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Zero Acquaintance Ratings of Broader Autism Phenotype (BAP) and Personality Traits in  
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Joyce Suh, PhD

University of Connecticut, 2015

Although Autism Spectrum Disorders (ASDs) have traditionally been considered a lifelong condition, there appear to be a subset of people who make such significant improvements that they no longer meet diagnostic criteria for autism. The current study examines whether these “optimal outcome” (OO) children and adolescents, despite losing their ASD diagnosis, exhibit Broader Autism Phenotype (BAP) traits and other personality traits that are more often found in those with ASD. Nine zero acquaintance raters evaluated the personality traits of children who have achieved “optimal outcomes” (n=22), high-functioning children with ASD (HFA; n=27), and their typically developing (TD) peers (n=23). HFA children were rated as significantly higher than OO and TD children on overall ratings of BAP traits (Aloofness, Pragmatic Language difficulties, and Rigidity), whereas OO children did not differ from TD children. Compared to HFA children, OO participants displayed a personality profile of higher Extraversion, Agreeableness, Conscientiousness, Openness, and lower Neuroticism. OO and TD children were indistinguishable in overall Big Five personality traits, with the exception of the Extraversion domain, where OO children were rated as *more* extraverted than TD children, and in the domain of Emotional Stability, where OO children were rated as potentially less emotionally stable than TD children. Greater observed extraversion in OO children is consistent with observations of more ADHD-like traits such as being more talkative and less inhibited. Regarding Big Five personality traits, Neuroticism best differentiated the HFA group from the OO and TD groups, whereas Extraversion best differentiated the OO group from the TD group.

Likewise, the BAP trait of Rigidity best differentiated the HFA group from the OO and TD groups, whereas the BAP traits of Aloofness, Pragmatic Language Deficits, and Rigidity could not reliably differentiate the OO group from the TD group. Overall, OO children are doing very well. However, residual ADHD-like symptoms could impact the quality of their relationships, and less emotional stability is associated with greater risk for psychopathology. It is recommended that these symptoms be explicitly evaluated in OO children and targeted for intervention.

Zero Acquaintance Ratings of Broader Autism Phenotype (BAP) and Personality Traits  
in Optimal Outcome (OO) Children with a History of Autism Spectrum Disorder (ASD)

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Doctor of Philosophy Dissertation

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## Zero Acquaintance Ratings of Broader Autism Phenotype (BAP) and Personality Traits in Optimal Outcome (OO) Children with a History of Autism Spectrum Disorder (ASD)

Autism Spectrum Disorder (ASD) is behaviorally defined by impairments in social interaction and communication, and restricted, repetitive interests and behaviors (American Psychiatric Association, 2013). ASD has traditionally been considered a lifelong condition; however, there are a subset of people who make such significant improvements that they no longer meet diagnostic criteria for ASD and score in the average range in standardized measures of cognition, language, adaptive behavior, and social skills (Fein et al, 2013; Fein, Dixon, Paul, & Levin, 2005; Helt et al., 2008; Kelley, Naigles, & Fein, 2010; Kelley, Paul, Fein, & Naigles, 2006; Sutter et al., 2007). These children are said to have attained an “optimal outcome” (OO). While not meeting diagnostic criteria for ASD, it is possible that these OO children retain milder traits associated with the Broader Autism Phenotype (BAP), such as aloofness, rigidity, and pragmatic language difficulties (Hurley, Losh, Parlier, Reznick, & Piven, 2007). Personality research suggests that people with autistic traits are more introverted and neurotic (Austin, 2005; Wakabayashi, Baron-Cohen, & Wheelwright, 2006), with some research also finding less agreeableness, conscientious, and openness to experience when compared with people with fewer characteristics associated with ASD (Austin, 2005; de Pauw, Mervielde, Van Leeuwen, & De Clercq, 2011; Fortenberry, Grist, & McCord, 2011; Schriber, Robins, & Solomon, 2014; Wakabayashi, Baron-Cohen, & Wheelwright, 2006). The current study examines whether OO individuals are perceived as having any residual Broader Autism Phenotype (BAP) traits, and whether they display a personality profile that is more similar to that of TD individuals, or individuals with ASD.

### **ASD and “Optimal Outcome”**

Recent studies, including longitudinal, cross-sectional, and case studies (e.g. Fein et al., 2013, 2005; Kelley et al., 2010; Lovaas, 1987; Perry, Cohen, & DeCarlo, 1995; Sallows & Graupner, 2005; Sutter et al., 2007; Zappella, 2010) have identified children who make such marked progress that they lose their ASD diagnosis. Although the precise factors that contribute to OO are unclear, features associated with better outcomes include: higher initial receptive language and non-verbal problem-solving; greater imitation skills; earlier age of diagnosis; intensive early intervention; and milder initial ASD presentation, especially in the social arena (Fein et al., 2013; Helt et al., 2008; Sallows & Graupner, 2005).

Because different definitions of “recovery” were used for different studies (e.g., Lovaas, 1987; Szatmari et al., 1989), Helt and colleagues (2008) introduced the term “optimal outcome” (OO), and provided operationalized criteria to characterize OO individuals. These individuals must no longer meet diagnostic criteria for an ASD, have a full scale IQ greater than 77, and be mainstreamed in a regular classroom and receive no more than one hour per week of speech, occupational or special educational services. Helt and colleagues (2008) estimated that between 3% and 25% of children originally diagnosed with an ASD lose the diagnosis and meet these “optimal outcome” criteria.

Studies have compared the profiles of children with OO, high functioning children with autism (HFA), and children with typical development (TD) to explore whether autistic features persist in the OO group and to establish which skills lag behind those of their peers. Residual deficits reported in a range of studies include attention problems, mild social deficits associated with impulsivity and immaturity, anxiety and tics, mild perseverative behaviors and interests, and subtle deficits in language functioning (Fein et al., 2013; Kelley et al., 2006; Naigles, Kelley, Troyb, & Fein, 2013; Piven, Harper, Palmer, & Arndt, 1996; Sallows & Graupner, 2005; Suh et



al., 2014; Zappella, 2010). However, no study to date has examined broader autism phenotype and personality characteristics of “optimal outcome” (OO) children.

### **The Broader Autism Phenotype (BAP)**

The term “broader autism phenotype” (BAP) was originally used to describe traits associated with ASD (e.g., social difficulties, communication deficits, rigidity) that are present in some relatives of people with ASD. These traits map onto diagnostic criteria for ASD and are considered to represent a milder phenotypic expression of a genetic vulnerability to autistic traits (Hurley et al., 2007). The Broad Autism Phenotype Questionnaire (BAPQ) has reliably distinguished parents of children with ASD with BAP traits, as they score higher on scales of aloofness, rigidity, and pragmatic language deficits compared to parents of children with ASD without significant BAP characteristics and parents of children without ASD. Other common traits that have been found to be more common in relatives of people with ASD include: shyness, sensitivity, neuroticism, eccentricity, and impulsivity (e.g., Murphy et al., 2000; Piven et al., 1997). The BAP has since been expanded to apply not only to relatives of people with ASD, but also to the general population. Research has found sex differences in BAP presentation: boys in the general population are more likely to score higher on autistic traits than girls (Williams et al., 2008), while fathers of children with ASD are more likely to be aloof and mothers are more likely to be rigid (Seidman, Yirmiya, Milshtein, Ebstein, & Levi, 2012).

### **Personality Studies in Individuals with ASD**

*Personality* is conceptualized as patterns of thinking, behaving, and feeling that develop from the interaction between one’s temperament and the environment (Cloninger, Przybeck, & Svrakic, 1991; Cloninger, Svrakic, & Przybeck, 1993). According to Cloninger’s biopsychosocial model, personality is divided into four dimensions of *temperament* and three

dimensions of *higher cognitive processes*. *Temperament* is frequently associated with innate characteristics that refer to internal emotional states that motivate people to act in certain ways (Cloninger, Przybeck, & Svrakic, 1991; Cloninger, Svrakic, & Przybeck, 1993). Cloninger identified the four temperament dimensions as: Novelty Seeking (e.g., impulsivity and irritability); Harm Avoidance (e.g., anxiety and pessimism); Reward Dependence (e.g., sociability and warmth); and Persistence (e.g., perseverance) (Cloninger et al., 1991). He identified the three character or “cognitive” dimensions as: Cooperativeness, Self-directedness, and Insightfulness. The Big Five Factor Model (FFM) has also been used extensively to categorize aspects of personality (John, Donahue, & Kentle, 1991; John & Srivastava, 1999). The “Big Five” personality traits have been identified as Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness to Experience, with people falling somewhere along a continuum for each of these traits. The model originated from earlier work to factor strongly-correlated personality traits (e.g., Norman, 1963; Tupes & Christal, 1992; see review by John & Srivastava, 1999). Although the traits have been reduced to five categories, the Big Five are considered to encapsulate more specific and distinct traits (John & Srivastava, 1999).

Researchers have evaluated temperament and personality characteristics that are more common in people with ASD than those without ASD. Kerekes and colleagues (2013) had parents of 1,886 twins rate their children (aged 9 to 12) on the Junior Temperament and Character Inventory (JTIC). They found that children with ASD displayed *more* characteristics associated with Harm Avoidance such as anxiety and pessimism and *fewer* characteristics associated with Reward Dependence, such as sociability and warmth, when compared to control pairs. Children with ASD were also less self-directed and less cooperative. Research with adults with ASD has produced similar results, with high Harm Avoidance and low Reward Dependence

and low Self-directedness and Cooperativeness, in addition to low Novelty Seeking (Anckarsäter et al., 2006).

Fortenberry, Grist, and McCord (2011) conducted a preliminary study of Big Five personality characteristics in children ages three to five with and without ASD by having the children's parents rate them using the M5-PS-45 Questionnaire, a five-factor personality measure for preschool children. According to analyses with a small sample (eight ASD and seven typically-developing children), children with ASD scored lower in Extraversion, Conscientiousness, and Openness to Experience than their typically developing peers. There was no significant difference in Agreeableness and Neuroticism at this age with this small sample. Furthermore, Schriber and colleagues (2014) evaluated personality traits using the Big Five Inventory (BFI) in children (aged 8-18) as well as adults (aged 18-40). They found that both children and adults displayed a profile of low Extraversion, Agreeableness, Conscientiousness and Openness, and high Neuroticism, a potentially distinct personality profile in individuals with ASD. This is a personality profile that has also been found by De Pauw and Mervielde (2010). Furthermore, Schriber and colleagues (2014) found that the degree of neuroticism was the best predictor of whether the child or adult belonged to the "typically developing" or ASD group.

### **Personality Studies in Individuals with Autistic Traits in the General Population**

The relationship between autistic traits and personality characteristics has also been examined in the general population. Austin (2005) administered the Autism Spectrum Quotient (AQ; Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001), a short Asperger's screening questionnaire, and the Personality Minimarkers questionnaire (Saucier, 1994), an abbreviated measure of the Big Five personality traits, to a non-clinical group of college students. They found that those who had higher AQ scores were more likely to rate themselves

as higher in Neuroticism and lower in Extraversion and Agreeableness. Wakabayashi, Baron-Cohen, and Wheelwright (2006) studied 320 non-autistic college students and found slightly different results: like the previous study, those who scored high on the AQ were more likely to be high in Neuroticism and low in Extraversion, but in this study they were also lower in Conscientiousness.

Robinson and colleagues (2012) studied 12-year-old children from 5,944 twin pairs in the general population who scored in the top 5% on each of three subscales of the Childhood Autism Spectrum Test (CAST; Scott, Baron-Cohen, Bolton, & Brayne, 2002): social impairment (SI), communication impairment (CI), and restricted, repetitive behaviors and interests (RRBIs). They found that autistic traits were moderately to highly heritable (0.58 to 0.88). Likewise, Ronald, Happé, Price, Baron-Cohen, and Plomin (2006) studied eight year olds, but found that while Social Impairment, Communication Impairment, and Restricted and Repetitive Behavior and Interests were highly heritable as individual factors, there was weak overlap among the three features in the general population. Other autistic traits endorsed by non-clinical groups have included: poorer social skills, greater attention to details and patterns, poorer communication skills, poorer attention switching, and poorer imagination (e.g., Wakabayashi et al., 2006). Constantino and Todd (2003) studied non-autistic twins and found that autistic traits as measured by the Social Responsiveness Scale (SRS) were continuously distributed in the general population and fit a skewed normal distribution. Because of the distributed nature of autistic traits in the general population, researchers have postulated that autistic traits may be a sixth dimension of personality (Constantino, 2011; Constantino et al., 2004; Wakabayashi et al., 2006).

### **Importance of Studying the BAP and Personality**

BAP and personality are important areas of study. Constantino (2011) argues that studying “autistic traits” as an extra dimension of personality could be particularly revealing, as autistic traits have been found to be inherited and to impact a person’s social behavior, others’ social responses to the individual, and the quality of his or her relationships. Kerekes and colleagues (2013) studied personality traits in ASD and ADHD and hypothesized that genes give rise to specific phenotypes that, at the extremes, manifest as neurodevelopmental disorders as well as personality traits. They suggested that personality and temperament measures could be used to tailor treatment to the individual’s strengths and weaknesses. For example, a person with personality characteristics related to less self-directedness and cooperativeness could have these features targeted for intervention. Finally, researchers have suggested that having traits associated with ASD could increase one’s risk for a personality disorder, which in turn could lead to secondary psychopathology (Anckarsäter et al., 2006; De Pauw, Mervielde, Van Leeuwen, & De Clercq, 2011). For example, Paranoid Personality Disorder and Schizotypal Personality Disorder are characterized by odd, eccentric, and reclusive behavior, while Avoidant Personality Disorder is characterized by social isolation and anxiety in social situations. Likewise, Obsessive-Compulsive Personality Disorder is characterized by inflexibility and preoccupations with orderliness. These personality traits are associated with ASD traits, both of which have been conceptualized to lie on a continuum of severity (American Psychiatric Association, 2013). A meta-analysis by Malouff, Thorsteinsson, and Schutte (2005) found that personality traits associated with high Neuroticism, low Conscientiousness, low Agreeableness, and low Extraversion were associated with greater psychopathology. A more recent study by Schriber et al. (2014) found that parent report of less Extraversion and greater Neuroticism in their children was associated with more negative behaviors directed toward the self (Internalizing

behaviors; e.g., depression, anxiety), whereas less Agreeableness, Conscientiousness, and more Neuroticism was associated with greater negative behavior directed toward the external environment (Externalizing behaviors; e.g., aggression, impulsivity, refusal to follow rules).

### **Third Person Ratings of Others' Personality: Research in Zero Acquaintance Settings**

Personality has been measured in many different ways, from self-ratings of personality to other-ratings, either from people who know the person or those with “zero acquaintance” to the person. Each method has its strengths and weaknesses, as even self-ratings are biased, and people are not always aware of their internal states. For example, Schriber et al. (2014) found that TD children were more likely to under-report negative characteristics, whereas children with ASD tended to self-enhance their personality ratings. Furthermore, ratings by friends and family could reflect dynamics in that particular relationship (Vazire & Mehl, 2008). Kenny (1991, 2004), meanwhile, stated that acquaintance to a person may not be as important as previously thought, and that short-term judgments and consensus (even from those with zero acquaintance) can be accurate.

The design of zero acquaintance studies have varied significantly, including rating personality by: looking at pictures (Ames, Kammrath, Suppes, & Bolger, 2010); “eavesdropping” on previously-recorded conversations (Holleran, Mehl, & Levitt, 2009); watching a mock interview (Mast, Bangerter, Bulliard, & Aerni, 2011); watching the nonverbal behavior of a teacher in a classroom (Ambady & Rosenthal, 1992); and sitting and rating each other's personalities without talking to each other (Beer & Watson, 2008). Furthermore, studies have differed in the amount of time given to observe the other person, including “thin-slice” exposures, where the rater observes the person for seconds up to five minutes, to ratings after longer exposures (Tom, Tong, & Hesse, 2010). In general, despite different designs, studies have

found that when shown short clips, zero acquaintance raters are consistently accurate at assessing extraversion, although not as accurate at judging neuroticism. However, on the whole, these “first impressions” have been remarkably accurate (e.g., Borkenau & Liebler, 1992; Gifford, 1994; Holleran et al., 2009; Mast et al., 2011). Mast and colleagues (2011) had college students rate a 60-second clip composed of four 15-second snippets of conversation from a two-minute mock interview of job candidates who were asked the same questions. College students rated the interviewee’s personality traits using the abbreviated form of the NEO Big Five personality trait measure, while the interviewee rated himself and was also rated by two of his friends. The researchers found, that, despite the artificial nature of a mock job interview, when compared to self and other ratings, Extraversion, Openness, and Conscientiousness were accurately assessed by zero acquaintance raters.

