INVESTIGATING THE ROLE OF PERSONALITY FACETS DIFFERENTIATING

CHILDREN WITH AUTISM SPECTRUM DISORDERS FROM TYPICALLY

DEVELOPING CHILDREN

by

BRIAN DAVID BARGER

(Under the Direction of Jonathan Campbell and Stacey Neuharth-Pritchett)

ABSTRACT

This dissertation reports data from two studies indicating that facet scores from the Five Factor Model (FFM) personality variables differentiate children with autism spectrum disorders (ASD) from typical children. Study one investigated FFM differences in children during early childhood and study two investigated middle childhood. In both studies numerous facets differentiated children with ASD from typically developing children. Furthermore, in both studies the distractible scale had poor internal reliability and was not included in analysis. The shy scale had poor internal reliability for the ASD group during middle childhood and was not included in analysis. During middle childhood, but not early childhood significant interactions were found indicating that females with ASD had more difficult temperaments than males with ASD or typically developing children. Furthermore, in both studies comparison of correlation matrices indicated fewer significant correlations in the ASD groups compared to the typically developing. Discussions are framed around current discussions regarding the usefulness of the FFM for discussing ASD.

INDEX WORDS: Autism, Personality, Five-Factor-Model, Temperament

INVESTIGATING THE ROLE OF PERSONALITY FACETS DIFFERENTIATING

CHILDREN WITH AUTISM SPECTRUM DISORDERS FROM TYPICALLY

DEVELOPING CHILDREN

by

BRIAN DAVID BARGER

B.A., Western Kentucky University, 2000

M.A., Western Kentucky University, 2005

A Dissertation Submitted to the Graduate Faculty of The University of Georgia in Partial

Fulfillment of the Requirements for the Degree

DOCTOR OF PHILOSOPHY

ATHENS, GEORGIA

2013

INVESTIGATING THE ROLE OF PERSONALITY FACETS DIFFERENTIATING

CHILDREN WITH AUTISM FROM TYPICALLY DEVELOPING CHILDREN

by

BRIAN DAVID BARGER

Co-Major Professors: JONATHAN CAMPBELL

Stacey Neuharth-Pritchett

Committee: Scott Ardoin
A. Michele Lease

Electronic Version Approved:

Maureen Grasso
Dean of the Graduate School
The University of Georgia
May 2013

DEDICATION

This dissertation is dedicated to Erin Mullins Barger who is my constant companion and whose love and devotion makes life worthwhile and exciting.

ACKNOWLEDGEMENTS

TABLE OF CONTENTS

LIST OF TABLES

Page

CHAPTER 1

INTRODUCTION AND LITERATURE REVIEW

There is a growing interest in the fields of developmental, personality, and clinical psychology to employ purportedly "universal" personality factors to organize discussions regarding the individual differences of typical and atypically developing populations (Muris & Ollendick, 2005; Nigg, 2004). These writings are beginning to impact discussions within the field of autism regarding temperament and personality differences between individuals with autism spectrum disorders (ASD) and typically developing populations framed according to broad universal factors (Garon et al., 2009). In particular, two models are prominently discussed within the ASD research literature. The first is a three-factor model which maintains that Surgency (i.e., positive affect and approach orientations), Negative Affectivity (i.e., expressions of negative emotions), and Effortful Control (i.e., self-control and inhibition of undesirable actions) are found in typically developing childhood (i.e., Rothbart, 2007) and adult (i.e., McCrae & Costa, 1987) populations. The second is the Five Factor Model (FFM; Digman, 1990; McCrae & Costa, 1997) which includes the three factors previously mention (labeled Extraversion, Neuroticism, and Conscientiousness), as well Agreeableness (i.e., preference for warm and engaging social relations) and Openness (i.e., engagement and interest in cultural and intellectual pursuits). Proponents of framing discussions of differences according to "universal" personality factors argue that using a common language can help stimulate cross disciplinary dialogue (Shiner, 1998). While this is undoubtedly a useful and ambitious goal, there are a number of reasons why ASD researchers should take care when framing their data according to popular conceptions of personality derived from typically developing populations.

