based norms, participants with Asperger syndrome scored significantly higher on harm avoidance and lower on self-directedness, cooperativeness, novelty seeking, and reward dependence. They also had significantly higher rarity scores, indicating a high level of idiosyncratic responses. This profile was interpreted as indicating "anxious personalities with coping difficulties in the areas of social interaction and self-directedness," a personality profile that corresponds well with the clinical picture of Asperger syndrome. A second empirical study of personality characteristics in ASD focused on paranoia. On a scale derived from MMPI paranoia items, participants with Asperger syndrome scored significantly higher than controls (Blackshaw, Kinderman, Hare, & Hatton, 2001). No other empirical research using personality inventories with people with ASD has been published to date.

Although little has been written about the relationship of ASD and personality, phenotypic similarities between Asperger syndrome and both schizoid and obsessive-compulsive personality disorders have been noted (Bejerot, Nylander, & Lindstrom, 2001; Gillberg, 1995; Rutter, 1987; Wolff, 1998). Furthermore, certain approaches to processing information that are often seen in ASD, including an orientation to detail and a drive to analyze and construct systems (Baron-Cohen, Richler, Bisarya, Gurunathan, & Wheelwright, 2003; Happe, 1999), have been cast as stylistic propensities somewhat akin to personality traits.

There has also been some research on the personality characteristics of the family members of individuals with ASD. Parents and siblings sometimes display difficulties that are qualitatively similar to ASD but far milder, in the subclinical range; these difficulties have collectively been labeled the broader autism phenotype (BAP). Such traits occur in 15% to 45% of family members (Bailey, Palferman, Heavey, & LeCouteur, 1998) and are thought to indirectly index a family's genetic liability to ASD. One study using the Modified Personality Assessment Scale found a significant increase in the expression of anxious, impulsive, shy,

aloof, oversensitive, irritable, and eccentric traits in parents and siblings of individuals with ASD, relative to family members of individuals with Down syndrome (Murphy et al., 2000). Factor analysis revealed group differences in two factors related to social function ("withdrawn" and "difficult") and one related to psychiatric function ("tense"). Using the same instrument, the Modified Personality Assessment Scale, Piven et al. (1994) reported higher rates of three characteristics, "aloof," "untactful," and "undemonstrative," in parents of children with autism relative to parents of children with Down syndrome. Using the NEO-PI, an instrument developed to measure normal dimensions of personality according to the five-factor model, Piven et al. (1997) also found that autism parents rated significantly higher than parents of children with Down syndrome in the neuroticism domain. Elevated rates of both depression and anxiety are also reported by the parents of people with ASD (Lainhart, 1999). The high heritability of both ASD (Bailey et al., 1995; International Molecular Genetic Study of Autism Consortium, 2001) and personality traits (Loehlin, McCrae, Costa, & John, 1998) suggests that individuals with ASD may demonstrate patterns similar to family members on personality profiles.

Many individuals with ASD suffer from some degree of mental retardation, but approximately 25% demonstrate intelligence in the average range or above. It is for these individuals that the evaluation of personality is most feasible. The diminished self-insight and ability to describe internal states that are part of the ASD phenotype may limit the use of self-report measures. One recent study, however, found that adolescents and adults with Asperger syndrome were comparable to controls on a measure of "private self-consciousness," defined as "attention to the private aspects of the self, such as feelings and motives" (Blackshaw et al., 2001). Autobiographical writings of adults with Asperger syndrome reveal awareness of interpersonal and socioemotional difficulties (Happe, 1991; Spicer, 1998). Although indirect, this work suggests that there may be some ability to introspect and, therefore, to accurately report on dimensions of personality.