To increase the accuracy of zero acquaintance ratings, researchers have suggested averaging the scores of multiple naïve raters. Holleran, Mehl, and Levitt (2009) had naïve raters listen to five short conversation fragments that equaled 2.5 minutes, and fill out the ACT questionnaire (Vazire & Mehl, 2008). The ACT is a questionnaire that relates to different personality characteristics by having people estimate how much time, compared to the average person, the target spends doing various activities, including the time spent by himself or herself (introversion), talking on the phone (extraversion), crying (emotional stability), arguing and fighting (antagonism), and laughing (extraversion). While a zero acquaintance rating by one person was not significantly accurate, averaging the ratings of eight to ten judges resulted in ratings that were *as accurate* as both the target’s and the informant’s (a friend of the target) rating of the amount of time spent on each activity. This is consistent with Ambady and

Rosenthal's (1992) meta-analysis of thin slices of behavior, that found that an aggregate rating from eight to nine judges was preferred.

Holleran and colleagues (2009) conducted another study that evaluated the number of one-minute sound files a rater listens to and the accuracy of zero acquaintance ratings. The sound files started with one sound file of one minute, and increased to ten one-minute sound files for a total ten minutes. The researchers found that five one-minute sound files rated by four to five judges were as accurate as the target's and informant's ratings, and that adding more sound files did not significantly improve the accuracy (also consistent with Ambady & Rosenthal, 1992). However, one of the major strengths that contributed to the high level of accuracy in this study was that the conversation snippets represented a broad sample of activities from regular conversations that the target had had throughout his or her day. Therefore, in contrast to other studies which took place in one setting, the rater was able to observe the target in a variety of different contexts.

### **The Current Study**

The primary aim of the study was to better understand and characterize OO children by determining whether they are more likely to retain subtle characteristics associated with the broader autism phenotype (BAP) or display personality traits that are more commonly observed in ASD. We did this by having naïve raters rate personality characteristics after watching activities from the Autism Diagnostic Observation Scale (ADOS). We wanted to explore whether, despite losing their ASD diagnosis, OO individuals exhibited characteristics associated with the broader autism phenotype, as well as personality characteristics that are associated with greater difficulties in socialization and greater risk for future psychopathology. A secondary aim was to determine whether OO, TD, and HFA groups could be differentiated based on their



personality profiles. Furthermore, we wanted to explore the relationship between individual BAP traits (Aloofness, Pragmatic Language difficulties, and Rigidity), as well as the relationship between “Big Five” personality traits (Extraversion, Agreeableness, Conscientiousness, Neuroticism, Openness) and traits typically associated with ASD (BAP traits and ADOS scores). Finally, as we are implementing a new methodology for rating BAP traits and personality in this population, we sought to explore how our zero acquaintance ratings compared to self- and other-ratings from previous studies.

A strength of our study is that there is greater external and face validity to assessing impressions made by OO individuals on naïve raters, as this mirrors the impressions these children make on others around them in the outside world. Also, while the behavioral observations were made in the laboratory and not in a naturalistic setting, the semi-structured nature of the ADOS allows behavioral observations to be made in a standardized manner by comparing children’s reactions to similar situations; furthermore, the assessment gives the opportunity to observe a broad range of behaviors, from creating stories, to demonstrating how to brush one’s teeth, to discussing friendships.

Previous studies from our lab found that OO children have reached the average range of functioning on standardized social, adaptive, language, executive functioning (EF), and academic performance measures (Fein et al., 2013; Troyb et al., 2013; Tyson et al., 2014). However, there are areas of executive functioning where OO participants scored differently from TD participants, in the sense that they did not reach the “high average” range as would be predicted by their other “high average” scores. Therefore, we hypothesized that OO children would continue to retain subtle deficits associated with the BAP (aloofness, rigidity, and pragmatic language difficulties) when compared to TD children as perceived by naïve raters. We also

hypothesized that HFA participants would display significant BAP characteristics as compared to OO and TD participants, and show a personality profile similar to those in previous studies: less extraversion, agreeableness, conscientiousness, and openness to experiences, and more neuroticism. We predicted that the OO group will be indistinguishable from the TD group in extraversion, agreeableness, and openness to experience, but have less conscientiousness and more neuroticism compared to TD peers, consistent with previous literature that suggested more impulsivity and anxiety in OO children (e.g., Fein et al., 2005).

## **Methods**

### **Participants**

The participants in the study were part of a larger study at the University of Connecticut that studied children with “optimal outcomes” (OO), and compared their functioning with those of typically developing (TD) children, as well as a group of children with high-functioning autism (HFA). The age ranged from 8 years old to 18 years old, with an average age of 13 for all three groups, with most children falling in the 11- to 15-year age range. The groups were matched on age and performance IQ (PIQ), and gender, full scale IQ (FSIQ), and verbal IQ (VIQ) did not differ among the groups. However, verbal IQ was marginally significant, with TD and OO having a somewhat higher VIQ than HFA,  $M(VIQ) = 111.0, 111.1, 103.6$ , for TD, OO, and HFA, respectively,  $p = .07$ . The participants were predominantly Caucasian, with only two individuals in the TD group, one individual from the OO group, and one individual from the HFA group reporting other races or ethnicities. See Table 1 for participant characteristics.

Only videos with good sound and video quality were coded. In total, 72 videos were coded, with 23 children in the TD group, 22 children in the OO group, and 27 children in the HFA group.

The larger study at the University of Connecticut was approved by the Institutional Review Board of the University of Connecticut, the Institute of Living Hartford Hospital, Children's Hospital of Philadelphia, and Queens University. Recruitment was done through media outlets (newspaper stories, radio interviews), private practices, and clinic referrals. In some cases, therapists contacted parents of children known to have attained an optimal outcome, and in some cases, parents saw media reports and contacted the investigators.

*Inclusion criteria.* All participants had verbal, nonverbal, and full-scale IQ standard scores greater than 77 (within 1.5 standard deviations (SDs) of the average of 100). Each group had additional specific inclusion criteria.

For the OO group:

1. Participants had a documented ASD diagnosis made by a physician or psychologist specializing in autism before the age of five, verified in a written diagnostic report provided by parents. Early language delay (no words by 18 months or no phrases by 24 months) documented in the report was required. As a second step in confirming diagnosis, the report was edited to remove information about diagnosis, summary, and recommendations but leaving descriptions of behavior. One of the co-investigators (MB), an expert in diagnosis of ASD and Director of the University of Connecticut Psychological Services Clinic, reviewed these reports, blind to early diagnosis and current group membership. In addition to potential OO participants, she reviewed 24 "foil" reports for children with non-ASD diagnoses, such as global delay or language disorder. Four potential OO participants were rejected for insufficient early documentation, and were dropped from the study. All 24 foils were correctly rejected.

2. Participants could not currently meet criteria for any ASD according to the Autism Diagnostic Observation Schedule (ADOS; Lord et al, 2000) administered by a research-reliable interviewer. In addition, the ADOSes of all potential OO cases were reviewed by a clinician with more than 15 years of autism diagnostic experience (IME, MB, or DF) who confirmed that ADOS scores were below ASD thresholds and that in their expert clinical judgment, an ASD was not present.
3. Participants' scores on the Communication and Socialization domains of the Vineland had to be greater than 77 (within 1.5 SDs of the mean of 100).
4. Participants had to be fully included in regular education classrooms with no one-on-one assistance and no special education services to address autism deficits (e.g., no social skills training). However, participants could be receiving limited special education services or psychological support to address impairments not specific to ASD, such as attention or academic difficulties.

For the HFA group:

- (1) Following Collaborative Programs of Excellence in Autism diagnostic guidelines, participants had to meet criteria for ASD on the ADOS (both Social and Communication domains and total score) and according to best estimate clinical judgment.

For the TD group:

1. Participants could not meet criteria for any ASD at any point in their development, by parent report.
2. Participants could not have a first-degree relative with an ASD diagnosis.

3. Participants could not meet current diagnostic criteria for an ASD on the ADOS, or by clinical judgment. There was no attempt to exclude TD children for psychiatric disorders (but see general exclusion criteria).
4. Scores on the Communication and Socialization domains of the Vineland had to be greater than 77.

*Exclusion criteria.* Potential participants for any group were excluded from the study if (1) at the time of the telephone screening they exhibited symptoms of major psychopathology (e.g., active psychotic disorder) that would impede full participation, (2) they had severe visual or hearing impairments per parent report, or (3) they had a history of seizure disorder, Fragile X syndrome, or significant head trauma with loss of consciousness. Further details of the methods, including the process of participant inclusion and exclusion, are reported in Fein et al. (2013).

## **Procedure**

Phone screenings based on study criteria were conducted with parents of each potential participant. Those who passed screening were scheduled for an assessment. Informed consent and assent were obtained, as appropriate, prior to testing. The evaluation was administered in a quiet room over the course of two or three testing sessions at the University of Connecticut, the Institute of Living of Hartford Hospital, Queens University, or in the home. Testing lasted approximately six hours. Parent interviews lasted approximately three hours for the OO and HFA groups and 1.5 hours for the TD group. Participants received a monetary incentive for participation, even if the testing could not be completed.

## **Measures**

**Cognitive and adaptive functioning.** In the larger study, cognitive functioning was evaluated using the *Wechsler Abbreviated Scale of Intelligence (WASI*; Wechsler, 1999) to

provide a measure of nonverbal reasoning and verbal ability. Parents completed the *Vineland Adaptive Behavior Scale (VABS; Sparrow, Balla, & Cicchetti, 1984)*, to assess adaptive functioning.

**Autism symptomatology.** In the larger study, autism symptomatology was evaluated using the Autism Diagnostic Observation Schedule-Revised (*ADOS; Lord, Rutter, DiLavore, & Risi, 2000*). The *ADOS* is a semi-structured assessment with standardized toys and tasks used to assess social and communication skills, play behaviors, and repetitive and stereotyped interests.

Ratings of behavior were obtained at standardized points on the *ADOS* (Lord et al., 2000), as displayed in *Figure 1*. Specific activities on the *ADOS* were picked to represent different types of activities to allow observation across different contexts and to give the opportunity to evaluate different personality characteristics. All activities are common to Modules 3 and 4. On average, around eight minutes of video was observed per child. Throughout these tasks, the response and reactivity to tasks informed Agreeableness, Conscientiousness, and Openness; attention to detail, meticulousness, and anxious presentation during the tasks informed Neuroticism; and inclusion of and response to examiner in activities informed Extraversion. See *Appendix* for more specific examples of observations made by raters.

### **Personality and Broad Autism Phenotype (BAP) traits**

The Ten Item Personality Inventory (TIPI; Gosling, Rentfrow, & Swann, 2003), Big Five Inventory (BFI; John, Donahue, & Kentle, 1991; John & Srivastava, 1999), and Broad Autism Phenotype Questionnaire (BAPQ; Hurley et al., 2007) were used to assess personality and BAP traits. See *Appendix* for questionnaires.

*The Ten Item Personality Inventory* (TIPI; Gosling, Rentfrow, & Swann, 2003) was chosen because it has been used extensively by third party raters watching videos of probands.

The TIPI is a 10-item questionnaire that measures each Big Five personality dimension (Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness). For each question, the rater was asked to rate on a 7-point scale the degree to which she agrees with the statement, with '1' for "strongly disagree" to '7' for "agree strongly." Two items correspond to each dimension, and one item from each dimension was reverse-scored. The direction to the questionnaire was modified from the first person ("I see myself as...") to the third person ("I see the person as most likely..."). The measure has been found to have fair convergent validity (mean  $r = .77$ ) when compared with the Big Five Inventory (BFI), as well as fair discriminant validity (absolute mean  $r = .20$ ), test-retest reliability ( $r = .72$ ), and convergence between self and other ratings (Gosling et al., 2003). For the current study, internal consistency reliability (coefficient alpha) was .96, .89, .95, .94, and .85, for the Extraversion, Agreeableness, Conscientiousness, Emotional Stability, and Openness scales respectively.

The *Big Five Inventory* (BFI; Goldberg, 1992; John et al., 1991; John & Srivastava, 1999) is an inventory consisting of 44 items that was used to provide a more in depth examination of personality traits within each "Big Five" domain. The BFI was also used to supplement results from the TIPI since, to the best of our knowledge, it has not been used by third party raters to rate personality through videos. The BFI examines the following domains: Extraversion versus Introversion; Agreeableness versus Antagonism; Conscientiousness versus Lack of Direction; Neuroticism versus Emotional Stability; and Openness versus Closedness to Experience. For each question, the rater was asked to rate on a 5-point scale to what degree she agreed with the statement, with '1' for "disagree strongly" to '5' for "agree strongly." Some items were reverse-scored, and each item corresponded to the Extraversion, Agreeableness, Conscientiousness, Neuroticism, or Openness scales. The direction to the questionnaire was

modified from the first person (“I see myself as someone who...”) to the third person (“This person is someone who...”). The reliability for the BFI has been found to be 0.88, 0.79, 0.82, 0.81, and 0.83 for the Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness scales, respectively, with a mean overall reliability of 0.89. The validity has been found to be 0.94, 0.92, 0.90, 0.92, and 0.92 for the Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness scales, with an overall mean of 0.92 (John & Srivastava, 1999). For the current study, internal consistency reliability (co-efficient alpha) was .97, .97, .97, .96, and .94 for Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness scales respectively.

The *Broad Autism Phenotype Questionnaire* (BAPQ; Hurley et al., 2007) is a 36-item questionnaire that produces three overall scales: Aloofness (lack of interest and enjoyment in social interaction); Pragmatic Language (difficulty with fluid reciprocal social communication and appropriate use of language for social purposes); and Rigidity (unwillingness to change or difficulty adjusting to change). For each question, the rater was asked to rate on a 6-point scale how frequently each statement applies, with ‘1’ for “very rarely” to ‘6’ for “very often.” Some items were reverse-scored. The informant version of the questionnaire was administered. With BAPQ cut-offs of 3.25 for Aloof, 2.75 for Pragmatic Language, 3.50 for Rigid, and 3.15 for Total Score, Hurley and colleagues (2007) found that overall sensitivity was 81.8%, while overall specificity was 78.1%. Inter-item reliability for each subscale was found to be .94, .91, and .85 for the Aloof, Rigidity, and Pragmatic Language subscales, respectively (Hurley et al., 2007). For the current study, internal consistency reliability (co-efficient alpha) was .98, .98, and .94 for the Aloof, Rigidity, and Pragmatic Language scales, respectively.



Confidence ratings were added to each measure (TIPI, BFI, and BAPQ), with the rater indicating the level of confidence she had in her assessment on a five-point scale, with: ‘A’ as “Not confident at all; ‘B’ as “Slightly leaning towards it”; ‘C’ as “Somewhat leaning towards it; ‘D’ as “Fairly confident”; and ‘E’ as “Confident.” During analyses, ‘A’ was converted to ‘1,’ ‘B’ to ‘2,’ ‘C’ to ‘3,’ ‘D’ to ‘4,’ and ‘E’ to ‘5.’ A previous study found that while accuracy was lower for those items marked as “Not confident at all,” rating accuracy was equally high for items that were rated from “slightly confident,” to “confident” (Ames et al., 2010). In the current study, average confidence ratings on each question of the TIPI ranged from 4.22 to 4.48, while ratings ranged from 3.59 to 4.15 on the BFI. Average confidence ratings for each question on the BAPQ ranged from 3.53 to 4.50.

**Rater characteristics.** Research has found that once ratings are obtained from eight to ten people, the accuracy of the ratings do not improve with additional raters (Ambady & Rosenthal, 1993; Holleran et al., 2009). Therefore, nine undergraduate research assistants (RAs) (who were blind to group membership) watched six clips of approximately one minute and one clip of two minutes, for a total of eight minutes of observation for each OO, HFA, and TD child. RAs with no prior experience with ASD were chosen. Female raters were chosen due to previous research that has suggested that women are more accurate raters of personality than men (Ambady, Hallahan, & Rosenthal, 1995). Three raters were aware that it was an “autism” study, whereas it was advertised as a “personality” study for the other six raters. There was no difference in ratings between the two groups.