The primary reason for taking a cautious approach is the simple fact that personality is a multifaceted concept with at least five levels of conceptualization (see Digman, 1997 for discussion):

1. Actual behavioral responses.

2. Habits and behavioral tendencies.

3. Facets.

4. Factors.

5. Broad theoretical systems.

Behavioral responses are actual specific behaviors that individuals display in various situations. Habits and behavioral tendencies refer to clusters of behaviors and habits that individuals develop over time and reflect general behavioral constellations. Facets refer to highly correlated groups of scale items querying raters regarding an individual's specific habits and behavioral tendencies (e.g., smiling behaviors; neatness). Factors are groups of facets that tend to correlate at a higher level of abstraction and relate to a conceptualization of an individual's behavior in a broad manner (e.g., extraversion; conscientiousness). Broad theoretical systems are higher levels of abstraction regarding correlations on personality items and are typically framed in regards to dualities, such as approach-avoidance and stability-plasticity. Thus, measures of personality seek to quantify raters perceptions of individual's habits and behavioral tendencies (level 2) with items that may be combined to provide personality metrics with more (levels 4 and 5) or less (level 3) abstraction. Thus, the higher the level of abstraction with which one considers personality in ASD the more assumptions one makes regarding the relationships between items, facets, and factors (i.e., factor structure).

To date, there is no evidence indicating that the factor structure of personality in groups of individuals with ASD is similar to that of typically developing groups. The neural structures associated with personality functioning, such as the prefrontal cortex, superior temporal sulcus, and limbic structures (De Young, et al., 2010) are the same structures that are frequently found

to be at odds with typical development in ASD populations (Bechavalier & Loveland, 2006; Redcay & Courschesne, 2005). Thus, it is possible that in ASD groups certain neurally guided aspects of personality come "online" at a different age than typically developing children. The differences could result in delayed or precocious personality facets that correlate in an atypical fashion and have a differential impact on personality development. Thus, factor analytic studies of personality in individuals with ASD could indicate that personality facets relate to each other in a fundamentally dissimilar manner when compared to typically developing populations. Therefore, I suggest that until factor analytic studies are performed that indicate the relationships between personality factors and their facets in ASD populations are similar to typical groups, subordinate facet level data are key to understanding the relative impact of personality in regards to answering certain research questions. This may be particularly true in respect to research questions regarding the role of personality variables in answering applied questions.

A focus on facet level information may allow for a finer-grained understanding of the relationship between personality and ASD functioning. For example, data from studies comparing individuals with ASD during infancy (Garon et al., 2009) and early childhood (Adamek et al., 2010; Bailey et al., 2000; Hepburn & Stone, 2006) with typically developing groups indicates that focusing primarily on broader factor level details could result in missing key information. Across several studies facets related to *positive affect* did not appear to correlate with *activity level* facets in the ASD group as would be expected from popular theories. Instead, for infants with ASD, *activity level* was rated as consistently higher than typical peers, but *positive affect* facets were rated as lower (Garon et al., 2009). In early childhood *activity level* was no different, but *positive affect* was significantly higher in ASD compared to typical groups (Adamek et al., 2010). If these facets correlated as strongly and in the direction expected (i.e., higher *positive affect* positively correlates with *activity level*) then both groups

should have seen significant differences in the same direction for these facets. Instead, one report (Garon et al., 2009) indicated significant differences between ASD and typically developing groups in opposite directions for *positive affect* and *activity level* and the other report (Adamek et al., 2010) only found significant group differences for *positive affect*. In accord with the previous suggestion, these findings indicate that a single broad Extraversion factor may not represent personality in ASD. Instead, *positive affectivity* and *activity level* may be less correlated in this group when compared to typically developing groups. Data such as these could potentially be used to inform research regarding ASD markers.