It may be useful to explore the personality and psychopathology profiles of adults with ASD for a number of reasons. First, it will help expand our understanding of the phenomenology of ASD and flesh out a heretofore unexplored facet of the phenotype. Second, it may assist in interpretation of profiles for individuals known to have ASD. For example, the test interpreter might comment on how similar to or different from a common ASD profile a given individual's scores are, interpreting scores that are higher than the ASD average or elevations that fall in different areas than those typically associated with ASD. Third, it may shed light on risk factors (e.g., what is transmitted in families), developmental origins, adult manifestations, correlates, and outcomes of ASD. Finally, it may be useful in treatment planning. Toward this end, we administered the MMPI-2, the most widely used measure of personality and psychopathology in the United States, to a group of adults with high-functioning autism and Asperger syndrome and a comparison sample of college students matched on age, gender, and IQ.

METHOD

Participants

The initial pool of participants included 21 adults with ASD and 25 adult community controls. All participants were at least 18 years of age. The adults with ASD were recruited from the University of Utah Child and Adolescent Specialties Clinic and were compensated for their participation with $20. All had been diagnosed with autistic disorder or Asperger disorder according to the *Diagnostic and Statistical Manual of Mental Disorders, fourth edition* (DSM-IV; American Psychiatric Association, 1994) by the first or last author, both of whom have expertise in ASD diagnosis. Each participant also met criteria for autism (cutoff = 10) or ASD (cutoff = 7) on the Autism Diagnostic Observation Schedule algorithm, Module 4, the gold standard measure for the diagnosis of ASD. All fell in the range indicative of high-functioning ASD by achieving Full Scale IQs above the range of mental retardation (≥ 70) on the Wechsler Abbreviated Scale of Intelligence (WASI). Eight of the participants in the ASD group were diagnosed with a comorbid psychiatric condition, in addition to ASD (3 with major depression, 2 with an anxiety disorder, 2 with both major depression and an anxiety disorder, and 1 with ADHD). One participant in the ASD group, a male, produced an invalid MMPI-2 profile (Cannot Say scale ≥ 30) and was excluded from further analyses. Thus, the final sample size for the ASD group was 20.

The control group was recruited from an introductory psychology class at the University of Utah. For participation, those in this group received extra credit toward their grade in this class. Potential participants were assessed with the WASI and matched to the group with ASD on Full Scale IQ, as well as on age and gender. During intellectual testing, potential participants were screened for signs of autism spectrum disorders using a checklist of *DSM-IV* symptoms. No potential control participants were excluded for demonstrating signs of ASD. No assessment of other psychiatric disorders was conducted for members of the control sample. One participant in the control group, a female, produced an invalid MMPI-2 profile (True Re-

sponse Inconsistency scale [TRIN] ≥ 80) and was excluded from further analyses. Thus, the final sample size for the control group was 24.

Measures

MMPI-2 (Butcher et al., 2001). The MMPI-2 consists of 567 self-report items, which are rated by the participant as true or false. Scores are summarized into 9 validity scales and 10 clinical scales; a number of additional content and supplementary scales can also be scored. Raw scores are converted to *T* scores ($M = 50$, $SD = 10$) relative to normative data (Butcher et al., 2001). Scores of 65 or above are considered to be in the clinically significant range. The MMPI-2 was completed by all participants.

WASI (Wechsler, 1999). This intelligence test is appropriate for individuals aged 6 to 89. It consists of four subtests that are summarized in three IQ scores: Verbal, Performance, and Full Scale IQ. Scores on the WASI correlate highly with other Wechsler tests and provide a valid and reliable estimate of intelligence (Wechsler, 1999).

Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2000). The ADOS is a standardized interview and observational assessment that measures social and communicative behaviors diagnostic of ASD. It is widely used in studies of autism and requires extensive training and achievement of 80% reliability with criterion ratings. The first and last author, both of whom are trained to reliability on the instrument, administered all ADOS protocols. Algorithm scores for social and communication symptoms corresponding to *DSM-IV* criteria are obtained. A cutoff of 7 is indicative of an autism spectrum diagnosis (such as Asperger syndrome), whereas a cutoff of 10 indicates the full clinical picture of autistic disorder. The ADOS demonstrates good reliability and validity when used by trained examiners and differentiates well between individuals with ASD and those with other developmental disabilities (Lord et al., 2000).