**Instructions for raters.** Each rater evaluated all 72 children in our sample, and the order of videos was randomized to account for the effect of exposure and experience on personality and BAP ratings. Each rater was given the following instructions:

“When you look around the world, you see all kinds of people with different personalities. Use your impressions and your gut feelings to rate what you think to be each person’s personality. Then indicate your confidence in your judgments.

Do not start rating the participant until you have finished watching all seven clips.”

### **Analysis**

As in previous literature (e.g., Ambady & Rosenthal, 1993; Holleran et al., 2009) the ratings from the nine raters were averaged to form an aggregate rating for each OO, HFA, and TD child. Analyses of variance (ANOVAs) were conducted to examine whether there were group differences between OO, HFA, and TD groups. Bivariate correlational analyses were conducted between Big Five Personality Traits, Broader Autism Phenotype (BAP) Traits, and ADOS Scores in HFA, OO, and TD to examine the relationship between personality and autism traits. Stepwise Discriminant Function Analysis (DFA) was used to examine which Big Five and Broader Autism Phenotype traits best predicted group membership.

### **Results**

One-way analyses of variance (ANOVAs) were used to evaluate differences among the OO, TD, and HFA groups for personality characteristics using the Ten-Item Personality Inventory (TIPI) and Big Five Inventory (BFI), and broader autism phenotype characteristics were examined using the Broader Autism Phenotype Questionnaire (BAPQ).

#### **TIPI and BFI Personality Analysis**

Construct validity between the TIPI and BFI was assessed by conducting bivariate correlations to examine the extent to which the same constructs correlated with each other (convergent validity). Each domain consisted of a series of questions and contained reverse-scored items. There was good convergent validity for all five scales: Extraversion ( $r=.97$ ,

$p < .001$ ), Agreeableness ( $r = .96$ ,  $p < .001$ ), Conscientiousness ( $r = .96$ ,  $p < .001$ ), Neuroticism (with Emotional Stability on the TIPI reverse-scored;  $r = .93$ ,  $p < .001$ ), and Openness ( $r = .87$ ,  $p < .001$ ). Overall, there were significant group differences for all five personality dimensions on the TIPI and BFI (see Tables 2 and 3 for *means*,  $F$ ,  $p$ , and  $\eta^2$  values). Further analysis was conducted on individual items in each domain, as the Big Five domains encapsulate subtly distinct traits (John & Srivastava, 1999). We also sought to examine how much agreement there was on individual traits within each domain (see Tables 4-9 for *means*,  $F$ ,  $p$ , and  $\eta^2$  values for all individual items).

**Extraversion.** In terms of overall domain score on the TIPI, the OO group was rated as significantly more extraverted than the TD group ( $t = -2.48$ ,  $p = .02$ ) and HFA group ( $t = 2.97$ ,  $p = .01$ ). There was no significant difference between TD and HFA ( $t = .11$ ,  $p = .91$ ). The same pattern was observed on the BFI, with the OO group rated as more extraverted than the TD group ( $p = .02$ ) and HFA group ( $p = .004$ ). Again, there was no significant difference between the TD and HFA groups ( $p = .66$ ). Further analysis was conducted on individual items on the TIPI and BFI.

**Individual items relating to extraversion.** On the TIPI, OO participants were rated as more “extraverted and enthusiastic” than TD ( $t = -2.52$ ,  $p = .02$ ) and HFA peers ( $t = 3.09$ ,  $p = .003$ ). There was no significant difference between TD and HFA groups ( $t = .29$ ,  $p = .78$ ). Likewise, on the BFI, OO children were rated as more talkative than TD ( $t = -2.13$ ,  $p = .04$ ) and HFA ( $t = 2.88$ ,  $p = .01$ ) children, while there was no significant difference between TD and HFA groups ( $t = .70$ ,  $p = .49$ ). OO children were also rated as more assertive than TD ( $p = .02$ ) and HFA ( $p = .03$ ) children. There were no significant group differences on “being full of energy,” ( $p = .10$ ) or “generating enthusiasm,” ( $p = .07$ ), although OO children were rated as generating marginally more enthusiasm than TD children ( $t = -1.92$ ,  $p = .06$ ) and HFA ( $t = 2.26$ ,  $p = .03$ ). HFA participants

were rated as less outgoing and social than OO ( $p < .001$ ) and TD ( $p = .004$ ) participants, whereas OO and TD children did not differ on sociability ( $p = .10$ ). See Table 5.

***Individual items relating to introversion.*** On the TIPI, OO children were rated as less reserved and quiet than TD ( $p = .02$ ) and HFA ( $p = .01$ ) children, whereas there was no significant difference between TD and HFA ( $p = .94$ ). Likewise, TD and HFA were rated as more introverted than OO on all individual items on the BFI. More specifically, TD and HFA children were rated as likely being more: reserved ( $ps = .01$  and  $.002$  for TD and HFA respectively); quiet ( $ps = .02$ ); and shy and inhibited ( $ps = .04$  and  $.002$ ) than OO children.

***Agreeableness.*** In terms of overall domain score on the TIPI, HFA participants were rated as significantly less agreeable than OO ( $t = 3.44, p = .001$ ) and TD ( $t = 4.78, p < .001$ ) participants. There was no significant difference between OO and TD ( $t = 1.13, p = .26$ ) children. The same pattern was observed on the BFI, with the HFA group rated as less agreeable than the OO ( $p = .001$ ) and TD ( $p < .001$ ) groups. Again, there was no significant difference between OO and TD ( $p = .35$ ) groups. Further analysis was conducted on individual items on the TIPI and BFI.

***Individual items relating to agreeableness.*** On the TIPI, HFA children were rated as less sympathetic and warm than OO ( $p = .003$ ) and TD ( $p < .001$ ) children. There was no significant difference between OO and TD ( $p = .55$ ) groups. Likewise, OO and TD participants were rated as more agreeable than HFA participants on all individual items on the BFI. More specifically, OO and TD children were rated as being more: helpful and unselfish ( $ps < .001$  and  $.002$  for OO and TD respectively); forgiving ( $ps = .003$  and  $< .001$ ); trusting ( $ps < .001$ ); considerate and kind ( $ps = .001$  and  $< .001$ ); and cooperative ( $ps = .004$  and  $< .001$ ) than HFA children. Again, there were no significant differences between OO and TD groups on any of these items. See Table 6.

***Individual items relating to antagonism.*** On the TIPI, HFA individuals were rated as more critical and quarrelsome than OO ( $t=-3.46$ ,  $p=.001$ ) and TD ( $t=-4.71$ ,  $p<.001$ ) individuals. There was no significant difference between OO and TD ( $t=-1.53$ ,  $p=.13$ ) children. Likewise, the HFA group was rated as more antagonistic than OO and TD groups on all individual items. More specifically, HFA children were rated as more likely than OO and TD children to: find fault with others ( $ps=.004$  and  $.002$  for OO and TD respectively); start quarrels ( $ps=.004$  and  $<.001$ ); be cold and aloof ( $ps<.001$  and  $=.001$ ); and be rude ( $ps=.01$  and  $<.001$ ). Again, there were no significant differences between OO and TD children on any of these items.

***Conscientiousness.*** In terms of overall domain score on the TIPI, HFA children were rated as significantly less conscientious than OO ( $t=-3.27$ ,  $p=.002$ ) and TD ( $t=-5.08$ ,  $p<.001$ ) children. There was no significant difference between OO and TD ( $t=1.12$ ,  $p=.27$ ) groups. The same pattern was observed on the BFI, with the HFA group rated as less conscientious than the OO ( $p=.003$ ) and TD ( $p<.001$ ) groups. Again, there was no significant difference between OO and TD ( $p=.45$ ) groups. Further analysis was conducted on individual items on the TIPI and BFI.

***Individual items relating to conscientiousness.*** On the TIPI, the HFA group was rated as less dependable and self-disciplined than the OO ( $t=5.24$ ,  $p<.001$ ) and TD ( $t=3.38$ ,  $p=.001$ ) groups, whereas there was no difference between OO and TD ( $t=1.43$ ,  $p=.16$ ) children. OO and TD children were rated as more conscientious than HFA children on all individual items on the BFI. More specifically, OO and TD participants were rated as being more: thorough ( $ps=.01$  and  $.002$  for OO and TD respectively); reliable ( $ps=.004$  and  $<.001$ ); persevering ( $ps=.01$  and  $.005$ ); efficient ( $ps<.001$ ); and likely to follow through on plans ( $ps=.001$  and  $<.001$ ) than HFA. Again, there was no significant difference between OO and TD participants on any of these items. See Table 7.

***Individual items relating to disorganization, carelessness, and distractedness.*** On the TIPI, HFA children were rated as more disorganized and careless than OO ( $p=.004$ ) and TD ( $p<.001$ ) children. There was no significant difference between the OO and TD ( $p=.44$ ) groups. Likewise, the HFA group was rated as more disorganized than the OO ( $p=.03$ ) and TD ( $p<.001$ ) groups on the BFI, whereas there was no significant difference between OO and TD ( $p=.41$ ) children. However, while HFA children were also rated to be more careless than TD children ( $p=.001$ ), the OO group did not differ in carelessness from either the TD ( $t= -1.25, p=.22$ ) or HFA ( $t= -1.88, p=.07$ ) groups. Furthermore, while HFA participants were rated as more easily distracted than OO ( $t= -2.79, p=.01$ ) and TD ( $t= -5.18, p<.001$ ) participants, OO children were rated as more easily distracted than TD ( $t= -2.25, p=.03$ ) children. There were no group differences for laziness ( $p= .09$ ).

**Emotional Stability/Neuroticism.** In terms of overall domain score, on the TIPI, the OO group fell in between the TD and HFA groups, and were rated as more emotionally stable than HFA children ( $t=5.00, p<.001$ ), but less emotionally stable than TD children ( $t=1.98, p=.05$ ). TD participants were also rated as more emotionally stable than HFA participants ( $t=6.98, p<.001$ ). The BFI evaluated overall neuroticism, the converse of emotional stability. In this domain, HFA children was rated as significantly more neurotic than OO ( $t=-4.92, p<.001$ ) and TD ( $t=.6.02, p<.001$ ) children. There was no significant difference between OO and TD ( $t=-.64, p=.53$ ) groups. Further analysis was conducted on individual items on the TIPI and BFI. However, the Emotional Stability/Neuroticism domain appeared to encapsulate several subtly distinct overall dimensions, with some overlap. Therefore, it was analyzed under the following categories: Depression; Anxiety; and Calmness and Emotional Stability. See Table 8.

***Items relating to depression.*** Only the BFI addressed items relating to depression. In those items, HFA children were consistently rated as having more characteristics related to depression than OO and TD children. More specifically, HFA individuals were rated as being more depressed and blue than OO ( $t = -3.47, p = .001$ ) and TD ( $t = -2.32, p = .03$ ) individuals as well as more moody than OO ( $t = 2.66, p < .001$ ) and TD ( $t = -5.47, p < .001$ ) individuals. There was no significant difference between OO and TD ( $t = 1.42, p = .16$ ) groups.

***Items relating to anxiety.*** On the TIPI, HFA children were rated as significantly more anxious and easily upset than OO ( $t = -4.89, p < .001$ ) and TD ( $t = -6.62, p < .001$ ) children. There was no significant difference between the OO and TD groups ( $t = -1.62, p = .11$ ). On the BFI, HFA participants were consistently rated as more anxious than OO and TD participants on individual items relating to anxiety. More specifically, HFA children were rated as more likely than OO and HFA children to: be tense ( $ps < .001$ ); be worrying ( $ps < .001$ ); and to get nervous easily ( $ps = .001$  and  $< .001$ , for OO and TD respectively).

***Items relating to calmness and emotional stability.*** On the TIPI, HFA individuals were rated as less calm and emotionally stable than OO ( $t = 4.70, p < .001$ ) and TD ( $t = 6.73, p < .001$ ) individuals. However, OO children were rated as less calm and emotionally stable than TD children ( $t = 1.97, p = .05$ ). In contrast, on the BFI, there was no significant difference between OO and TD groups on being emotionally stable and not easily upset ( $t = 1.25, p = .22$ ). Nevertheless, HFA children were rated as less likely to remain calm in a tense situation than OO and TD children ( $ps < .001$ ), while OO individuals were rated as less likely than TD individuals to remain calm in a tense situation ( $t = 2.06, p = .04$ ). HFA participants were also rated as less relaxed and less likely to handle stress well when compared to TD and OO participants ( $ps < .001$ ), while the

difference between OO and TD groups approached significance, with the OO group as marginally less relaxed and likely to handle stress well than the TD group ( $t=1.91, p=.06$ ).

**Openness.** In terms of overall domain score, on the TIPI, the HFA group was rated as less open than the OO ( $t=3.05, p=.004$ ) and TD ( $t=3.31, p=.002$ ) groups. There was no significant difference between OO and TD children ( $t=.01, p=.99$ ). A similar pattern was observed on the BFI, with HFA individuals rated as less open than OO individuals ( $t=2.30, p=.03$ ), with a trend for HFA children as also less open than TD children ( $t=1.89, p=.06$ ). Further analysis was conducted on individual items on the TIPI and BFI.

**Items relating to openness to new experiences.** On the TIPI, the HFA group was rated as less open to new experiences than the OO and TD groups ( $p<.001$ ). There was no significant difference between OO and TD groups ( $p=.77$ ). Likewise, on the BFI, OO and TD children were rated as more likely than HFA children to: be original and come up with new ideas ( $p=.01$ ), and to like to reflect and play with ideas ( $p=.01$  and  $.05$  for OO and TD respectively). OO children were rated as being marginally more curious about different things when compared to TD ( $p=.06$ ) and HFA ( $p=.03$ ) children. There were no significant group differences on ratings of: being ingenious and a deep thinker ( $p=.09$ ); having an active imagination ( $p=.70$ ); being inventive ( $p=.58$ ); valuing artistic, aesthetic experiences ( $p=.50$ ), and being sophisticated in art, music, or literature ( $p=.21$ ). See Table 9.

**Items relating to closedness to experience.** On the TIPI, there was no significant difference between groups in ratings of conventionality and uncreativity ( $p=.11$ ). Likewise, on the BFI, there was no significant difference between groups in rating for likelihood of “hav[ing] few artistic interests” ( $p=.21$ ). However, the HFA group was rated as significantly more likely



than the OO ( $t=-4.14, p<.001$ ) and TD ( $t=-4.97, p<.001$ ) groups to prefer routine work. There was no significant difference between OO and TD groups.

### **BAPQ Analysis**

Overall, there was a main effect for the three overall dimensions on the BAPQ: Aloofness, Pragmatic Language, and Rigidity (see Table 10 for *means*, *F*, *p*, and  $\eta^2$  values). Each domain consisted of a series of questions and contained reverse-scored items. Further analysis was conducted on individual items to examine potentially subtle distinctions among traits in each domain, and to examine how much agreement on individual traits there was within each domain (see Tables 4-9 for *means*, *F*, *p*, and  $\eta^2$  values for all individual items).

**Aloofness.** In terms of overall domain score, HFA children were rated as significantly more aloof than OO ( $t=-5.06, p<.001$ ) and TD ( $t=-4.36, p<.001$ ) children. There was no significant difference between OO and TD participants ( $t=1.05, p=.30$ ). Within the Aloof domain, HFA children scored higher than OO and TD participants on every individual item. More specifically, HFA individuals were rated as more likely to: prefer to talk to get information from others (rather than to socialize) ( $ps <.001$ ); get bored during conversation ( $ps = .001$ ); and prefer to be alone ( $ps <.001$ ). There were no significant differences between OO and TD children on any individual items in this domain, with one exception. OO children were rated as less likely to make conversation just to be polite than TD ( $t=3.52, p=.001$ ) and HFA ( $t=-4.40, p<.001$ ) children; rather OO participants appeared to enjoy the conversation with the examiner more, and were rated as more likely to enjoy having conversations with others. There was no significant difference between TD and HFA participants on this item ( $t=-.39, p=.70$ ). In terms of reverse scored items, HFA children were rated to be less likely to enjoy being around other people when compared with OO and TD children on all individual items. More specifically,

HFA children were rated as less likely to: like being around other people ( $ps < .001$ ); enjoy being in social situations ( $ps < .001$ ); be easy to approach ( $ps < .001$ ); look forward to meeting other people ( $ps < .001$ ); be good at making small talk ( $ps < .001$ ); feel like he or she is connecting with people ( $ps < .001$ ); be warm and friendly in interactions ( $ps < .001$  and  $=.001$  for OO and TD, respectively), and enjoy chatting with people ( $ps < .001$  and  $.002$ ). There were no significant differences between the OO and TD groups on any of these items. See Table 11 for *means*, *F*, *p*, and  $\eta^2$  values for each individual item.