A third related issue has to do with the fact that different personality and temperament instruments measure similar and unique subordinate facets of broader level factors. As such, reported significant group differences on a personality factor may be differentially impacted by facet level differences. For example, as noted above, facets related to *positive affect* appear to behave independently of *activity level* facets in children with ASD when compared to non-ASD children (Garon et al., 2009; Adamek et al., 2010). These data primarily come from studies employing scales measuring Rothbart's (2007) temperament theory. When other scales are employed, such as Carey and McDevitt's (1978) Behavioral Style Questionnaire (BSQ; Bailey et al., 2000; Hepburn & Stone, 2006), comparisons regarding the relationship between *positive affect* and *activity* oriented facets cannot be made as BSQ does not include facet scales explicitly related to *positive affect*. Thus, conversations regarding factor level information may disallow opportunities for finer grained discussions regarding the role that unique facet level information plays in driving personality differences between individuals with ASD and other non-ASD groups.

These three concerns serve as the broader conceptual framework for the studies presented in this dissertation. Study one aims to compare the personality facets of ASD and typically developing children between the ages of 4 and 7 using the Inventory of Children's

Individual Differences (ICID; Deal et al., 2005), an instrument based upon the FFM of personality. In addition to the three conceptual issues, this paper also identifies the changing nature of personality across development as a variable of consideration (Halverson, Kohnstamm, & Martin, 1994). In particular, research supports that in typically developing populations facet level variables may shift over development and become more or less associated with different superordinate factors (De Pauw, Mervielde, & Van Leeuwen, 2009; Angleitner & Ostendorf, 1994); thus, another reason to consider facet level details involves the possibility that the ASD populations display a different developmental trajectory for facet factor relationships. Study two also employs the ICID to examine potential personality differences between children with ASD and typically developing 8-12 year old children.

 Overall, the proposed research features two studies united by a trio of concerns centered on a critique of a popular discussion in the psychological literature regarding the utility of organizing discussions of personality in typical and atypical populations according to a handful of broader "universal factors" (e.g., DePauw & Mervielde, 2010). It is argued that discussing the role of factor level differences between individuals with ASD and typical groups may be a premature and ultimately stymying approach because (1) there are no data regarding the factor structure of personality in ASD, thus the field is unsure whether comparisons on traits such as Extraversion or Agreeableness reflect congruous constructs; (2) factor level comparisons and discussions may mask useful facet level information; and (3) different personality scales employ similar and unique facet level details that should be considered individually in regards to their impact on ASD functioning. Study one investigates personality facet differences between children with ASD and typically developing youth between the ages of 4 and 7, or early childhood, and study two compares children between the ages of 8 and 12, or middle childhood.

References

Adamek, L., Nichols, S., Tetenbaum, S., Bregman, J., Ponzio, C., & Carr, E. (2011). Individual temperament and problem behavior in children with autism spectrum disorders. *Focus on Autism and Other Developmental Disorders, 76,* 173-183.

Angleitner, A., & Ostendorf, F. (1994). Temperament and the Big Five factors of personality. In C. F., Halverson, G. Kohnstamm, & R. P., Martin (Eds.). *The developing structure of temperament and personality from infancy to adulthood* (pp. 69–90). Hillsdale, NJ: Erlbaum.

Bailey, D. B., Hatton, D. D., Mesibov, G., Ament, N., & Skinner, M. (2000). Early development, temperament, and functional impairment in autism and fragile X syndrome. *Journal of Autism and Developmental Disorders, 30,* 49–59.

Bachevalier, J., & Loveland, K. A. (2006). The orbitofrontal-amygdala circuit and self-regulation of social-emotional behavior in autism. *Neuroscience and Biobehavioral Reviews, 30,* 97 – 117.

Carey, W. B., & McDevitt, S. C. (1978). Revision of the infant temperament questionnaire. *Pediatrics, 61,* 735-739.

Deal, J. E., Halverson, C. F., Martin, R. P., Victor, J., & Baker, S. (2007). The Inventory of Children's Individual Differences: Development and validation of a short version. *Journal of Personality Assessment, 89,* 162–166.