RESULTS

There were no significant group differences in Verbal, Performance, or Full Scale IQ, age, ethnicity, or gender. Significantly more participants in the control group than the ASD group were living outside the parental home. The control group had a significantly higher level of educational attainment than the ASD group (see Table 1).

Because the sample sizes in this study were modest and this investigation is exploratory and descriptive in nature, effect sizes (e.g., the magnitude of the group differences), *d*s, are reported, rather than statistical significance. After Cohen (1992), we categorize effects of 0 to .49 as small effects, .50 to .79 as medium effects, and .80 and above as large effects.

Table 2 displays group means and effect sizes for the Validity, Clinical, Content, Supplementary, PSY-5, and Restructured Clinical scales of the MMPI-2. On the Validity scales, there were large group differences on the Fb, Fp, and L scales, with the ASD group displaying higher scores than the control group. There was a medium size effect on the F scale, again higher in the ASD group.

On the Clinical scales, there were large group differences on scales 2 (D) and 0 (Si), and medium size group differences on scale 8 (Sc; both when *K* corrected and when not), with the ASD group displaying higher scores than the control group. In addition, there was a medium size effect on scale 9 (Ma; both when *K* corrected and when not), this time with higher mean scores in the controls. Because five individuals with ASD were also diagnosed with major depression, the size of the group difference on Scale 2 was recalculated, removing these participants from the analysis. The size of *d* now fell in the medium range, .68, with the ASD group still higher on this scale than the controls.

On the Content scales, there was a large group difference on the Social Discomfort (SOD) scale and medium group differences on the Low Self-Esteem (LSE), Work Interference (WRK), and Negative Treatment Indicators (TRT) scales, in all cases with the ASD group displaying higher scores than the control group. On the Supplementary scales, there were large group differences on the Repression (R), MacAndrew Alcoholism–Revised (MAC-R), and Addiction Potential (APS) scales, and medium group differences on the Anxiety (A) and Ego Strength (Es) scales. The ASD group had a higher mean score than the control group on the R and A scales and lower mean scores than the control group on the MAC-R, APS, and Es scales. On the PSY-5 scales, there were large group differences on the Aggressiveness (AGGR), Disconstraint (DISC), and Introversion (INTR) scales. The ASD group had a higher mean score than the control group on the INTR scale and lower mean scores than the control group on the AGGR and DISC scales. Finally, on the Restructured Clinical scales, there were no large-size group differences, but there were medium-size effects on the Demoralization (RCd), Low Positive Emotions (RC2), and Hypomanic Activation (RC9) scales, higher in the ASD group on the first two and higher in the control group on the latter scale. When the five individuals with ASD who also had major depression were removed from the analysis, the size of the group difference on RC2 fell to the small range, .36.

Table 3 contains the percentages of each group with scores in the clinically significant range ($T \geq 65$) on the Va-

TABLE 1
Demographic Characteristics of the Samples

	ASD Group			*Control Group*		
Age (in years)	23.0	(6.3)	18.0–40.0	20.9	(3.2)	18.0–29.0
Verbal IQ	104.3	(13.4)	75–127	109.1	(11.3)	82–134
Performance IQ	103.3	(18.9)	66–134	106.6	(11.0)	77–119
Full Scale IQ	104.7	(13.7)	73–129	109.2	(11.7)	82–127
Years of education	12.7	(1.2)	11–15	13.7	(1.6)*	12–19
ADOS algorithm score	11.8	(3.3)	6–18	NA		
Gender (% male)	85			75		
Ethnicity (% Caucasian)	90			96		
Living situation (% out of parental home)	15			63**		