**Pragmatic Language.** In terms of overall domain score, HFA individuals were rated as having significantly more pragmatic language difficulties than OO ( $t=-4.49$ ,  $p<.001$ ) and TD ( $t=-5.97$ ,  $p<.001$ ) individuals. There was no significant difference between OO and TD children ( $t=-.80$ ,  $p=.43$ ). Within the Pragmatic Language domain, the HFA group was rated as having more pragmatic deficits than the OO and TD groups on all individual items. More specifically, HFA individuals were rated as more likely to: find it hard to get words out smoothly ( $ps < .001$ ), feel disconnected in conversations with others ( $ps < .001$ ), have people ask to repeat things because he or she is difficult to understand ( $ps = .001$  and  $<.001$ ); speak too loudly or too softly ( $ps <.001$  and  $= .01$ ); and leave pauses in conversation ( $ps = .001$  and  $.01$ ). There were no significant differences between OO and TD groups on these items. In terms of reverse scored items, HFA children were also rated as less likely to: be “in tune” with their conversation partner ( $ps < .001$ ); be able to tell when someone is not interested in what he or she is saying ( $ps < .001$ ); or be able to tell when it is time to change a conversation topic ( $ps < .001$ ). There were no significant differences between the OO and TD groups on these items.

However, there were several items where there was a significant difference between the OO and TD groups. OO children were rated as significantly more likely than TD children to:

find it hard to avoid getting sidetracked in conversation ( $t = -2.94, p = .01$ ); and lose track of their original point when talking ( $t = -2.84, p = .01$ ). Nevertheless, both OO and TD individuals were less likely than HFA individuals to get sidetracked in conversation ( $ps = .05$  and  $<.001$  for OO and TD respectively), and to lose track of their original point while talking ( $ps = .01$  and  $<.001$ ). OO children were also rated as more likely than TD children to be told that they talk too much about certain topics ( $t = -2.54, p = .02$ ) and did not significantly differ from HFA children on this item ( $t = .78, p = .44$ ), whereas HFA individuals significantly differed from TD individuals ( $t = 2.47, p = .02$ ). There was also a domain where OO children were rated as *better* than TD children: OO individuals were rated as having *less* of a flat and monotone voice than TD ( $t = 2.07, p = .045$ ) or HFA ( $t = -3.41, p = .001$ ) children. See Table 12 for *means*, *F*, *p*, and  $\eta^2$  values for each individual item.

**Rigidity.** In terms of overall domain score, HFA participants were rated as being significantly more rigid than OO ( $t = -5.19, p < .001$ ) and TD ( $t = -6.60, p < .001$ ) participants. There was no significant difference between the OO and TD groups ( $t = -1.34, p = .19$ ). Within the Rigidity domain, HFA children were rated as being more rigid than OO and TD children on all individual items. More specifically, HFA children were rated as more likely than OO and TD children to: have to be talked into trying something new ( $ps < .001$ ); have to warm up to the idea of visiting an unfamiliar place ( $ps < .001$ ); feel a strong need for sameness ( $ps < .001$ ); have a hard time with changes in routine ( $ps = .002$  and  $<.001$  for OO and TD, respectively); act set in his or her ways ( $ps < .001$ ); get frustrated and be unwilling to bend ( $ps < .001$ ); and closely follow a routine ( $ps < .001$ ). In terms of reverse scored items, HFA children were rated as less likely than OO or TD children to: be comfortable with unexpected changes in plans ( $ps < .001$ ); be flexible about how things should be done ( $ps < .001$ ); or alter his or her daily routine and try something

different ( $ps < .001$ ). There were no significant differences between the OO and TD groups on any items, with one exception. OO children were rated as more likely than TD children to keep doing things the way he or she knows even when he or she knows that another way is better ( $t = -2.19, p = .03$ ). See Table 13 for *means*, *F*, *p*, and  $\eta^2$  values for each individual item.

### **Covariance Analyses**

Analyses of Covariance (ANCOVAS) were performed on the overall domains above, covarying for gender, age, FSIQ, PIQ, and VIQ respectfully. Controlling for gender, age, FSIQ, VIQ, and PIQ did not eliminate any group differences, with the exception of the BFI Openness domain. In this domain, controlling for FSIQ ( $R^2_{adj} = .13, p = .13$ ) and VIQ ( $R^2_{adj} = .23, p = .29$ ) eliminated group differences.

### **Correlational Analyses**

#### **Correlation between Big Five Personality Traits, BAP Traits, and ADOS Scores**

Bivariate correlational analyses were conducted between Big Five Personality Traits, Broader Autism Phenotype (BAP) Traits, and ADOS Scores for the HFA, OO, and TD groups. See Tables 14-16.

**HFA children.** Results found that the BAP traits of Aloofness and Rigidity were negatively correlated with Extraversion, Agreeableness, Conscientiousness, Emotional Stability, and Openness, and positively correlated with Neuroticism. The BAP trait of Pragmatic Language difficulties displayed the same pattern, with the exception that there was no correlation between Pragmatic Language and Extraversion. In terms of ADOS scores, the Reciprocal Social Interaction domain displayed the same pattern of correlations and correlated with all factors, with the exception of the Extraversion domain. The Social Communication domain did not correlate with any BFI or BAPQ factors. Greater Aloofness, Pragmatic Language Difficulties, and

Rigidity were associated with higher ADOS Social Interaction scores. Greater Aloofness was associated with greater Pragmatic Language difficulties and Rigidity, greater Pragmatic Language difficulty was associated with greater Aloofness and Rigidity, and greater Rigidity was associated with greater Aloofness and Pragmatic Language difficulties. See Table 14.

**OO children.** Results found that, consistent with the HFA group, the BAP traits of Aloofness and Rigidity were negatively correlated with Extraversion, Agreeableness, Conscientiousness, Emotional Stability, and Openness, and positively correlated with Neuroticism. Likewise, the BAP trait of Pragmatic Language difficulties displayed the same pattern, with the exception that there was no correlation between Pragmatic Language and Extraversion. In terms of ADOS scores, the Reciprocal Social Interaction domain again displayed the same pattern of correlations and correlated with all factors with the exception of Extraversion. The Social Communication domain did not correlate with any BFI or BAPQ factors, but greater Aloofness and Pragmatic Language difficulties were associated with higher ADOS Social Communication scores. Greater Aloofness, Pragmatic Language Difficulties, and Rigidity were associated with higher ADOS Social Interaction and ADOS Combined (Social Interaction and Communication) scores. Furthermore, greater Aloofness was associated with greater Pragmatic Language difficulties and Rigidity, greater Pragmatic Language difficulty was associated with greater Aloofness and Rigidity, and greater Rigidity was associated with greater Aloofness and Pragmatic Language difficulties. See Table 15.

**TD children.** Results found that, overall, the BAP traits of Aloofness and Pragmatic Language difficulties were negatively correlated with Extraversion, Agreeableness, Conscientiousness, Emotional Stability, and Openness, and positively correlated with Neuroticism. The BAP trait of Rigidity displayed the same pattern, with the exception that there

was no correlation between Rigidity and Conscientiousness in TD children. In terms of ADOS scores, the Reciprocal Social Interaction as well as the Combined domains were negatively correlated with Agreeableness and Emotional Stability. ADOS Communication difficulties were associated with lower Emotional Stability. Furthermore, consistent with the HFA and OO groups, greater Aloofness was associated with greater Pragmatic Language difficulties and Rigidity, greater Pragmatic Language difficulty was associated with greater Aloofness and Rigidity, and greater Rigidity was associated with greater Aloofness and Pragmatic Language difficulties. See Table 16.

### **Discriminant Function Analysis**

Stepwise Discriminant Function Analysis (DFA) was used to determine: 1) which Big Five personality traits could best predict group membership; 2) which Broader Autism Phenotype (BAP) traits could best predict group membership; and 3) which of the eight Big Five and BAP traits (Extraversion, Agreeableness, Openness, Neuroticism, Openness, Aloofness, Pragmatic Language, and Rigidity) could best predict group membership.

#### **Big Five personality traits**

***TD and HFA children.*** The analyses for TIPI Big Five personality traits and BFI Big Five personality traits were conducted separately. Results from the stepwise DFA suggest that for the TIPI, Emotional Stability (the converse of Neuroticism) was the best predictor; likewise on the BFI, Neuroticism was the best predictor, followed by Extraversion. For both sets of analyses, the stepwise discriminant functional analyses were significant. More specifically, using Emotional Stability on the TIPI as the predictor, Wilks' lambda  $\Lambda = .496$ , chi-square  $\chi^2(1, N = 50) = 33.28, p < .0005$ , with a canonical correlation of .71 (eta square=.5041, meaning that 50.41% of the variability in the discriminant function is explained by the difference between TD

and HFA groups); for the BFI, using Neuroticism and Extraversion as the predictors, Wilks' lambda  $\Lambda = .510$ , chi-square  $\chi^2 (2, N = 50) = 31.64, p < .0005$ , with a canonical correlation of .70 (eta square = .49). For the BFI, the standardized canonical discriminant function coefficients were 1.167 and .539 for Neuroticism and Extraversion, respectively, indicating Neuroticism was most strongly related to the discriminant function. The TIPI model correctly classified 84.0% of the cases with 100% (23/23) negative predictive value and 70.37% (19/27) positive predictive value; the BFI model correctly predicted 84.0% of the cases as well, with 95.65% (22/23) negative predictive value and 74.07% (20/27) positive predictive value.

***OO and HFA children.*** Results from the stepwise DFA suggest that for the TIPI, Emotional stability (the converse of Neuroticism) was the best predictor; likewise on the BFI, Neuroticism was the best predictor. For both sets of analyses, the stepwise discrimination functional analyses were significant. For the TIPI, using Emotional Stability as the predictor, Wilks lambda  $\Lambda = .653$ , chi-square  $\chi^2 (1, N=49) = 19.83, p < .0005$ , with a canonical correlation of .59 (eta square = .35); for the BFI, using Neuroticism as the predictor, Wilks lambda  $\Lambda = .660$ , chi-square  $\chi^2 (1, N=49) = 19.32, p < .0005$ , with a canonical correlation of .58 (eta square = .34). The TIPI model correctly classified 79.6% of the cases with 90.9% (20/22) negative predictive value and 70.4% (19/27) positive predictive value; likewise, the BFI model correctly predicted 75.5% of the cases, with 77.3% (17/22) negative predictive value and 74.1% (20/27) positive predictive value.

***OO and TD children.*** Results from the stepwise DFA suggest that for the TIPI, Extraversion was the best predictor, followed by Openness; likewise on the BFI, Extraversion was the best predictor, followed by Neuroticism. For both sets of analyses, the stepwise discrimination functional analyses were significant. For the TIPI, using Extraversion and

Openness as the predictors, Wilks lambda  $\Lambda = .738$ , chi-square  $\chi^2 (2, N=45) = 12.76, p = .002$ , with a canonical correlation of .51 (eta square=.26); for the BFI, using Extraversion and Neuroticism as the predictors, Wilks lambda  $\Lambda = .745$ , chi-square  $\chi^2 (2, N=45) = 12.63, p = .002$ , with a canonical correlation of .51 (eta square=.26). For the TIPI, the standardized canonical discrimination coefficient was 1.568 for Extraversion, followed by 1.211 for Openness; for the BFI, the canonical discriminant function coefficients were 1.345 for Extraversion, followed by 1.082 for Neuroticism. The TIPI model correctly classified 73.3% of the cases with 69.6% (16/23) negative predictive value and 77.3% (17/22) positive predictive value; likewise, the BFI model correctly predicted 73.3% of the cases, with 69.6% (16/23) negative predictive value and 77.3% (17/22) positive predictive value.

**OO, TD, and HFA children.** Results from the stepwise DFA suggest that for the TIPI, Emotional Stability (the converse of Neuroticism), followed by Extraversion were the best predictors; likewise on the BFI, Neuroticism, followed by Extraversion, were the best predictors. For both sets of analyses, the stepwise discrimination functional analyses were significant ( $p's < .0005$ ). The TIPI model (using Emotional Stability and Extraversion as the predictors) correctly classified 68.1% of the cases, while the BFI model (using Neuroticism and Extraversion as the predictors) correctly classified 65.3% of the cases (See Figures 2 and 3).

### **Broader Autism Phenotype (BAP) traits**

**TD and HFA children.** Results from the stepwise DFA suggest that Rigidity was the best predictor of group membership. Using Rigidity as the predictor, Wilks lambda  $\Lambda = .524$ , chi-square  $\chi^2 (1, N=50) = 30.67, p < .0005$ , with a canonical correlation of .69 (eta squared=.48). The BAPQ model correctly predicted 82.0% of the cases, with 95.7% (22/23) negative predictive value and 70.4% (19/27) positive predictive value.



***OO and HFA children.*** Results from the stepwise DFA suggest that Rigidity was the best predictor of group membership. Using Rigidity as the predictor, Wilks lambda  $\Lambda = .636$ , chi-square  $\chi^2 (1, N=49) = 21.08, p < .0005$ , with a canonical correlation of .60 (eta square = .36). The BAPQ model correctly predicted 75.5% of the cases with 86.4% (19/22) negative predictive value and 66.7% (18/27) positive predictive value.

***OO and TD children.*** Results from the stepwise DFA found that none of the BAP variables (Aloofness, Pragmatic Language, Rigidity) qualified for the analysis to differentiate the OO and TD groups.

***OO, TD, and HFA children.*** Results from the stepwise DFA from the BAPQ suggest that Rigidity and Aloofness were the best predictors. The stepwise discrimination functional analyses were significant ( $p < .0005$ ), and correctly predicted 70.8% of the cases (See Figure 4).

### **Big Five Personality and Broader Autism Phenotype traits**

***TD and HFA children.*** Results from the stepwise DFA suggest that, inputting the Big Five personality traits from the TIPI and BFI, as well as Broader Autism Phenotype (BAP) traits from the BAPQ, TIPI Emotional Stability, which correctly predicted 84% of the cases, remained the best predictor of group membership.

***OO and HFA children.*** Results from the stepwise DFA suggest that BAPQ Rigidity, which correctly predicted 75.5% of the cases, remained the best predictor of group membership.

***OO and TD children.*** Results from the stepwise DFA suggest that TIPI Extraversion, followed by BAPQ Rigidity, were the best predictors of group membership. Using Extraversion and Rigidity as the predictors, Wilks lambda  $\Lambda = .729$ , chi-square  $\chi^2 (2, N=45) = 13.27, p = .001$ , with a canonical correlation of .52 (eta square = .27). Standardized canonical discrimination coefficients were 1.11 for Extraversion and .924 for Rigidity, indicating that Extraversion was

most strongly related to the discriminant function. This model correctly predicted 75.6% of the cases with 69.6% (16/23) negative predictive value and 81.8% (18/22) positive predictive value.

***OO, TD, and HFA children.*** Results from the stepwise DFA suggest that TIPI Extraversion and TIPI Emotional Stability were the best predictors of group membership. The stepwise discrimination functional analyses were significant ( $p < .001$ ), and correctly predicted 68.1% of the cases (See Figure 2).

### **Zero Acquaintance Ratings**

Another goal of the study was to compare our results with zero-acquaintance raters using the BAPQ and BFI with results from previous studies. We compared our findings from the BAPQ with the original article by Hurley and colleagues (2007). They utilized a sample consisting of 86 parents of children with autism, some of whom would meet criteria for having significant BAP characteristics (BAP-present parents), and some of whom did not (BAP-absent parents). They also evaluated 64 parents of typically developing children (Controls). On the BAPQ, these were our ratings on the Aloof domain: 2.54, 2.34, and 3.46 for the TD, OO, and HFA groups respectively. Hurley and colleagues (2007), averaging ratings from self- and informant- ratings using the BAPQ, reported ratings of: 2.75, 2.55, and 3.77 for Control, BAP-absent, and BAP-present parents, respectively. For the Pragmatic Language domain, our findings were: 2.31, 2.43, and 3.30 for the TD, OO, and HFA groups, respectively. The comparison study (Hurley and colleagues') findings were: 2.45, 2.46, and 3.13 for Control, BAP-absent, and BAP-present parents, respectively. Finally, our findings for the Rigidity domain were: 2.74, 2.90, and 3.85 for the TD, OO, and HFA groups, respectively. Our comparison study's findings were: 3.02, 3.03, and 3.58, respectively. Hurley and colleagues found that the cut-offs on the BAPQ with the best sensitivity and specificity were 3.25 for the Aloofness domain, 2.75 for the Pragmatic Language

domain, and 3.50 for the Rigidity domain. Our HFA group met the cut-offs in all three domains, whereas our OO and TD groups did not.