De Pauw, S., & Mervielde, I. (2010). Temperament, personality and developmental psychopathology: A review based on the conceptual dimensions underlying childhood traits. *Child Psychiatry and Human Development, 41,* 313–329.

De Pauw, S., Mervielde, I., & Van Leeuwen, K. G. (2009). How are traits related to problem behavior in preschoolers? Similarities and contrasts between temperament and personality. *Journal of Abnormal Child Psychology, 37*, 309–325.

DeYoung, C. G., Hirsh, J. B., Shane, M. S., Papademetris, X., Rajeevan, N., & Gray, J. R.

(2010).Testing predictions from personality neuroscience: brain structure and the big five. *Psychological Science, 21*, 820–828.

Digman, J. M. (1990). Personality structure: Emergence of the Five-Factor Model. *Annual Review of Psychology, 41,* 417-40.

Digman, J. (1997). Higher order factors of the Big Five. *Journal of Personality and Social Psychology, 73,* 1246-1257.

Garon, N., Bryson, S., Zwaigenbaum, L., Smith, I., Brian, J., Roberts, W., & Szatmari, P. (2009). Temperament and its relationship to autistic symptoms in a high-risk infant sib cohort. *Journal of Abnormal Child Psychology, 37*, 59–78.

Halverson, C. F., Kohnstamm, G. A., & Martin, R. P. (Eds.). (1994). *The developing structure of temperament and personality from infancy to adulthood.* Hillsdale, NJ: Erlbaum.

Hepburn, S. L., & Stone, W. L. (2006). Using Carey temperament scales to assess behavioral style in children with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 36,* 637–642.

McCrae, R. R., & Costa, P. T. (1987). Validation of the 5-factor model of personality across instruments and observers. *Journal of Personality and Social Psychology, 52*, 81–90.

Muris, P., & Ollendick, T. H. (2005). The role of temperament in the etiology of child psychopathology. *Clinical Child and Family Psychology Review, 8,* 271–289.

Nigg, J. T. (2006). Temperament and developmental psychopathology. *Journal of Child Psychology and Psychiatry, and Allied Disciplines, 47*, 395–422.

Redcay, E., & Courchesne, E., (2005). When is the brain enlarged in autism? A meta-analysis of all brain size reports. *Biological Psychiatry, 58*, 1–9.

Rothbart, M. K. (2007). Temperament, development, and personality. *Current Directions in Psychological Science, 16*, 207–212.

Shiner, R. (1998). How shall we speak of children's personalities in middle childhood? A preliminary taxonomy. *Psychological Bulletin, 124*, 308–332.

CHAPTER 2

A COMPARISON OF CHILDREN IN EARLY CHILDHOOD WITH AUTISM AND TYPICALLY

DEVELOPING POPULATIONS ON THE PERSONALITY FACET SCORES ON THE

INVENTORY OF CHILDREN'S INDIVIDUAL DIFFERENCES

Abstract

To date, the role of personality in ASD is under-investigated and most studies employ instruments designed to measure constructs from either Thomas and Chess or Mary Rothbart's theories. Furthermore, few have investigated gender differences within ASD or ASD status X gender temperament interactions. This study reports data indicating that personality variables measured with the new Inventory of Children's Individual Differences- Short Form (ICID; Deal, Halverson, Martin, Victor, & Baker, 2005) differentiate children with ASD from typical children. A 2 (ASD versus typical) X 2 (Gender) age controlled MANCOVA comparing 139 children with ASD (113 boys; 26 girls) and 374 control children (190 boys; 184 girls) between the ages of 4 and 7 (Early Childhood; EC) on the 15 temperament subscales of the ICID is reported. We collected data from ASD children on-line via the Interactive Autism Network (IAN) and data from typical children from the ICID norming sample data set. The internal reliabilities for the *activity level* and *negative affect* facets were significantly higher in the ASD group and the *compliance*, *distractible*, and *positive emotion* facets were higher in the control group. No significant ASD X gender interactions were found, but diagnostic group differences were found favoring lower scores for ASD on *achievement, compliance, consideration, intelligence, openness, positive emotion*, and *sociability*. Higher scores for the ASD groups were found on *antagonism, distractible, fear/insecurity, negative emotion (anger), shy*, and *strong willed*. No differences were found on *activity level* or *organized* and no significant gender X ASD diagnostic status interactions were found. Collectively, these results indicate widespread personality differences between children with ASD and typically developing children. Furthermore, no gender X ASD diagnosis interactions were reported. The strongest differences were on the facets of *sociability* and *shyness*, temperament traits related to the core diagnostic symptoms of ASD.