NOTE: ASD = autism spectrum disorders; ADOS = Autism Diagnostic Observation Schedule. Values represent means (with standard deviations in parentheses) and ranges except where indicated.
*$p < .05$. **$p < .01$.

lidity, Clinical, Content, Supplementary, PSY-5, and Restructured Clinical scales. There were two scales (8 and PK [Post-traumatic Stress Disorder scale]) on which 40% of the ASD sample produced clinically significant elevations, three scales (0, OBS [Obsessiveness scale], and SOD) on which 35% did, six scales (L, 6, 7, ANX [Anxiety scale], WRK, and INTR) on which 30% did, and four scales (S, 2, R, and RCd) on which 25% were elevated.

Pearson product-moment correlations were calculated between chronological age, verbal IQ, years of education, ADOS algorithm scores, and all MMPI-2 scales on which medium or large group differences, with the ASD group higher, were evident. Defining effect size as the absolute value of the product-moment coefficient (Cohen, 1992), *r* values of .30 to .49 were considered medium-size effects, and *r* values of .50 or higher were considered large-size effects. Age was negatively related to Fp ($r = –.41$) and L scores ($r = –.45$). Verbal IQ was negatively correlated with scales 0 ($r = –.54$), SOD ($r = –.31$), R ($r = –.34$), INTR ($r = –.44$), and RC2 ($r = –.45$). The ADOS algorithm score (in which higher values indicate more symptoms) was positively related to Scale 0 ($r = .45$), SOD ($r = .41$), R ($r = .33$), and INTR ($r = .51$) scores. This pattern of relationships indicates, in general, that the lower functioning an individual with ASD is (in terms of intelligence, autistic symptomatology, or age), the more different from normative values are his or her scores on the MMPI-2.

DISCUSSION

This is the first study using the MMPI-2 to study personality and psychopathology in adults diagnosed with an ASD who function in the average range of intelligence or better. We found that a group of adults with ASD had higher scores than a comparison group of college students matched on age, gender, and intelligence on several MMPI-2 scales, reflecting social isolation, interpersonal difficulties, depressed mood, and coping deficits. These results are consistent with the clinical picture of ASD, as reflected in the American Psychiatric Association's (2000) *DSM-IV-TR*. In addition, they further describe some of the difficulties experienced by this group that may have been less evident in previous research using other instruments. Therefore, the MMPI-2 appears to be both a valid and a valuable tool for use with this population.

We found large group differences and elevations in 25% of the ASD group on Clinical Scale 2 (D). High scores on this scale are typically associated with depressive symptoms. Difficulties with mood and depression are widely reported in people with ASD, and this is one of the most common comorbid psychiatric disorders for this group (Green, Gilchrist, Burton, & Cox, 2000; Kim, Szatmari, Bryson, Streiner, & Wilson, 2000; Lainhart, 1999; Lainhart & Folstein, 1994; Tantam, 2000; Tonge, Brereton, Gray, & Einfeld, 1999), so high scores on this scale are not surprising. Indeed, 5 participants with ASD were also diagnosed with major depression. Even when these individuals were omitted from the analyses, however, medium-size group differences from the comparison sample remained. This indicates that unhappiness and dysphoria may be an aspect of the behavioral phenotype of high-functioning ASD in adulthood, even when *DSM-IV-TR* criteria for a depressive disorder are not met. In addition, high scorers on this scale are described by Graham (1993) in this way:

> A lifestyle characterized by withdrawal and lack of intimate involvement with other people is common. High scorers tend to be described as introverted, shy, retiring, timid, seclusive. . . . They tend to be aloof and to maintain psychological distance from other people. . . . They often have a severely restricted range of interests. (p. 59)