We compared our findings from the BFI with the findings reported in a recent article by Schriber and colleagues (2014), who compared the personality profiles of 50 children with ASD with 50 TD children. Their sample was similar to ours, in that the mean age was 12.1 years ( $SD=3.4$ ), range 8-18 years old, while the children from our sample were on average around 13.1 to 13.6 years old, with a range from 8-18 years old. In the Extraversion domain, our findings were: 2.97, 3.54, and 3.22 for the TD, OO, and HFA groups, respectively. Our comparison group's findings for Extraversion, with child self-report findings reported first, followed by ratings by parents were: 3.55/3.74 for TD, and 3.22/2.99 for ASD. In the Agreeableness domain, our findings were: 4.08, 3.92, and 3.31 for the TD, OO, and HFA groups, respectively. Our comparison group's findings for Agreeableness were: 3.92/4.33 for TD, and 3.50/3.37 for ASD. For the Conscientiousness domain, our findings were: 3.84, 3.72, and 3.09 for the TD, OO, and HFA groups, respectively. Our comparison group's findings for Conscientiousness were: 3.48/3.67 for TD, and 3.18/2.48 for ASD. For the Neuroticism domain, our findings were: 2.10, 2.18, and 3.07 for the TD, OO, and HFA groups, respectively. Our comparison group's findings for Neuroticism were: 2.55/2.25 for TD, and 3.05/3.77 for ASD. Finally for the Openness domain, our findings were: 3.60, 3.67, and 3.30 for the TD, OO, and HFA groups, respectively. Our comparison group's findings for Openness were: 3.86/4.04 for TD, and 3.64/3.32 for ASD.

### **Discussion**

This study examined the personality profile of children with “optimal outcomes,” (OO), children with high functioning autism (HFA), and typically developing (TD) children. Consistent with previous studies of Big Five personality domains, HFA children displayed a personality profile

that was clearly differentiated from TD children, and HFA individuals were also clearly differentiated from OO individuals. More specifically, HFA children were rated as being higher in Neuroticism, and lower in Agreeableness, Conscientiousness, and Openness to Experience. Contrary to our hypothesis, OO children were rated as higher in Extraversion than TD and HFA children, whereas TD and HFA groups did not significantly differ from each other, a finding which will be discussed later. Furthermore, the HFA group was clearly differentiated from OO and TD groups in BAP traits, and were rated as more aloof, having more pragmatic language difficulties, and being more rigid. In terms of overall BAP traits, OO children were indistinguishable from TD children. However, there were subtle but distinct areas of personality and BAP traits where OO children did differ from their TD peers.

### **ADHD-like symptoms and Extraversion in OO**

An area where OO participants differed from TD participants generally corresponded to ADHD-like symptoms: on the Big Five Inventory (BFI), under the Conscientiousness domain, OO children were rated as more easily distracted than TD children, although less so than HFA individuals. Likewise, on the Pragmatic Language domain of the BAPQ, OO individuals were rated as likely to display the following traits more often than TD individuals (but less often than HFA children): getting sidetracked in conversation; talking too much about certain topics; and losing track of his or her original point when talking. OO children were also consistently rated as more extraverted than TD and HFA children.

More specifically, OO individuals were consistently rated as more talkative, enthusiastic, and assertive than TD and HFA children, whereas TD and HFA children were rated as more inhibited, quiet, shy, and reserved than OO individuals. There are two potential explanations. One possibility is that OO children as a group are more talkative and extraverted than the general

population. A study identified a subset of children with ASD who are “active but odd” rather than aloof (Wing & Gould, 1979), and another study identified a subset who displayed a drive towards friendships and social relationships (Prior et al., 1998). It is possible that children who later achieve “optimal outcomes” are more likely to have initially had this more extraverted personality. Another (although not mutually exclusive) explanation is that these observed “extraverted” traits in OO are associated with ADHD-like characteristics: less inhibition, more talkativeness, and more energy and enthusiasm (consistent with case studies presented by Fein and colleagues (2005)). In contrast, it is possible that the “introversion” observed in TD (most of whom were teenagers) is a reflection of the setting in which they were observed: sitting in a room with an adult stranger who asked them personal questions about friends and relationships, as well as to engage in more “child-like” activities such as telling a story using a picture book. In these situations, OO children were less likely to appear inhibited. Furthermore, OO individuals were also rated to have less of a monotone voice than TD and HFA individuals; rather, they were more animated when they talked. OO children were also rated as being more likely than TD children to keep doing something the way he or she knows, even though he or she knows that another way may be better, a characteristic that may have been inferred by the raters due to observations of impulsivity, which could present as “assertive” or stubborn.

### **Potential Emotional Instability/Neuroticism in OO**

A potential area of difference between OO and TD children was in emotional stability (the converse of Neuroticism), although the data for this was more mixed: while the OO group did not significantly differ from the TD group in overall Neuroticism on the BFI, they were rated as less emotionally stable ( $p=.05$ ) than the TD group on the TIPI. In general, OO children did not differ from items relating to “easily” being anxious, nervous, or a worrier, or in being depressed

and moody. Where OO children did differ from TD children, however, related to situations when they might be in a more difficult situation: remaining calm during a tense situation, or handling stress well. However, as some of these results were mixed and dependent on naïve raters' observations, more research needs to be conducted to determine whether OO children are more likely to be less calm during more difficult situations. Research has shown that Neuroticism is a domain that is harder for outside raters to judge, as it tends to be an internal trait. What is notable, however, was that HFA individuals were rated to be significantly more anxious and moody and less calm than OO and TD individuals, and the difference was clear, with large effect sizes.

### **Personality Traits and Group Membership**

In terms of “Big Five” personality traits, consistent with previous research (e.g., Schriber, Robins, & Solomon, 2014), Neuroticism (as well as “Emotional Stability,” the converse of Neuroticism) was the best predictor of group membership when trying to differentiate TD from HFA children, as well as OO from HFA individuals. In contrast, Extraversion was the best Big Five personality trait to differentiate OO from TD children. In terms of broader autism phenotype (BAP) personality traits, Rigidity was the best predictor of group membership when trying to differentiate TD from HFA individuals, as well as OO from HFA individuals. Overall, we found that OO and TD children could not be differentiated using only the BAP personality traits of aloofness, pragmatic language difficulties, and rigidity. Furthermore, we found that OO and TD children had a distinct personality profile (at least as displayed during the ADOS), such that Extraversion and Openness on the TIPI differentiated OO from TD children in approximately 73% of the cases, and Extraversion and Neuroticism on the BFI differentiated OO from TD children in approximately 73% of the cases.

**Areas OO and TD did not differ in BAP and BFI personality traits.**

One of the noteworthy findings was that in most areas, OO children did *not* differ from TD children, even in very subtle traits associated with the broader autism phenotype. For example, OO participants did not differ from TD participants on any individual questions on the BAPQ Pragmatic Language domain, other than those previously mentioned that could be associated with attention and impulsivity. More specifically, in contrast to a previous study by our lab that transcribed and systematically analyzed OO narratives and found OO participants to be more dysfluent than TD participants (Suh et al., 2014), OO children were not *perceived* by naïve raters as having more difficulty getting out their words, leaving more pauses, or being more frequently difficult to understand than TD children. Furthermore, OO children were rated as equally connected and “in tune” with their conversation partner. In terms of the Aloofness domain, OO children were rated as *more* likely than TD and HFA children to make conversation out of enjoyment rather than to be polite (a quality potentially related to being less inhibited with the adult examiner). OO children did not differ from TD children on any other individual questions, whereas OO and TD individuals differed from HFA individuals in every question in this domain. The OO and TD groups also differed from the HFA group in every question in the Rigidity domain, and the OO group did not differ from the TD group on any questions, with the exception of the question relating to continuing to do things a particular way even though another way may be better, a characteristic potentially inferred by observations of impulsivity in OO children. Nevertheless, OO participants did not significantly differ from TD participants on questions related to being comfortable with unexpected changes in plans, being flexible, and trying new things, and were not perceived to have a stronger need for sameness or a routine. Likewise, the OO group did not differ from the TD group on individual questions relating to Big Five

personality characteristics, with the exception of questions associated with greater ADHD-like characteristics, extraversion, emotional stability, and curiosity.

**Relationship between individual Big Five Personality Traits, Broader Autism Phenotype (BAP) traits, and ADOS scores in OO, TD, and HFA.**

The current study found that greater aloofness, pragmatic language difficulties, and rigidity were generally associated with lower extraversion, agreeableness, conscientiousness, emotional stability, and greater neuroticism in HFA, OO, and TD children, with the exception that for HFA and OO children, extraversion and pragmatic language difficulties were not related, and for TD children rigidity and conscientiousness were not related. In terms of ADOS scores, the ADOS Communication domain, which encapsulates stereotyped, idiosyncratic use of language, reporting of events, conversation, and use of gesture, did not significantly correlate with any Big Five personality factors or BAP factors in the HFA group. In contrast, more communication deficits as measured by the ADOS Communication domain were associated with greater aloofness and pragmatic language difficulties in the OO group, and greater aloofness and rigidity in the TD group. The ADOS Reciprocal Social Interaction domain, which encapsulates unusual eye contact, direction of facial expressions, quality of social overtures, quality of social response, amount of reciprocal social interaction, and overall quality of rapport, showed the same pattern in HFA and OO individuals, with greater social interaction deficits as measured by the ADOS associated with the general personality profile seen in HFA children: less extraversion, agreeableness, emotional stability, and openness, and greater neuroticism, aloofness, pragmatic language deficits, and rigidity, as observed by naïve raters. In TD children, greater social interaction deficits on the ADOS were associated with less agreeableness, emotional stability,



and greater rigidity. ADOS Communication, Social Interaction, and Combined scores did not correlate with extraversion in any of the three groups.

An important finding was that the BAP traits of Aloofness and Pragmatic Language deficits, which correspond to ASD diagnostic criteria for difficulties in Social Communication, and the BAP trait of Rigidity, which corresponds to the ASD criteria for Restricted, Repetitive Patterns of Behavior, were found to be significantly correlated with each other within not only the HFA group, but also within the OO and TD groups. This is in contrast to previous studies that found that, while communication, social interaction, and restricted behaviors correlated with each other in people with ASD, and were found to lie on a continuum in people in the general population, communication impairment, social impairment, and restricted, repetitive behaviors were only modestly correlated with each other in the general population (Ronald, Happé, & Plomin, 2005; Ronald et al., 2006). Therefore, in the general population, these factors were thought to arise from distinct genetic etiologies. The finding from the current study that BAP traits that map onto diagnostic criteria for ASD positively correlate with each other, with large effect sizes, (such that greater aloofness is associated with greater pragmatic language difficulties and more rigidity) suggests that there is a strong relationship between the traits, even in the general population. Therefore, this study adds evidence that symptoms associated with ASD are dimensional (lie on a continuum) and relate to each other, even in the general population.

### **Zero Acquaintance Ratings**

The averages of our zero acquaintance ratings were remarkably similar to those obtained from our comparison studies that used the BAPQ (Hurley et al., 2007) and BFI (Schriber et al., 2014). The data from the former study involved averages of self- and acquaintance- ratings using the BAPQ, and the latter also involved paper-and-pencil self-ratings by children and other-ratings by

their parents using the BFI. Overall, our zero acquaintance ratings were remarkably comparable to best estimate ratings in the study by Hurley and colleagues (2007), and our HFA group consistently met cut-offs for having significant BAP characteristics, whereas our OO and TD groups consistently did not. For the BFI, overall, our ratings were very similar to self-ratings by children and ratings by their parents. However, there were two exceptions. Our TD group scored lower in the Extraversion domain than their TD group and comparable to their HFA group, whereas our OO group scored comparable to their TD group. This provides evidence for our hypothesis that the TD children in our sample scored lower in Extraversion because of the specific situation in which they were placed: with an adult stranger, asked personal questions and engaging in “child-like” tasks. Furthermore, there was some overlap in scores from our TD and OO groups with their ASD self-ratings for Openness, although parent report of Openness in HFA were very similar to our ratings (3.32 to 3.30 for their average rating, and our rating, respectively).

### **Strengths, Limitations, and Directions for Future Research**

There were strengths to having zero-acquaintance raters evaluate the personality characteristics of the OO, TD, and HFA children by observing video clips from the ADOS. First, using zero-acquaintance raters reflects the impressions these children may make on others who encounter them in the outside world. Furthermore, the semi-structured manner of the ADOS allows comparison across a similar set of activities and conversations. Additionally, unlike many other studies of zero acquaintance ratings, the raters were able to observe the children performing a range of different activities. There was also high reliability and consistency among the questions that fed into each domain of personality in our study, and our findings for HFA and TD/OO groups are very similar to findings using the BAPQ by Hurley and colleagues (2007), as well as

findings from Schriber and colleagues (2014) using the BFI. Our methodology also allowed us to examine more subtle, potentially subthreshold traits, such as attention problems, which may not reach the level to qualify for a diagnosis, but are present and could still impact the life of the child. Other strengths relate to the rigorous manner in which the OO, HFA, and TD groups were defined and characterized. Every group, including the HFA group, had VIQ, PIQ, and FSIQ in the average range, and so an examination of personality and broader autism phenotype characteristics was, on the whole, not confounded by IQ factors or intellectual disability, which could have otherwise impacted the quality of the social interaction between the child and the examiner. Furthermore, each OO child was rigorously evaluated to meet very specific criteria for “optimal outcome”, as described in the Methods.

However, there are also limitations to our methodology. First, the types of activities that the OO, TD, or HFA child engaged in does not necessarily reflect the type of activities that he or she may engage in in everyday life: for example, teenagers are not usually asked to pretend to brush their teeth or tell a story using a storybook. Nevertheless, these activities were able to elicit a variety of responses from the child that may not have been observed in a typical short observation. For example, the children were asked to answer personal questions about friendships and romantic relationships. Their responses included: freely sharing (or over-sharing) about themselves and their friends; being initially shy, but agreeably complying with the task; to uncomfortably fidgeting, refusing to answer the question, and getting upset. Furthermore, the children were asked to talk with an adult stranger, and thus, we were not able to evaluate how they interact with adults with whom they are acquainted with, and importantly, how they interact with peers. Children at this age spend most of their day interacting with peers, and so interaction with peers would reflect many, if not the majority, of their everyday interactions. Additionally,

there are characteristics, such as neuroticism, that may be more difficult to observe in a fine-tuned manner through zero-acquaintance ratings. A future (and potentially very informative) study would be to have self-ratings, as well as parent and peer ratings using the same questionnaires, which would also allow us to examine the way the child typically responds in his or her daily life, rather than in one specific context. There were also limitations related to our sample characteristics. First is our sample size of 22 to 27 children per group. A larger sample would allow us to examine whether there are distinct subgroups of personality profiles in OO children. Our limited sample also prevented us from examining potentially different personality profiles in males and females. For example, previous studies found differences between males and females, with fathers of children with ASD more likely to be aloof and mothers more likely to be rigid (Seidman et al., 2012), and boys displaying more autistic traits than girls (Williams et al., 2008). However, Schriber et al (2014), who studied Big Five personality traits and had a sample that was greater than 50% female, did not find a significant difference between males and females. A future study should examine in more depth whether girls with OO have distinct personality and BAP profiles when compared to their male peers. Furthermore, although the criteria to qualify to be in the “optimal outcome” group were rigorous and initial diagnoses had to be made by a specialist in autism, not all of the OO group were administered the ADOS or ADI-R at the time of initial diagnosis. Additionally, as this is a cross-sectional study, we were not able to evaluate these children at different time points. An important area of future study would involve examining whether children who are more extraverted are more likely to have “optimal outcomes.” It would also be informative to see whether or how personality profiles change as these children grow into adults.