INDEX WORDS: Autism, Temperament, Personality

Introduction

Autism spectrum disorders (ASD) are a heterogeneous class of developmental disorders that share the core diagnostic criteria of impaired or atypical social and communication abilities, as well as perseverative interests or behaviors. The behavioral symptoms of ASD are widely believed to be strongly heritable (Constantino & Todd, 2003; Hoektra, Bartels, Ver Weij, & Boomsma, 2007), neurologically based (Bachevalier & Loveland, 2006; Redcay & Courschesne, 2005), and, more recently, to represent the extreme end of a cluster of behavioral traits normally distributed throughout the normal population (Austin, 2009; Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001). Symptoms of ASD can typically be detected by the age of two and the symptoms continue to impact the functioning of individuals throughout their developmental lifespan. Furthermore, the presentation of ASD symptoms varies widely from individual to individual and there is a growing interest in determining the factors that account for this wide variability (see Mundy, Henderson, Inge, & Coman, 2007 for a review). Individuals with ASD vary in regards to their emotional expressiveness (Capps, Kasari, Yirmiya, & Sigman, 1993), executive and attentional capacities (Hill, 2003), intelligence (Siegel, Minshew, & Goldstein, 1996) and sensory sensitivity (Baranek, David, Poe, Stone, & Watson, 2006), each of which might have a modulatory impact on the expression of ASD symptoms.

Recently, a number of researchers have turned their attention to the role that temperament or personality might play in the heterogeneity of behaviors found amongst individuals with ASD (Baily, Hatton, Mesibov, Ament, & Skinner, 2000; Burnette et al., 2010; De Pauw, Mervielde, Van Leeuwen, & De Clerque, 2010; Mundy, Henderson, Inge, & Coman, 2007; Garon et al., 2009; Hepburn & Stone, 2006; Konstantanareas & Papgeournio, 2006; Konstantanareas & Stewart, 2006; Mundy et al., 2007; Rivers & Stoneman, 2008; Samyn, Roeyers, & Bijttbier, 2011; Schwartz et al.2009; Sutton et al., 2005; Zwaigenbaum et al., 2005). Although definitions of temperament vary to a certain degree, most theorists agree that temperament involves affectively based approach and withdrawal orientations towards the world

that are constitutional (i.e., neurologically based via genetics or early nurturing) and appear early in human development (Buss & Plomin, 1984; Martin & Bridger, 1998; Rothbart, 2007; Zenter & Bates, 2008). To this widely agreed upon criteria, several theorists include a role for emotional modulation via early developing, neurologically based, attentional faculties supported by prefrontal inputs (see Rothbart, 2007). Recently, Zenter and Bates have compiled a list of key temperament criteria found across several popular theories: (a) behaviors commonly expressed in regards to latency, intensity, duration, threshold of response, and recovery times; (b) emphasis in regards to the domains of affect, attention and sensory sensitivity; (c) a partial appearance in infancy and full appearance by preschool age; (d) homologous traits found in primates and other mammals; (e) biological bases; (f) traits are relatively enduring; and (g) predictive of conceptually coherent outcomes.