TABLE 2
Group Differences on MMPI-2 Scales

Scale	*ASD Group*		*Control Group*		*Effect Size,* d
Validity scales					
VRIN	48.4	(9.7)	51.5	(10.4)	.31
TRIN	55.5	(4.1)	56.7	(7.6)	.21
CNS	3.9	(6.8)	2.3	(5.1)	.26
F	54.8	(14.4)	48.3	(10.0)	.54
Fb	53.5	(8.9)	46.6	(5.2)	.98
Fp	57.4	(10.2)	48.2	(8.2)	1.00
L	59.0	(12.0)	49.4	(9.7)	.89
K	50.7	(12.1)	52.3	(11.5)	.14
S	54.0	(12.5)	54.9	(9.2)	.06
Clinical scales					
1	50.8	(12.8)	51.4	(9.7)	.06
1 *K* corrected	52.4	(12.1)	53.4	(6.3)	.12
2	57.7	(11.7)	48.2	(9.3)	.91
3	51.7	(12.4)	51.9	(8.1)	.01
4	52.1	(12.0)	50.3	(8.3)	.18
4 *K* corrected	52.8	(11.8)	51.9	(8.5)	.12
6	56.5	(17.1)	53.9	(10.4)	.21
7	54.6	(14.5)	50.4	(13.5)	.28
7 *K* corrected	57.4	(14.4)	52.5	(10.6)	.39
8	59.6	(14.8)	51.4	(11.8)	.61
8 *K* corrected	63.3	(14.5)	53.8	(9.8)	.78
9	50.4	(12.8)	56.5	(11.0)	.52
9 *K* corrected	50.4	(12.4)	57.9	(12.0)	.62
0	57.5	(11.5)	45.5	(9.7)	1.14
Content scales					
ANX	52.5	(13.7)	48.6	(10.7)	.32
FRS	48.3	(11.2)	44.5	(6.9)	.42
OBS	55.0	(14.8)	47.9	(9.5)	.58
DEP	54.0	(13.7)	49.8	(11.8)	.35
HEA	50.3	(12.7)	52.6	(9.0)	.21
BIZ	53.6	(12.3)	52.8	(9.7)	.07
ANG	46.3	(10.0)	50.0	(10.0)	.37
CYN	48.8	(11.2)	47.2	(9.4)	.16
ASP	47.7	(9.5)	47.8	(9.8)	.00
TPA	45.8	(10.0)	47.6	(7.0)	.22
LSE	54.4	(9.9)	48.7	(8.9)	.60
SOD	58.1	(11.9)	45.7	(8.4)	1.22
FAM	51.0	(11.9)	48.8	(6.1)	.23
WRK	55.0	(12.4)	49.6	(8.2)	.56
TRT	54.6	(11.6)	47.8	(7.9)	.70
Supplementary scales					
A	54.1	(11.8)	48.0	(10.3)	.55
R	57.1	(11.1)	48.2	(7.5)	.96
Es	44.8	(11.2)	51.7	(10.1)	.65
Do	45.1	(8.6)	48.9	(8.2)	.45
Re	51.4	(10.0)	46.8	(8.9)	.49
PK	57.3	(15.0)	51.2	(12.4)	.45
O-H	54.1	(10.0)	53.0		.11
MAC-R	40.9	(8.5)	50.5	(8.7)	1.12
AAS	45.2	(7.4)	48.9	(8.6)	.46
APS	40.4	(8.9)	51.8	(10.1)	1.20
PSY-5 scales					
AGGR	42.3	(8.6)	50.0	(10.4)	.82
PSYC	54.1	(11.5)	49.5	(9.5)	.44
DISC	43.8	(8.2)	52.3	(8.5)	1.02
INTR	55.9	(14.5)	45.3	(7.6)	.95
Restructured clinical scales					
RCd	57.8	(13.4)	51.8	(9.6)	.51
RC1	51.5	(12.9)	53.7	(9.1)	.20
RC2	55.4	(16.0)	47.5	(7.3)	.67
RC3	48.0	(12.0)	46.8	(8.1)	.12
RC4	47.8	(9.0)	50.0	(9.2)	.25
RC6	57.1	(10.3)	53.5	(9.1)	.36
RC7	50.8	(12.1)	49.0	(9.8)	.16
RC8	54.3	(15.3)	52.0	(9.1)	.19
RC9	45.2	(11.4)	52.5	(9.3)	.72