### **Implications for Treatment**

Our study found that OO children have very few residual deficits compared to TD children, and were even characterized as being more extraverted and enjoying conversation more with the examiner than TD individuals. However, the observed ADHD-like symptoms during conversation, including being less inhibited, more easily distracted, more tangential, and more likely to talk too much about certain topics, could potentially impact the quality of their social interactions and the quality of their relationships. These characteristics could be explicitly evaluated in OO and HFA children and targeted for intervention. Furthermore, OO participants were rated as more likely to be less emotionally stable than their TD peers, and to potentially not react as well under stress; however, there is a possibility that some of this was inferred not due to actual observation of emotional stability, but due to impulsive and hyperactive behaviors on the part of OO children. Nevertheless, neuroticism (and its converse, emotional stability) are traits that have been associated with greater susceptibility to psychopathology (Ormel et al., 2013), and previously observed in a subset of children with “optimal outcomes,” (Fein et al., 2013); therefore, it is recommended that anxiety and neuroticism (as well as emotional stability under pressure) be evaluated in “optimal outcome” children.

Consistent with previous studies, HFA children displayed a personality profile that has been associated with greater psychopathology: less extraversion, agreeableness, conscientiousness, openness, and more neuroticism (Malouff et al., 2005; Schriber et al., 2014). It is likely that these individual characteristics are leading to more negative interactions with others, and are thus individual factors that could be targeted for intervention. This could include explicit teaching to smile, make eye contact, and ask about others’ interests; to be more mindful to agree with others’ suggestions and engage in more cooperative behaviors; to work on being more reliable, organized and conscientious (factors that overlap with executive functioning and

attention problems seen in HFA individuals); and to learn to be more flexible and less rigid. Furthermore, consistent with previous studies, HFA children were observed to be more likely to be anxious and depressed than their TD and OO peers. Children with ASD who are high-functioning are more aware of their deficits, which could lead to more anxiety and depression as they try to navigate the social world (Hill, Berthoz, & Frith, 2004). This was also observed during the ADOS, as some children would get anxious, upset, or cry when asked about friendships. These children could potentially benefit from therapy and social skills groups, which could help them feel less alone in their struggles. Additionally, we found that the Ten Item Personality Inventory (TIPI) was an efficient measure of personality that corresponded very closely to that of the much longer Big Five Inventory (BFI). Therefore, as there is variability in personality profiles in all children, including those characterized as having high-functioning autism, having “optimal outcomes”, or having “typical development”, assessing personality profiles could be a good addition to guide treatment in all children.

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**Table 1.** Demographic Information

	<b>TD (SD)</b> n=23	<b>OO (SD)</b> n=22	<b>HFA (SD)</b> n=27	<b>F</b>	<b>p</b>	<b>η<sup>2</sup></b>	<b>Post-Hoc</b>
Age	13.6 (2.0) 9.9-17.4	13.3 (3.2) 8.5-18.5	13.1 (2.5) 8.6-18.4	.198	.821	.01	
Gender* (male: female)	21:2	17:5	25:2		.22		
WASI FSIQ	113.8(11.2) 97-142	113.0 (13.8) 82-134	108.3 (12.3) 80-138	1.45	.241	.04	
WASI VIQ	111.0(11.9) 93-136	111.1 (14.6) 80-136	103.6 (12.9) 81-133	2.72	.073	.07	
WASI PIQ	114.4(13.2) 89-139	111.8 (13.7) 87-134	111.5 (13.8) 78-147	.321	.726	.01	
Vineland Communication	92.6 (7.6) 81-115	97.7 (12.4) 79-122	84.0 (12.4) 51-108	9.49	<.001	.22	HFA<OO,TD
Vineland Social	102.7(6.9) 86-117	102.6 (8.8) 80-118	75.1 (16.4) 46-109	62.3	<.001	.57	HFA<OO,TD

\*Pearson chi-square

**Table 2.** Personality Characteristics from Ten-Item Personality Inventory (TIPI)

	<b>TD (SD)</b> N=23	<b>OO (SD)</b> N=22	<b>HFA (SD)</b> N=27	<b>F</b>	<b>p</b>	<b>η<sup>2</sup></b>	<b>Post-Hoc</b>
TIPI Extraversion	4.07(1.42)	5.01 (1.09)	4.03(1.20)	4.57	.01	.12	<b>OO&gt; TD, HFA</b>
TIPI Agreeable	5.57(.45)	5.36(.74)	4.46(1.03)	13.91	<.001	.29	HFA< OO, TD
TIPI Conscientious	5.43(.62)	5.13(1.09)	4.09(1.13)	13.01	<.001	.27	HFA< OO, TD
TIPI Emotional Stability	5.74(.36)	5.41(.72)	4.00(1.15)	31.13	<.001	.47	<b>HFA&lt;OO&lt;TD</b>
TIPI Openness to Experience	5.16(.81)	5.16(.95)	4.30(.99)	7.26	.001	.17	HFA< OO, TD

**Table 3.** Personality Characteristics from Big Five Inventory (BFI)

	<b>TD (SD)</b> N=23	<b>OO (SD)</b> N=22	<b>HFA (SD)</b> N=27	<b>F</b>	<b>p</b>	<b>η<sup>2</sup></b>	<b>Post-Hoc</b>
BFI Extraversion	2.97(.89)	3.54(.76)	2.86(.79)	4.73	.01	.12	OO>TD, HFA
BFI Agreeable	4.08(.33)	3.96(.47)	3.31(.75)	13.92	<.001	.29	HFA< OO, TD
BFI Conscientious	3.84(.44)	3.72(.66)	3.09(.75)	10.27	<.001	.23	HFA< OO, TD
BFI Neuroticism*	2.10(.32)	2.18(.51)	3.07(.72)	24.34	<.001	.41	HFA> OO, TD
BFI Openness to Experiences	3.60(.52)	3.67(.53)	3.30(.57)	3.20	.047	.09	Trend HFA< OO, TD <i>p</i> (HFA,TD)=.06

\*Note that the TIPI evaluates Emotional Stability, whereas the BFI evaluates the converse, Neuroticism

**Table 4.** Individual TIPI questions in Extraversion, Agreeableness, Conscientiousness, Emotional Stability, and Openness Domains

	TD (SD) N=23	OO (SD) N=22	HFA (SD) N=27	F	p	$\eta^2$	Post-Hoc
<b>EXTRAVERSION</b>							
1 Extraverted, enthusiastic	4.39(1.44)	5.35(1.08)	4.28(1.30)	4.85	.01	.12	<b>OO&gt;TD, HFA</b>
<b>Reverse-Scored</b>							
6 Reserved, quiet	4.24(1.44)	3.32(1.15)	4.21(1.17)	3.96	.02	.10	<b>OO&lt;TD, HFA</b>
<b>AGREEABLENESS</b>							
7 Sympathetic, warm	5.31(.61)	5.17(.91)	4.28(1.05)	10.21	<.001	.23	HFA< TD, OO
<b>Reverse-Scored</b>							
2 Critical, quarrelsome	2.17(.57)	2.45(.64)	3.36(1.08)	14.46	<.001	.30	HFA>TD, OO
<b>CONSCIENTIOUS</b>							
3 Dependable, self-disciplined	5.55(.64)	5.18(1.07)	4.04(1.25)	14.67	<.001	.30	HFA<TD, OO
<b>Reverse-Scored</b>							
8 Disorganized, careless	2.69(.66)	2.91(1.15)	3.86(1.07)	10.02	<.001	.23	HFA>TD, OO
<b>EMOTIONALLY STABLE</b>							
9 Calm, emotionally stable	5.86(.40)	5.50(.79)	4.10(1.20)	28.05	<.001	.45	<b>HFA&lt;OO&lt;TD</b>
<b>Reverse-Scored</b>							
4 Anxious, easily upset	2.39(.44)	2.69(.76)	4.10(1.17)	28.03	<.001	.45	HFA>TD, OO
<b>OPENNESS TO EXPERIENCE</b>							
5 Open to new experiences	5.33(.76)	5.26(.87)	4.09(1.18)	13.34	<.001	.28	HFA<TD, OO
<b>Reverse-Scored</b>							
10 Conventional, uncreative	3.01(.98)	2.94(1.08)	3.45(.99)	2.15	.12	.06	

**Table 5.** Individual BFI questions in Extraversion Domain

EXTRAVERSION Domain	TD (SD) N=23	OO (SD) N=22	HFA (SD) N=27	F	p	$\eta^2$	Post-Hoc
1 Is talkative	3.37(.90)	3.90(.76)	3.19(.93)	4.23	.02	.11	<b>OO&gt; HFA, TD</b>
11 Is full of energy	2.88(1.05)	3.49(.93)	3.10(.91)	2.36	.10	.06	
16 Generates a lot of enthusiasm	2.91(1.10)	3.50(.96)	2.87(.97)	2.80	.06	.08	Trend <b>OO&gt; HFA, TD</b> $p(\text{OO, TD})=.04$ $p(\text{OO, HFA})=.03$
26 Is assertive	2.63(.75)	3.17(.73)	2.76(.61)	3.79	.03	.10	<b>OO&gt; HFA, TD</b>
36 Is outgoing, sociable	3.67(.73)	4.03(.68)	2.96(.91)	11.67	<.001	.25	OO, TD> HFA
<b>Reverse-Scored Introversion</b>							
6 Is reserved	3.18(.96)	2.47(.82)	3.22(.82)	5.50	.01	.14	<b>OO&lt; HFA, TD</b>
21 Tends to be quiet	4.07(1.05)	4.01(.87)	3.39(.87)	4.21	.02	.11	<b>OO&lt; HFA, TD</b>
31 Is sometimes shy, inhibited	3.37(.93)	2.82(.81)	3.58(.81)	4.98	.01	.13	<b>OO&lt; HFA, TD</b>

**Table 6.** Individual BFI questions in Agreeableness Domain

AGREEABLENESS Domain	TD (SD) N=23	OO (SD) N=22	HFA (SD) N=27	F	p	$\eta^2$	Post-Hoc
7 Is helpful and unselfish	4.10(.36)	3.96(.65)	3.25(.80)	12.72	<.001	.27	HFA< TD,OO
17 Has a forgiving nature	4.07(.39)	3.99(.49)	3.41(.75)	9.92	<.001	.22	HFA< TD,OO
22 Is generally trusting	4.07(.28)	4.01(.37)	3.39(.69)	14.56	<.001	.30	HFA< TD,OO
32 Is considerate and kind	4.19(.36)	4.04(.61)	3.31(.84)	13.21	<.001	.28	HFA< TD,OO
42 Likes to cooperate	4.22(.26)	4.05(.57)	3.45(.79)	11.57	<.001	.25	HFA< TD,OO
<b>Reverse-Scored Antagonism</b>							
2 Tends to find fault with others	1.93(.40)	1.98(.43)	2.51(.74)	8.37	.001	.20	HFA> TD,OO
12 Starts quarrels with others	1.78(.39)	1.95(.41)	2.52(.80)	11.06	<.001	.24	HFA> TD,OO
27 Can be cold and aloof	2.29(.73)	2.21(.77)	3.14(.90)	10.20	<.001	.23	HFA> TD,OO
37 Is sometimes rude to others	1.92(.51)	2.24(.63)	2.86(.98)	10.14	<.001	.23	HFA> TD,OO

**Table 7.** Individual BFI questions in Conscientiousness Domain

CONSCIENTIOUSNESS Domain	TD (SD) N=23	OO (SD) N=22	HFA (SD) N=27	F	p	$\eta^2$	Post-Hoc
3 Does a thorough job	3.96(.51)	3.94(.75)	3.26(.92)	7.09	.002	.17	HFA< TD, OO
13 Is a reliable worker	3.94(.45)	3.83(.79)	3.09(.89)	9.67	<.001	.22	HFA< TD, OO
28 Perseveres until the task is finished	3.94(.52)	3.96(.79)	3.34(.84)	5.84	.01	.14	HFA< TD, OO
33 Does things efficiently	3.84(.53)	3.71(.68)	2.90(.76)	14.59	<.001	.30	HFA< TD, OO
38 Makes plans and follows through	3.93(.39)	3.78(.60)	3.15(.68)	12.96	<.001	.27	HFA< TD, OO
<b>Reverse Scored</b> Lack of Direction							
8 Can be somewhat careless	2.38(.62)	2.70(.85)	3.24(.99)	5.82	.01	.14	HFA>TD OO=TD OO=HFA
18 Tends to be disorganized	2.31(.52)	2.49(.87)	3.03(.79)	6.57	.002	.16	HFA> TD, OO
23 Tends to be lazy	2.30(.65)	2.13(.57)	2.53(.67)	2.46	.09	.07	
43 Is easily distracted	2.00(.49)	2.44(.78)	3.14(.95)	13.77	.01	.29	<b>HFA&gt;OO&gt;TD</b>

**Table 8.** Individual BFI questions in Neuroticism Domain

NEUROTICISM Domain	TD (SD) N=23	OO (SD) N=22	HFA(SD) N=27	F	p	$\eta^2$	Post-Hoc
4 Is depressed, blue	2.06(.61)	1.80(.61)	2.55(.85)	7.14	.002	.17	HFA> TD,OO
14 Can be tense	2.57(.57)	2.51(.72)	3.43(.78)	13.54	<.001	.28	HFA> TD,OO
19 Worries a lot	2.24(.44)	2.16(.47)	2.93(.72)	13.91	<.001	.29	HFA> TD,OO
29 Can be moody	2.18(.44)	2.35(.66)	3.28(.88)	18.60	<.001	.35	HFA> TD,OO
39 Gets nervous easily	2.20(.49)	2.39(.61)	3.10(.78)	13.85	<.001	.29	HFA> TD,OO
<b>Reverse Scored</b> Emotional Stability							
9 Is relaxed, handles stress	4.15(.30)	3.90(.55)	2.84(.93)	27.53	<.001	.44	Trend HFA< OO<TD p(OO, TD)= .06
24 Is emotionally stable, not easily upset	4.15(.29)	3.98(.57)	3.02(.80)	25.37	<.001	.42	HFA< TD, OO
34 Remains calm in tense situations	4.16(.31)	3.89(.56)	2.87(.85)	29.57	<.001	.46	<b>HFA&lt;OO&lt;TD</b>

**Table 9.** Individual BFI questions in Openness Domain

OPENNESS Domain	TD (SD) N=23	OO (SD) N=22	HFA(SD) N=27	F	p	$\eta^2$	Post-Hoc
5 Is original, comes up with new ideas	3.90(.65)	3.96(.66)	3.42(.66)	5.17	.01	.13	HFA< TD, OO
10 Is curious about many different things	3.88(.62)	3.98(.61)	3.53(.79)	2.96	.05	.08	<b>Trend</b> <b>HFA,TD&lt;OO</b> $p(OO, TD)=.06$
15 Is ingenious, a deep thinker	3.50(.74)	3.50(.79)	3.12(.81)	1.98	.15	.05	
20 Has an active imagination	3.84(.66)	4.09(.60)	3.77(.55)	1.84	.17	.05	
25 Is inventive	3.72(.65)	3.89(.66)	3.65(1.01)	.541	.58	.02	
30 Values artistic, aesthetic experiences	3.45(.61)	3.54(.72)	3.32(.67)	.695	.50	.02	
40 Likes to reflect, play with ideas	3.55(.69)	3.71(.69)	3.16(.71)	4.16	.02	.11	HFA< TD, OO
44 Is sophisticated in art, music, or literature	3.46(.73)	3.45(.74)	3.21(.77)	.856	.43	.02	
<b>Reverse Scored:</b> Closed to Experience							
35 Prefers work that is routine	3.07(.32)	3.13(.37)	3.63(.45)	15.75	<.001	.31	HFA> TD, OO
41 Has few artistic interests	2.29(.49)	2.32(.55)	2.55(.65)	1.60	.21	.04	

**Table 10.** Personality Characteristics from Broader Autism Phenotype Questionnaire (BAPQ)

	TD (SD) N=23	OO (SD) N=22	HFA (SD) N=27	F	p	$\eta^2$	Post-Hoc
BAPQ Aloof	2.54(.61)	2.34(.68)	3.46(.84)	17.09	<.001	.33	HFA> OO, TD
BAPQ Pragmatic Language	2.31(.38)	2.43(.62)	3.30(.71)	20.82	<.001	.38	HFA> OO, TD
BAPQ Rigid	2.74(.34)	2.90(.47)	3.85(.74)	29.20	<.001	.46	HFA> OO, TD