The consideration of the symptoms of ASD according to these notions is striking as ASD behavioral symptoms appear to align well with Zenter and Bates' (2008) criteria. As noted previously, research in ASD supports that the behavioral symptoms of ASD are associated with atypical emotional reactions, cognitive abilities, and sensory issues (criteria b), are apparent prior to preschool age (criteria c), display strong biological linkages (criteria e), and are relatively enduring (criteria f). Additionally, questions on commonly used on diagnostic questionnaires often employ behavioral items (criteria a) including regarding latency to response (e.g. responds to name), intensity and duration of response (e.g., perseverative interests), and threshold of response (e.g., under-responsiveness to stimuli; see Fortenberry, Grist, & McCord, 2011 for an example). Furthermore, recent research indicates that temperament measures are related to conceptually coherent outcomes (criteria g), such as age of diagnoses in infants with ASD (Garon et al., 2009) and social affect and abilities in adolescents (Burnette et al., 2010). Finally, animal models indicate that ASD symptoms may be generated via the disruption of homologous neurological structures (i.e., amygdala, orbitofrontal cortex) in lower primates, indicating a

possible phylogenetic basis (criteria f) for the socio-communicative deficits of this disorder (for review see Bechavalier & Loveland, 2006).

Due to similar conceptual overlap in other clinical populations and related issues, there are a growing number of clinical and developmental researchers arguing for greater communication between the fields of temperament and clinical psychopathology (Clark, 2005; De Pauw & Mervield, 2010; Mervielde, De Clercq, De Fruyt, & Van Leeuwen, 2005; Muris & Olendick, 2005; Nigg, 2006). This goal is worthwhile and several strands of reasoning support it. The primary line of reasoning involves the development of a common language to facilitate communication about group differences between pathological conditions, comorbid conditions, and typically developing groups (Clark, 2005; Schwartz et al., 2009; Shiner & Caspi, 2003; Nigg, 2006). Other lines of reasoning involve explaining the joint impact of personality and pathology on the social environment (Konstantanareas & Papgeournio, 2006) and heterogeneity commonly found among pathological conditions (Sutton et al., 2005). Finally, the conversation is also thought to be reciprocally beneficial in that discussions between pathologists and personality psychologists may inform research regarding typical personality development (Austin, 2005; Kunihara, Senju, Dairoku, Wakabayashi, & Hasegawa, 2006; Wakabayashi, Baron-Cohen, & Wheelwright, 2006).

Crucially, these conversations mostly situate the discussion in regards to three commonly agreed upon conceptual superordinate temperament factors (i.e., approach, withdrawal, and constraint) or the Five Factor Model (FFM) from personality theory. The FFM refers to five broad superordinate factors that appear to be human universals including Extraversion (i.e., preference for sociability and/or dominance), Agreeableness (i.e., preference for warm social interactions), Conscientiousness (i.e., self-control), Neuroticism (i.e., tendency toward negative affective experiences), and Openness to experience (i.e., intellectual pursuits). While the terms personality and temperament traditionally were thought to refer to different phenomena, recent evidence indicates that this depends upon the operationalization of the

terms (McCrae et al., 2000; Zenter & Bates, 2008). When the term personality is operationalized to reflect the basic traits that impact complex behaviors (e.g., McCrae et al., 2000) the FFM appears much more like temperament and meets the majority of temperament criteria (see Zenter and Bates for a discussion); however, when it is expanded to reflect broader issues such as values, life stories, interpersonal schemata, and other culturally impacted factors, the term personality moves further away from the biological and genetically influenced "core" factors traditionally of central concern to temperament researchers (Mc Adams, 2010).