NOTE: ANX = Anxiety scale; FRS = Fears scale; OBS = Obsessiveness scale; DEP = Depression scale; HEA = Health Concerns scale; BIZ = Bizarre Mentation scale; ANG = Anger scale; CYN = Cynicism scale; ASP = Antisocial Practices scale; TPA = Type A scale; LSE = Low Self-Esteem scale; SOD = Social Discomfort scale; FAM = Family Problems scale; WRK = Work Interference scale; TRT = Negative Treatment Indicators scale. A = Anxiety scale; R = Repression scale; Es = Ego Strength scale; Do = Dominance scale; Re = Social Responsibility scale; PK = Post-traumatic Stress Disorder scale; O-H = Overcontrolled Hostility scale; MAC-R = MacAndrew Alcoholism–Revised scale; AAS = Addiction Admission scale; APS = Addiction Potential scale; AGGR = Aggressiveness scale; PSYC = Psychoticism scale; DISC = Disconstraint scale; INTR = Introversion scale; RCd = Demoralization scale; RC1 = Somatic Complaints scale; RC2 = Low Positive Emotions scale; RC3 = Cynicism scale; RC4 = Antisocial Behavior scale; RC6 = Ideas of Persecution scale; RC7 = Dysfunctional Negative Emotions scale; RC8 = Aberrant Experiences scale; RC9 = Hypomanic Activation scale. Values represent means (with standard deviations in parentheses). For effect sizes, 0-.49 = small effects, .50-.79 = medium effects, ≥ .80 = large effects. Clinical Scale 5 and supplementary scales GM (Gender Role Masculine) and GF (Gender Role Feminine) were not scored because both samples contained both males and females. The supplementary Marital Dissatisfaction scale was not scored because it was not appropriate for this sample of unmarried adults. The supplementary College Maladjustment scale was not applicable to the ASD group and thus was not scored.

This description is very applicable to people with ASD and conforms well to the core features of the autism spectrum.

We also found higher scores than the control group and substantial rates of elevated scores on Clinical Scale 0 (Si), Content scale SOD, Supplementary scale R, and PSY-5 scale INTR. Collectively, these are associated with a constellation of behaviors that includes discomfort in social situations, social reservation and introversion, shyness, and social anxiety (Graham, 1993; Greene, 2000), all features of ASD. The low positive emotionality that is captured by the INTR (Harkness, McNulty, & Ben-Porath, 1995) and RC2 scales may also be consistent with the difficulty processing and talking about emotions that is a prominent feature of adults with ASD (Hill, Berthoz, & Frith, 2004). In addition, rigidity, inflexibility, and resistance to change have been associated with high scores on Scale 0 (Graham, 1993). These additional correlates fit well with both clinical descriptions of adults with

TABLE 3
Percentage of Autism Spectrum Disorders (ASD) and Control Groups With Significant Elevations

Scale	*ASD Group %*	*Control Group %*
Validity scales		
L	30	16.7
K	15	25
S	25	12.5
Clinical scales		
1	15	8.3
1 *K* corrected	15	8.3
2	25	0
3	15	0
4	10	4.2
4 *K* corrected	10	4.2
6	30	12.5
7	30	12.5
7 *K* corrected	30	16.7
8	40	12.5
8 *K* corrected	40	16.7
9	15	29.2
9 *K* corrected	20	29.2
0	35	4.2
Content scales		
ANX	30	8.3
FRS	5	0
OBS	35	4.2
DEP	15	12.5
HEA	15	4.2
BIZ	15	12.5
ANG	5	8.3
CYN	10	12.5
ASP	0	8.3
TPA	5	0
LSE	15	8.3
SOD	35	4.2
FAM	15	0
WRK	30	4.2
TRT	15	0
Supplementary scales		
A	20	12.5
R	25	4.2
Es	0	8.3
Do	0	0
Re	5	4.2
PK	40	12.5
O-H	15	12.5
MAC-R	0	4.2
AAS	5	4.2
APS	0	16.7
PSY-5 scales		
AGGR	5	8.3
PSYC	10	8.3
DISC	0	4.2
NEGE	15	12.5
INTR	30	0
Restructured clinical scales		
RCd	25	12.5
RC1	15	12.5
RC2	20	4.2
RC3	5	4.2
RC4	0	8.3
RC6	20	8.3
RC7	15	12.5
RC8	20	12.5
RC9	5	8.3