**Table 11.** Individual BAPQ questions in Aloof Domain

ALOOF Domain	TD (SD) N=23	OO (SD) N=22	HFA(SD) N=27	F	p	$\eta^2$	Post-Hoc
5. Prefers to talk to get information rather than socialize	2.46(.70)	2.23(.62)	3.28(.82)	14.58	<.001	.30	HFA> OO, TD
18 Makes conversation just to be polite (not out of enjoyment)	3.15(.75)	2.44(.60)	3.23(.64)	9.85	<.001	.22	<b>HFA, TD&gt;OO</b>
27 Gets bored with conversation	2.91(.82)	2.88(.85)	3.85(1.01)	9.39	<.001	.21	HFA> OO, TD
31 Prefers to be alone	2.40(.61)	2.21(.63)	3.28(.85)	16.22	<.001	.32	HFA> OO, TD
<b>Reverse Scored</b>							
1 Likes being around other people	4.84(.55)	4.89(.71)	3.91(.96)	13.02	<.001	.27	HFA< OO, TD
9 Enjoys being in social situations	4.77(.58)	4.86(.74)	3.65(.98)	17.76	<.001	.34	HFA< OO, TD
12 Other people find it easy to approach him/her	4.57(.54)	4.55(.74)	3.41(.86)	20.89	<.001	.38	HFA< OO, TD
16 Looks forward to meeting other people	4.30(.63)	4.54(.66)	3.41(.81)	30.21	<.001	.34	HFA< OO, TD
23 Good at making small talk	4.48(.81)	4.75(.98)	3.26(1.17)	15.62	<.001	.31	HFA< OO, TD
25 Feels like he/she is connecting with people	4.36(.68)	4.53(.90)	3.16(.94)	19.39	<.001	.36	HFA< OO, TD
28 Warm and friendly in interactions	4.62(.70)	4.73(.84)	3.68(1.03)	10.78	<.001	.24	HFA< OO, TD
36 Enjoys chatting with people	4.52(.81)	4.89(.75)	3.62(1.10)	12.63	<.001	.27	HFA< OO, TD

**Table 12.** Individual BAPQ questions in Pragmatic Language Domain

PRAGMATIC LANGUAGE Domain	TD (SD) N=23	OO (SD) N=22	HFA (SD) N=27	F	p	$\eta^2$	Post-Hoc
2 Finds it hard to get words out smoothly	2.34(.77)	2.48(.83)	3.70(1.16)	15.86	<.001	.31	HFA> OO, TD
4 Finds it hard to avoid getting sidetracked in conversation	1.90(.46)	2.50(.87)	3.01(.92)	12.38	<.001	.26	<b>HFA&gt;OO&gt;TD</b>
10 Has a flat or monotone voice	3.01(1.36)	2.31(.85)	3.25(1.05)	4.63	.01	.12	<b>HFA,TD &gt;OO</b>
11 Feels disconnected in conversations with others	2.10(.47)	2.18(.73)	3.35(1.01)	20.11	<.001	.37	HFA> OO, TD
14 People ask to repeat things because don't understand him/her	1.98(.54)	2.10(.89)	3.21(1.16)	14.10	<.001	.29	HFA> OO, TD
17 Told talks too much about certain topics	2.29(.56)	2.89(.98)	2.71(.63)	3.99	.02	.10	<b>HFA, OO&gt;TD</b>
20 Speaks too loudly/too softly	2.61(.97)	2.38(.69)	3.36(.96)	8.38	.001	.20	HFA> OO, TD
29 Leaves pauses in conversation	2.76(.78)	2.40(.86)	3.47(1.11)	8.29	.001	.19	HFA> OO, TD
32 Loses track of original point when talking	1.87(.33)	2.34(.70)	2.94(.86)	15.54	<.001	.31	<b>HFA&gt;OO&gt;TD</b>
<b>Reverse Scored</b>							
7 "In-tune" with others during conversation	4.92(.47)	4.77(.83)	3.73(.99)	16.22	<.001	.32	HFA< OO, TD
21 Able to tell when someone is not interested in what he/she is saying	4.55(.38)	4.25(.74)	3.08(.92)	28.57	<.001	.45	HFA< OO, TD
34 Able to tell when time to change topic	4.64(.45)	4.34(.62)	3.55(.78)	19.44	<.001	.36	HFA< OO, TD



**Table 13.** Individual BAPQ questions in Rigid Domain

RIGID Domain	TD (SD) N=23	OO (SD) N=22	HFA (SD) N=27	F	p	$\eta^2$	Post-Hoc
6 Has to be talked into trying something new	2.50(.51)	2.61(.64)	3.70(.88)	22.30	<.001	.39	HFA> OO, TD
8 Has to warm him/herself to idea of visiting an unfamiliar place	2.58(.54)	2.72(.60)	3.82(.92)	22.45	<.001	.39	HFA> OO, TD
13 Feels a strong need for sameness	2.78(.58)	2.91(.57)	3.83(.80)	18.44	<.001	.35	HFA> OO, TD
22 Has a hard time dealing with changes in routine	2.29(.38)	2.50(.63)	3.65(.92)	27.80	<.001	.45	HFA> OO, TD
24 Acts very set in his/her ways	3.03(.50)	3.31(.52)	4.07(.74)	19.76	<.001	.36	HFA> OO, TD
26 Gets frustrated because is unwilling to bend	2.02(.43)	2.29(.66)	3.58(1.14)	25.60	<.001	.43	HFA> OO, TD
33 Likes to closely follow a routine while working	3.36(.48)	3.54(.46)	3.96(.46)	10.94	<.001	.24	HFA> OO, TD
35 Keeps doing things the way he/she knows, even if another way is better	3.18(.39)	3.46(.46)	4.00(.64)	16.14	<.001	.32	<b>HFA&gt;OO&gt;TD</b>
<b>Reverse Scored</b>							
3 Comfortable with unexpected change in plans	4.60(.40)	4.38(.62)	3.18(.91)	31.21	<.001	.47	HFA< OO, TD
15 Flexible about how things should be done	4.59(.48)	4.40(.57)	3.19(.91)	30.21	<.001	.47	HFA< OO, TD
19 Looks forward to trying new things	4.36(.50)	4.49(.58)	3.43(.93)	16.52	<.001	.32	HFA< OO, TD
30 Alters daily routine to try something different	3.36(.53)	3.26(.43)	2.60(.56)	16.45	<.001	.32	HFA< OO, TD

**Table 14.** Correlations of Big Five Personality Traits with BAP Characteristics and ADOS: Children with High Functioning Autism (HFA)

High Functioning Autism (HFA)	BAPQ Aloof	BAPQ Pragmatic	BAPQ Rigid	ADOS Communication	ADOS Social Interaction	ADOS Combined
TIPI Extraversion	-0.74***	ns	-0.47**	ns	ns	ns
BFI Extraversion	-0.79***	ns	-0.49**	ns	ns	ns
TIPI Agreeableness	-0.69***	-0.56**	-0.78***	ns	-0.41**	ns
BFI Agreeableness	-0.75***	-0.68***	-0.84***	ns	-0.46**	ns
TIPI Conscientious	-0.46*	-0.82***	-0.71***	ns	-0.42**	-0.47**
BFI Conscientious	-0.63***	-0.88***	-0.79***	ns	-0.47**	-0.48**
TIPI Emotional Stability	-0.71***	-0.80***	-0.86***	ns	-0.5**	-0.44*
BFI Neuroticism	0.82***	0.72***	0.89***	ns	0.47**	ns
TIPI Openness	-0.91***	-0.77***	-0.83***	ns	-0.43*	ns
BFI Openness	-0.7***	-0.74***	-0.68***	ns	-0.46**	-0.42*
BAPQ Aloof	na	0.73***	0.87***	ns	0.47**	ns
BAPQ Pragmatic	0.87***	na	0.82***	ns	0.51**	0.5**
BAPQ Rigid	0.87***	0.82***	na	ns	0.56**	0.46**

**Table 15.** Correlations of Big Five Personality Traits with BAP Characteristics and ADOS: Children with Optimal Outcomes (OO)

Optimal Outcomes (OO)	BAPQ Aloof	BAPQ Pragmatic	BAPQ Rigid	ADOS Communication	ADOS Social Interaction	ADOS Combined
TIPI Extraversion	-0.77***	ns	-0.58**	ns	ns	ns
BFI Extraversion	-0.78***	ns	-0.57	ns	ns	ns
TIPI Agreeableness	-0.85***	-0.66**	-0.78***	ns	-0.42*	ns
BFI Agreeableness	-0.82***	-0.74***	-0.74***	ns	-0.49**	-0.42*
TIPI Conscientious	-0.76***	-0.87***	-0.77***	ns	-0.65***	-0.59**
BFI Conscientious	-0.81***	-0.86***	-0.75***	ns	-0.65***	-0.59**
TIPI Emotional Stability	-0.83***	-0.90***	-0.85***	ns	-0.52**	-0.50**
BFI Neuroticism	0.93***	0.76***	0.87***	ns	0.42**	0.43*
TIPI Openness	-0.93***	-0.72***	-0.87***	ns	-0.41*	ns
BFI Openness	-0.91***	-0.73***	-0.75***	ns	-0.46**	-0.45**
BAPQ Aloof	na	0.76***	0.87***	0.44*	0.51**	0.52**
BAPQ Pragmatic	0.76***	na	0.8***	0.49*	0.76***	0.71***
BAPQ Rigid	0.87***	0.80***	na	ns	0.51**	0.51**

\*\*\*p&lt;.001, \*\*p&lt;.01, \*p&lt;.05

**Table 16.** Correlations of Big Five Personality Traits with BAP Characteristics and ADOS: Children with Typical Development (TD)

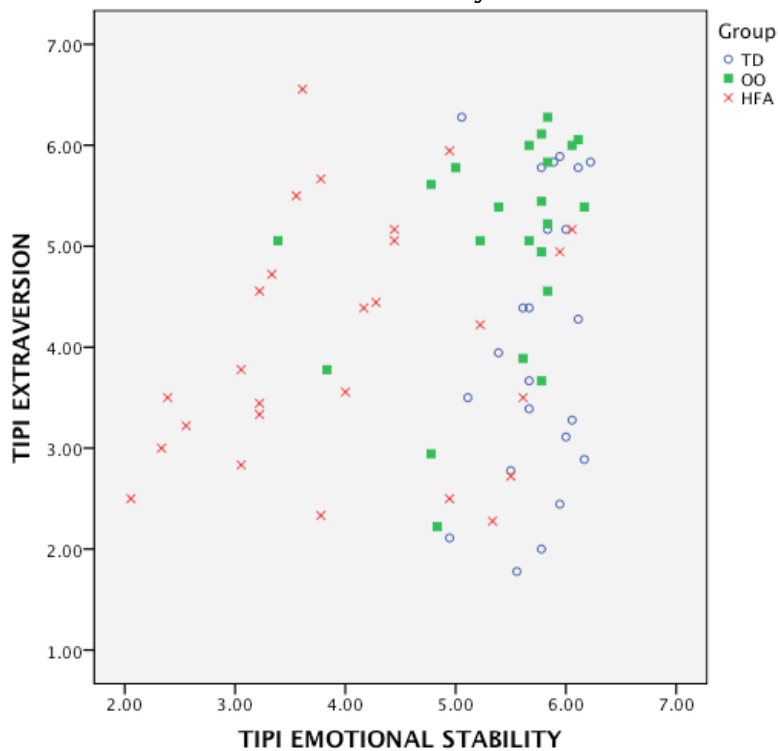
Typically Developing (TD)	BAPQ Aloof	BAPQ Pragmatic	BAPQ Rigid	ADOS Communication	ADOS Social Interaction	ADOS Combined
TIPI Extraversion	-0.85***	-0.67***	-0.53**	ns	ns	ns
BFI Extraversion	-0.88***	-0.68***	-0.55**	ns	ns	ns
TIPI Agreeableness	-0.63***	ns	-0.75***	ns	-0.50**	-0.51**
BFI Agreeableness	-0.65***	-0.48*	-0.81***	ns	-0.41*	-0.42*
TIPI Conscientious	ns	-0.61**	ns	ns	ns	ns
BFI Conscientious	-0.51**	-0.76***	ns	ns	ns	ns
TIPI Emotional Stability	-0.54**	-0.45*	-0.55***	-0.53**	-0.53**	-0.6**
BFI Neuroticism	0.80***	0.69***	0.62	ns	ns	ns
TIPI Openness	-0.85***	-0.68***	-0.55**	ns	ns	ns
BFI Openness	-0.61**	-0.65***	-0.4*	ns	ns	ns
BAPQ Aloof	na	0.71***	0.76***	0.41	ns	0.41*
BAPQ Pragmatic	0.71***	na	0.47*	ns	ns	ns
BAPQ Rigid	0.76***	0.47*	na	0.44*	0.58**	0.59**

\*\*\*p&lt;.001, \*\*p&lt;.01, \*p&lt;.05

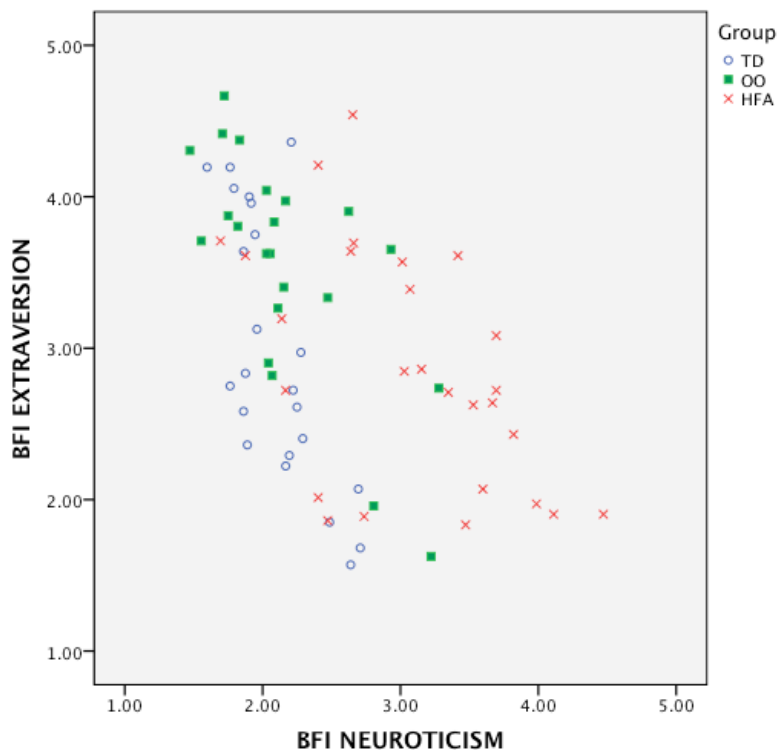
**Figure 1.** Activities on the ADOS and Potential Characteristics to Observe

Activity	Potential Characteristics to Observe	Time
Conversation sample between examiner and child	Extraversion, Agreeableness	1 minute
Telling a story from the <i>Tuesday</i> book “I’m going to start the story and I want you to finish it.”	Openness (creativity), Neuroticism (attention to detail)	2 minutes
Cartoon with monkeys “Could you stand up and tell me the story?”	Openness (creativity), Neuroticism (attention to detail, anxiety)	Approximately 1 minute
Questions about Marriage “Do you ever think about getting married? Why, do you think, do some people get married when they grow up?”	Understanding of social relationships, Extraversion	1 minute
Question about Friends “Do you have some friends? Can you tell me about them?”	Understanding of social relationships, Extraversion	1 minute
Demonstration Task “Show and tell me how you brush your teeth.”	Neuroticism (attention to detail)	Approximately 1 minute
Creating a Story “Create a story using five objects from the bag.”	Openness (creativity)	Approximately 1 minute