Therefore, there is a growing, yet still inconclusive, research base indicating that the FFM factors resemble temperamental constructs in regards to (a) appearing early in development (criteria c; Deal et al., 2007; Mervielde & De Fruyt, 2002); (b) having a phylogenetic basis (criteria d; Gosling & John, 1999; Gosling, 2001; King and Figueredo, 1997); (c) being biologically based (criteria e; Bouchard & Loehlin, 2001; Bouchard & McGue, 2003; De Young, Peterson, & Higgins, 2005; De Young, Shamosh, Green, Raver, & Gray, 2009; De Young et al., 2010; Di Lalla & Jones, 2000; McCrae et al., 2000; Saudino, 2005); (d) being relatively enduring (criteria f; De Fruyt, Bartels, Van Leeuwen, De Clerq, Decouyper, & Mervielde, 2006; Roberts & Del Vecchio, 2000; Shiner & Caspi, 2005); and (e) predictive of conceptually coherent outcomes (criteria g; De Pauw, Mervielde, & van Leeuwen, 2009; De Pauw & Mervielde, 2010; Nigg, 2006; Saulsman & Page, 2004). Furthermore, although FFM measures tend to focus on broader traits instead of specific behaviors (criteria a and b), joint factor analyses indicate that many of the temperament and FFM facets load on the same factor in early childhood (De Pauw et al., 2009) and that correspondence increases in adults (Angleitner & Ostendorf, 1994). Thus, there is some evidence indicating that the FFM personality traits are similar to temperamental variables. In particular, conceptual analyses support that the FFM Extraversion factor is homologous to Surgency, Neuroticism to Negative Affectivity, and Conscientiousness to Effortful Control, with the latter comparisons reflecting Rothbart's temperament factors (Rothbart, 2007; DePauw & Mervield, 2010; Zenter & Bates,

2008). Considering the correspondence between the FFM and definitional criteria for temperament, the term *personality* is employed for the remainder of this paper to include both temperament and FFM factors and facets. Furthermore, so the reader may easily discriminate between them, personality factors are capitalized and facets are left in lower case form.

While the endeavor to employ superordinate factors in order to organize discussions regarding the role of personality differences between clinical populations and other groups is certainly laudable, it is important for ASD researchers to approach organizing strategies carefully for a number of reasons. First, there is the reality that no published data bear on the pertinent issue of whether the factor structure of temperament/personality is similar to the factor structure of typically developing groups. Second, a primary emphasis on broadband personality factors is likely to be limited in regards to its relevance for answering questions of an applied or translational nature (e.g., early identification). Related to this issue is the fact that separate measures of purportedly similar personality factors are often comprised of both common and non-overlapping facet level scales. A focus only on the superordinate factors might obscure important facet level information. Additionally, the factor structure of personality develops over time (Halverson, Kohnstamm, & Martin, 1994) and facets related to one factor at one developmental stage may relate to different factor at another stage (De Pauw et al., 2009; Angleitner & Ostendorf, 1994).

It is with these issues in mind that the personality and ASD literature is selectively reviewed with a focus on specific instances in the literature. Since there are a number of recent thorough treatments of the entire literature regarding personality in ASD (De Pauw et al., 2009; Garon et al., 2009; Mundy et al., 2007; Schwartz et al., 2009), a replication of these reviews is deemed redundant. Instead, this review elaborates on the issues raised above and employs illustrative examples from the literature published after the year 2000 from researchers that have employed personality rating instruments normed on typically developing groups and that are not clinical instruments (i.e., Minnesota Multiphasic Personality Inventory; Ozonoff, Garcia,

Clark, & Lainhart, 2005), or electrophysiological measures associated with personality (i.e., Burnette et al., 2010). To date, normed personality rating measures employed in the ASD literature have relied primarily on measurements derived from three theoretical traditions: The BSQ reflecting Thomas and Chess's (1977) nine factor model (McDevitt & Carey, 1978), Rothbart's psychobiological model (Rothbart, 2007), and Cloninger's adult model (Cloninger, Pryzbeck, & Syrakic, 1993). Furthermore, a handful of studies have employed other personality measures (i.e., Bieberich & Morgan, 2004; De Pauw et al., 2009). These boundaries allow for a more refined discussion regarding some of the nuances regarding connecting broad factors from personality and psychopathology literatures to organize information and discussions. Interested readers are encouraged to refer to cited reviews for a more thorough general review regarding personality research in ASD populations.