NOTE: ANX = Anxiety scale; FRS = Fears scale; OBS = Obsessiveness scale; DEP = Depression scale; HEA = Health Concerns scale; BIZ = Bizarre Mentation scale; ANG = Anger scale; CYN = Cynicism scale; ASP = Antisocial Practices scale; TPA = Type A scale; LSE = Low Self-Esteem scale; SOD = Social Discomfort scale; FAM = Family Problems scale; WRK = Work Interference scale; TRT = Negative Treatment Indicators scale; A = Anxiety scale; R = Repression scale; Es = Ego Strength scale; Do = Dominance scale; Re = Social Responsibility scale; PK = Post-traumatic Stress Disorder scale; O-H = Overcontrolled Hostility scale; MAC-R = MacAndrew Alcoholism–Revised scale; AAS = Addiction Admission scale; APS = Addiction Potential scale; AGGR = Aggressiveness scale; PSYC = Psychoticism scale; DISC = Disconstraint scale; INTR = Introversion scale; RCd = Demoralization scale; RC1 = Somatic Complaints scale; RC2 = Low Positive Emotions scale; RC3 = Cynicism scale; RC4 = Antisocial Behavior scale; RC6 = Ideas of Persecution scale; RC7 = Dysfunctional Negative Emotions scale; RC8 = Aberrant Experiences scale; RC9 = Hypomanic Activation scale. Because invalid profiles were dropped from the sample, no one scored in the clinically significant range on the Variable Response Inconsistency scale, True Response Inconsistency scale, and *F* (≥ 80), Fb (≥ 90), or Fp (≥ 100). For all other scales, the cutoff for a clinically significant elevation was ≥ 65.

Asperger syndrome and HFA (Ritvo, Ritvo, Freeman, & Mason-Brothers, 1994) and *DSM-IV-TR* criteria (American Psychiatric Association, 2000). Finally, anxiety is a correlate of Scale 0 elevations, and this is consistent with the high rate of comorbid anxiety disorders seen in ASD (Gillott, Furniss, & Walter, 2001; Kim et al., 2000; Muris, Steerneman, Merckelbach, Holdrinet, & Meesters, 1998).

This study also found medium-size group differences from the control sample and elevations in 30% to 40% of the ASD group on Scale 8 (Sc). Many of the correlates of high scores on this scale fall in the realm of psychosis, including delusions, hallucinations, and extreme cognitive disorientation. Such symptoms are rarely seen in conjunction with an ASD diagnosis. This is consistent with the low scores, few elevations, and similarity to controls on the Bizarre Mentation (BIZ) and Aberrant Experiences (RC8) scales. Scale 8 also measures social alienation and general maladjustment, which are the most likely explanations for the high rate of elevations and large group differences on this scale.