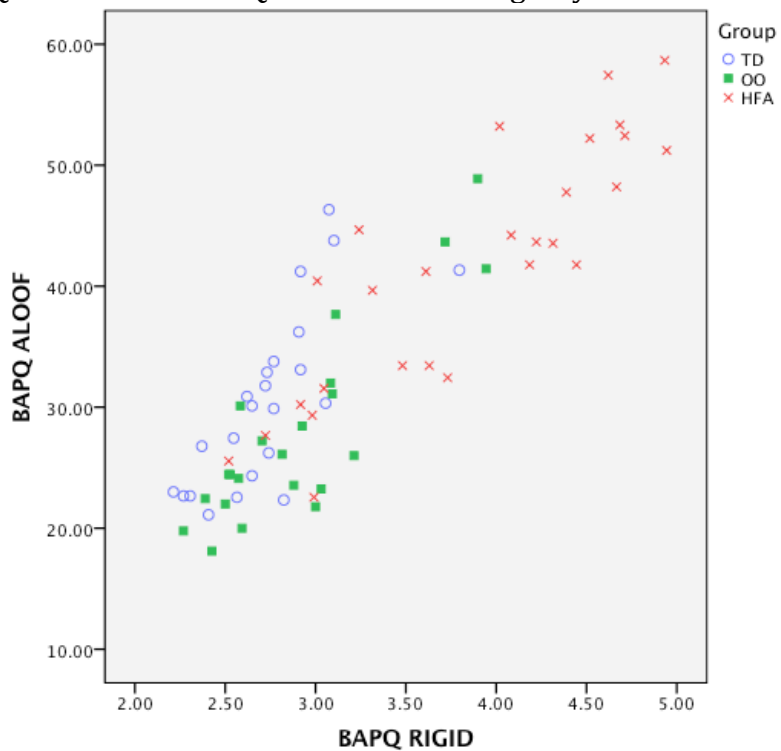
**Figure 2.** Discriminant Function Analysis (DFA) for Ten Item Personality Inventory (TIPI): Extraversion and Emotional Stability



**Figure 3.** Discriminant Function Analysis (DFA) for Big Five Inventory (BFI): Extraversion and Neuroticism



**Figure 4.** Discriminant Function Analysis (DFA) for Broader Autism Phenotype Questionnaire BAPQ: Aloofness and Rigidity



**Appendix I:** Specific Examples of Observations for different Personality Traits

Big Five Personality Traits	Observations
Extraverted/Introverted	<ul style="list-style-type: none"> <li>• Makes/avoids eye contact</li> <li>• One to two word responses versus volunteering information and providing depth in responses to questions</li> <li>• Chatty, seemed eager to ask and answer questions</li> <li>• “Bubbly” and energetic versus low energy/shy</li> <li>• Expressive versus monotone voice</li> <li>• Looked comfortable/didn’t look comfortable standing up to tell the Cartoon (monkey) story</li> </ul>
Agreeable, Sympathetic/ Critical	<ul style="list-style-type: none"> <li>• Willingness to respond to difficult questions and engage in silly tasks versus critical/rude comments and refusal to engage in activities</li> <li>• Eye contact, active listening, paying attention, smiling</li> <li>• Responds empathetically to examiner, such as when examiner mentions that his dog died, versus ignoring comment</li> <li>• Seems to genuinely care about friends when talking about them</li> <li>• Asks why they have to complete a certain task a certain way (e.g., stand up during Monkey story)</li> <li>• Whiny, complains that they are bored or tired/ doesn’t want to talk about a topic, repeatedly responds “I don’t know” to questions</li> <li>• Ignores examiner’s question and continues with own activities or cuts off examiner when the examiner is talking</li> <li>• Mentions has trouble getting along with people during conversation</li> </ul>
Conscientious, Dependable / Disorganized, Careless	<ul style="list-style-type: none"> <li>• Completes tasks as directed versus rushing through a task (skipping pages in the <i>Tuesday</i> book) or stopping task prematurely</li> <li>• Pays attention, waits before speaking, versus does not pay attention, goes on tangents, interrupts examiner, seems forgetful and spacey or in their “own world”</li> <li>• Thorough, thoughtful answers that are easy to follow versus jumbled sentences/thoughts</li> <li>• Examiner needs to repeat instructions, needs help from examiner to complete a task</li> <li>• Careful with, and helps put away ADOS toys versus rough with toys</li> <li>• Mentions having a job or engaging in a task that requires some commitment</li> </ul>



Neuroticism/Emotionally Stable	<ul style="list-style-type: none"> <li>• Appears anxious, such as repeatedly touching objects, looking down and avoiding eye contact</li> <li>• Stuttering/ease of speech</li> <li>• Excitable, overly emotional (cries), loud or expressive versus calm presentation</li> <li>• Seems overly shy, sad, or shows anger</li> <li>• Shows extreme happiness or extreme dissatisfaction</li> <li>• Constantly asks whether still being videotaped</li> <li>• Fidgeting, impulsive, versus sitting still</li> <li>• Overly detailed when explaining the steps to brush teeth</li> <li>• Ease in answering questions, smiling, relaxed</li> <li>• Ability to transition to new questions/tasks with little objection</li> </ul>
Open/Closed to Experience	<ul style="list-style-type: none"> <li>• Creativity during <i>Tuesday, Creating a Story</i> tasks versus rote, unimaginative stories</li> <li>• Content during conversation about hobbies (adventurous/not adventurous), likes/dislikes</li> <li>• Openly engages in all activities, even if they seem silly</li> <li>• Open or hesitant to telling Monkey story in front of camera</li> <li>• Rigid in way wants to complete an activity</li> </ul>

Examples of Observations for BAPQ	Observations
ALOOF: Seemed to enjoy conversation, versus makes conversation just to be polite	<ul style="list-style-type: none"> <li>• Eye contact</li> <li>• Elaborates and asks examiner questions versus very short answers and little elaboration</li> <li>• Active listening, paying attention, showing genuine interest in what examiner is saying</li> <li>• Responds promptly and energetically/sympathetically</li> <li>• Tester has to frequently prompt to keep conversation going</li> <li>• Did not actively start conversation, awkward breaks in conversation</li> <li>• Ignores examiner's questions, continues with own activities</li> <li>• Seems polite, but does not look engaged and is reserved.</li> </ul>
PRAGMATIC LANGUAGE: Easily distracted	<ul style="list-style-type: none"> <li>• Tangents when answering questions</li> <li>• Loses track of what they are saying</li> <li>• Uncommonly long responses</li> <li>• Inconsistent eye contact, looks around the room</li> <li>• Fidgety, difficulty sitting still</li> <li>• Switches topics abruptly, does not stick to the task</li> </ul>

	<ul style="list-style-type: none"> <li>• Takes a very inefficient route to finishing a task or telling a story</li> </ul>
PRAGMATIC LANGUAGE: “In tune” (or not “in tune”) with others during conversation	<ul style="list-style-type: none"> <li>• Eye contact, versus looking away during conversation</li> <li>• Smiling, active listening</li> <li>• Appropriate/related versus unrelated responses</li> <li>• Builds on examiner’s comments/ shares interests</li> <li>• Responds genuinely/ shows enthusiasm,</li> <li>• Laughs at examiner’s jokes</li> <li>• Seems interested in conversation, asks examiner questions</li> <li>• Listens to examiner and does not take over the conversation</li> </ul>
RIGID: Has to be talked into trying something new/ Has a hard time dealing with changes in routine	<ul style="list-style-type: none"> <li>• Trouble with Creating a Story task: was too open-ended for the child</li> <li>• Resistant to new tasks</li> <li>• Not open to standing up during the Monkey task or hesitant to move from their spot</li> <li>• Hard time transitioning from one activity to another</li> </ul>
RIGID: Keeps doing things they way he/she knows, even if another way is better	<ul style="list-style-type: none"> <li>• Stubborn with activities</li> <li>• Fixation on one topic of conversation</li> <li>• Seems very opinionated, unwavering in beliefs or opinions</li> <li>• Answers a question during conversation that indicates a need to keep things the same</li> <li>• Acts superior, or like they know more than the examiner</li> <li>• Takes a long time to finish task about brushing teeth and adamant about each and every step</li> </ul>

\*Activities: Conversation sample, *Tuesday* book, Monkey cartoon, Questions about Marriage, Question about Friends, Demonstration task (brushing teeth), Creating a story (w/ 5 objects)

**Appendix II. Modified Ten Item Personality Inventory (TIPI)**

Disagree strongly 1	Disagree moderately 2	Disagree a little 3	Neither agree nor disagree 4	Agree a little 5	Agree moderately 6	Agree strongly 7
I see the person as most likely:				How confident are you of this assessment?		
1. Extraverted, enthusiastic	1 2 3 4 5 6 7			1. A B C D E	A= Not confident at all	
2. Critical, quarrelsome	1 2 3 4 5 6 7			2. A B C D E	B= I am slightly leaning	
3. Dependable, self-disciplined	1 2 3 4 5 6 7			3. A B C D E	toward it	
4. Anxious, easily upset	1 2 3 4 5 6 7			4. A B C D E	C= I am somewhat leaning	
5. Open to new experiences, complex	1 2 3 4 5 6 7			5. A B C D E	toward it	
6. Reserved, quiet	1 2 3 4 5 6 7			6. A B C D E	D= I am fairly confident	
7. Sympathetic, warm	1 2 3 4 5 6 7			7. A B C D E	E= I am confident	
8. Disorganized, careless	1 2 3 4 5 6 7			8. A B C D E		
9. Calm, emotionally stable	1 2 3 4 5 6 7			9. A B C D E		
10. Conventional, uncreative	1 2 3 4 5 6 7			10. A B C D E		

**Appendix III. Modified Broad Autism Phenotype Questionnaire (BAPQ)**

1—Very Rarely 2—Rarely 3—Occasionally 4—Somewhat Often 5—Often 6—Very Often	
How often is/does this person...	How confident are you of this assessment?
1. Like being around other people 1 2 3 4 5 6	1. A B C D E
2. Find it hard to get his/her words out smoothly 1 2 3 4 5 6	2. A B C D E
3. Comfortable with unexpected changes in plans 1 2 3 4 5 6	3. A B C D E
4. Find it hard to avoid getting sidetracked in conversation 1 2 3 4 5 6	4. A B C D E
5. Prefer to talk to people to get information rather than to socialize 1 2 3 4 5 6	5. A B C D E
6. Have to be talked into trying something new 1 2 3 4 5 6	6. A B C D E
7. 'In-tune' with the other person during conversation*** 1 2 3 4 5 6	7. A B C D E
8. Have to warm him/herself up to the idea of visiting an unfamiliar place 1 2 3 4 5 6	8. A B C D E
9. Enjoy being in social situations 1 2 3 4 5 6	9. A B C D E
10. Have a voice that has a flat or monotone sound to it 1 2 3 4 5 6	10. A B C D E
11. Feel disconnected or "out of sync" in conversations with others*** 1 2 3 4 5 6	11. A B C D E
12. Have people that find it easy to approach him/her. *** 1 2 3 4 5 6	12. A B C D E
13. Feel a strong need for sameness from day to day 1 2 3 4 5 6	13. A B C D E
14. Have people ask him/her to repeat things because they don't understand what he/she said 1 2 3 4 5 6	14. A B C D E
15. Flexible about how things should be done 1 2 3 4 5 6	15. A B C D E
16. Look forward to situations where he/she can meet new people 1 2 3 4 5 6	16. A B C D E
17. Told that he/she talks too much about certain topics 1 2 3 4 5 6	17. A B C D E
18. Make conversation just to be polite (not because he/she enjoys it) *** 1 2 3 4 5 6	18. A B C D E
19. Look forward to trying new things 1 2 3 4 5 6	19. A B C D E
20. Speak too loudly or softly 1 2 3 4 5 6	20. A B C D E
21. Able to tell when someone is not interested in what he/she is saying 1 2 3 4 5 6	21. A B C D E
22. Have a hard time dealing with changes in his/her routine 1 2 3 4 5 6	22. A B C D E
23. Good at making small talk*** 1 2 3 4 5 6	23. A B C D E
24. Act very set in his/her ways 1 2 3 4 5 6	24. A B C D E
25. Feel like he/she is really connecting with other people 1 2 3 4 5 6	25. A B C D E
26. Get people frustrated because he/she is unwilling to bend 1 2 3 4 5 6	26. A B C D E
27. Get bored with conversation*** 1 2 3 4 5 6	27. A B C D E
28. Warm and friendly in his/her interactions with others*** 1 2 3 4 5 6	28. A B C D E
29. Leave long pauses in conversation 1 2 3 4 5 6	29. A B C D E
30. Alter his/her daily routine by trying something different 1 2 3 4 5 6	30. A B C D E
31. Prefer to be alone rather than with others 1 2 3 4 5 6	31. A B C D E
32. Lose track of his/her original point when talking to people 1 2 3 4 5 6	32. A B C D E
33. Like to closely follow a routine while working 1 2 3 4 5 6	33. A B C D E
34. Able to tell when it is time to change topics in conversation *** 1 2 3 4 5 6	34. A B C D E
35. Keep doing things the way he/she knows, even if another way might be better 1 2 3 4 5 6	35. A B C D E
36. Enjoy chatting with people *** 1 2 3 4 5 6	36. A B C D E

\*\*\*Casual interaction with acquaintances, rather than special relationships such as with close friends and family members

**Appendix IV. Modified Big Five Inventory (BFI)**

1—Disagree strongly	2—Disagree a little	3—Neither agree nor disagree	4—Agree a little	5—Agree strongly
This person is someone who...				How confident are you of this assessment?
1. Is talkative	1 2 3 4 5			1. a b c d e
2. Tends to find fault with others	1 2 3 4 5			2. a b c d e
3. Does a thorough job	1 2 3 4 5			3. a b c d e
4. Is depressed, blue	1 2 3 4 5			4. a b c d e
5. Is original, comes up with new ideas	1 2 3 4 5			5. a b c d e
6. Is reserved	1 2 3 4 5			6. a b c d e
7. Is helpful and unselfish with others	1 2 3 4 5			7. a b c d e
8. Can be somewhat careless	1 2 3 4 5			8. a b c d e
9. Is relaxed, handles stress well	1 2 3 4 5			9. a b c d e
10. Is curious about many different things	1 2 3 4 5			10. a b c d e
11. Is full of energy	1 2 3 4 5			11. a b c d e
12. Starts quarrels with others	1 2 3 4 5			12. a b c d e
13. Is a reliable worker	1 2 3 4 5			13. a b c d e
14. Can be tense	1 2 3 4 5			14. a b c d e
15. Is ingenious, a deep thinker	1 2 3 4 5			15. a b c d e
16. Generates a lot of enthusiasm	1 2 3 4 5			16. a b c d e
17. Has a forgiving nature	1 2 3 4 5			17. a b c d e
18. Tends to be disorganized	1 2 3 4 5			18. a b c d e
19. Worries a lot	1 2 3 4 5			19. a b c d e
20. Has an active imagination	1 2 3 4 5			20. a b c d e
21. Tends to be quiet	1 2 3 4 5			21. a b c d e
22. Is generally trusting	1 2 3 4 5			22. a b c d e
23. Tends to be lazy	1 2 3 4 5			23. a b c d e
24. Is emotionally stable, not easily upset	1 2 3 4 5			24. a b c d e
25. Is inventive	1 2 3 4 5			25. a b c d e
26. Has an assertive personality	1 2 3 4 5			26. a b c d e
27. Can be cold and aloof	1 2 3 4 5			27. a b c d e
28. Perseveres until the task is finished	1 2 3 4 5			28. a b c d e
29. Can be moody	1 2 3 4 5			29. a b c d e
30. Values artistic, aesthetic experiences	1 2 3 4 5			30. a b c d e
31. Is sometimes shy, inhibited	1 2 3 4 5			31. a b c d e
32. Is considerate and kind to almost everyone	1 2 3 4 5			32. a b c d e
33. Does things efficiently	1 2 3 4 5			33. a b c d e
34. Remains calm in tense situations	1 2 3 4 5			34. a b c d e
35. Prefers work that is routine	1 2 3 4 5			35. a b c d e
36. Is outgoing, sociable	1 2 3 4 5			36. a b c d e
37. Is sometimes rude to others	1 2 3 4 5			37. a b c d e
38. Makes plans and follows through with them	1 2 3 4 5			38. a b c d e
39. Gets nervous easily	1 2 3 4 5			39. a b c d e
40. Likes to reflect, play with ideas	1 2 3 4 5			40. a b c d e
41. Has few artistic interests	1 2 3 4 5			41. a b c d e
42. Likes to cooperate with others	1 2 3 4 5			42. a b c d e
43. Is easily distracted	1 2 3 4 5			43. a b c d e
44. Is sophisticated in art, music, or literature	1 2 3 4 5			44. a b c d e