The finding that, at first glance, is least consistent with the clinical picture of ASD is the large group difference and high rate of elevation (30%) on the L scale. High scores are typically thought to reflect a desire to present a favorable impression by denying even minor personal flaws. Individuals with ASD are known for their honesty, however; deception is a particularly difficult cognitive

skill for this group due to their underdeveloped mental perspective-taking ability (Hughes & Russell, 1993; Sodian & Frith, 1992). Thus, high scores on L would appear incompatible with the ASD diagnosis. However, individuals with high scores on the L scale are also described as rigid and moralistic, with little or no insight, and little awareness of the consequences of their behavior on other people (Graham, 1993). Such limitations in insight and self- and other-awareness are primary features of ASD and are included in diagnostic tests (e.g., the ADOS). We believe that these aspects of the ASD phenotype are better explanations for the high L scores in participants in the ASD group than a defensive test-taking attitude. It is also of note that the vast majority of ASD participants yielded valid profiles (20 of 21 initially tested) and that there were very small group differences on the VRIN (Variable Response Inconsistency), TRIN, K, and S validity scales.

One of the only previous studies to examine personality in individuals with ASD found higher scores than controls on a paranoia scale that was composed of MMPI items (Blackshaw et al., 2001). We did not replicate that finding in this investigation. Group means on Scale 6 (Pa) were comparable, the effect size of the group difference was small (.21), and there was also only a small group difference on Ideas of Persecution (RC6), which measures similar content. It is worth noting that 30% of the ASD sample did have elevated scores on Scale 6. This is consistent with some of the correlates of high scores that are similar to the clinical picture of ASD, such as being moralistic and rigid and overemphasizing rationality (Graham, 1993). Difficulty talking about emotions is another correlate of high Scale 6 scores, and this may be consistent with the deficits in emotion processing seen in adults with ASD (Hill et al., 2004). We believe these are better explanations for the 30% rate of elevations on Scale 6 than paranoia and persecutory ideation.

In summary, there are striking similarities between the clinical picture of ASD and the correlates of the scales that were most often elevated or that produced the largest group differences from controls. The defining feature of ASD is social disability, and this sample of adults with ASD obtained higher than average scores on scales that reflect social discomfort and isolation. This suggests that the MMPI-2 accurately captures the ASD phenotype and may be a valid tool for measurement of both personality and psychopathology in this population. If future studies replicate these findings, this work may prove useful in profile interpretation for individuals already diagnosed with an ASD. For example, an examiner might comment on an examinee's similarities to and differences from an ASD profile, interpreting scores that are higher than the ASD average or elevations that fall in different areas than those typically associated with ASD. Another way in which the results of an MMPI-2 evaluation may be helpful is in treatment planning. Elevated scores on the SOD or WRK scales, for example, may suggest areas that need to be addressed in a social skills or vocational intervention.

This study had several limitations that are essential to note. The size of both samples was small, a clinical control group was not included, medication usage was not collected, and the college student comparison sample was not evaluated for psychopathology. It is essential that these results are replicated on an independent sample that is larger and includes other clinical conditions.

It is not uncommon for individuals with ASD to escape formal diagnosis until adolescence and adulthood, when they transition into more demanding social, educational, and vocational settings. As children, they often receive multiple incorrect or incomplete diagnoses, including ADHD, learning disabilities, obsessive-compulsive disorder, personality disorders, depression, and anxiety disorders (Myles, Simpson, & Johnson, 1995; Nylander & Gillberg, 2001). Without accurate diagnosis, appropriate treatment services are not offered to these individuals, who often languish for years in inappropriate therapies or school settings with no support (Spicer, 1998). As adults, outcome can be grim, even for high-functioning individuals, with few living independently and maintaining competitive employment (Howlin et al., 2004). Many of these individuals are seen by multiple providers who have little knowledge of ASD characteristics and little experience in screening for an ASD diagnosis. An important goal for future research is to identify indicators of risk for ASD on a standard assessment tool, such as the MMPI-2, often used by general practitioners performing general mental health evaluations. This will necessitate the use of multiple clinical comparison groups in future research and may be difficult to do without generating an unacceptably high false-positive rate. Nevertheless, we believe this is an important future goal, given the underidentification and undertreatment of adults with mild ASD symptoms.

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