    The factor structure of personality in autism. Typically, when researchers are interested in testing whether groups with a particular disorder differ from typically developing individuals on some trait, psychometrically sound measures are usually selected. Often, test construction is a multi-iterative process involving several different participant cohorts, deletion of ill performing test items, and repeated analysis of factor structure until a test is thought to adequately measure the desired construct (for example, see Mervielde & De Fruyt, 2002, p. 134, Table 2). Due to the relative sparseness of atypically developing populations, testing the factor structure within these groups is rarely performed on non-diagnostic instruments. Even when the factor structure of diagnostic instruments is tested, results can be quite variable. For example, although ASD symptoms are thought to encompass three distinct domains, factor analysis of ASD populations using clinical instruments sometimes find a different number of factors than anticipated (Constantino et al., 2004; Frazier, Youngstrom, Kubu, Sinclair, & Rezai, 2008). While this issue is universal to test development, it is often overlooked when considering whether to employ a measure of personality to clinical populations. Independent test validation is particularly relevant for individuals with ASD if one considers that the behaviors of individuals

with ASD are considered by many to represent the extreme end of a *spectrum* of behavioral functioning found normally distributed within the population (Baron-Cohen et al., 2001). Just as Spearman's Law of Diminishing Returns maintains that the correlations between intelligence test factors are weaker among high IQ groups compared to low IQ groups (Spearman, 1927 as cited by Detterman & Daniels, 1989), it is possible that the factor structure of personality is different when considering rarified clinical populations such as ASD. This is especially true when one considers the fact that personality factors, such as those measured by FFM instruments, largely reflect socially relevant components of behavioral functioning (Digman, 1990), a primary area of atypical development in ASD populations.

The issue of factor structure is particularly significant when one considers that the facet level measures of temperament in typically developing populations can shift over time depending upon developmental stage. Take, for example, the changing role of the *fear* facet across development in the factor structure of Rothbart's theory and measures. During early and middle childhood this facet is more strongly related to Neuroticism (Rothbart, Ahadi, Hershey, & Fischer, 2001; Putnam, Garstein, & Rothbart, 2006); however, in adolescence *fear* is more (negatively) associated with Extraversion and likely reflects the role that fearfulness plays in the expanding social arena of adolescence (Ellis & Rothbart, 2006). A similar trend is seen with the perceptual sensitivity facet, which moves from the Neuroticism factor in early childhood (Rothbart et al., 2001) to the Conscientiousness factor in adolescence (Ellis & Rothbart, 2006). Likewise, joint factor analyses of data employing FFM measures and Buss and Plomin's (1984) Emotionality Activity Sociability scales indicates that, in preschool populations, the facets of *energy* (i.e., activity level) and *sociability* load on separate factors (De Pauw et al., 2009), but in adulthood they jointly load on a single Extraversion factor (Angleitner & Ostendorf, 1994). Collectively, these data indicate that the relationships between personality facets change over development in typical groups. It is possible that ASD populations have distinctly different personality patterns compared to typically developing groups. Different factorial patterns may

arise, in part, due to atypical early brain development for children with ASD. In particular, the atypical parietal (Courschesne, Press, & Yeung-Courschesne, 1993), limbic (Baron-Cohen et al., 2000), and prefrontal (Redcay & Courschesne, 2007) developmental patterns found amongst ASD groups are respectively related to the FFM Agreeableness, Neuroticism, as well as Conscientiousness and Openness (De Young et al., 2007; De Young et al., 2011).

As a developmental disorder marked by atypical development of neurological structures (e.g., prefrontal cortex and amygdala; Bechavalier & Loveland, 2006; Redcay & Courschesne, 2005) thought to be related to personality functioning (De Young et al., 2010), the primary consideration of superordinate personality factors without more information regarding the relationship between the subordinate facets might lead to faulty conclusions (e.g., individuals with ASD being low in Extraversion when only low in one facet). As such, until the requisite research is done indicating that the factor structure of personality in ASD populations is fundamentally similar to that of typically developing populations, and across multiple stages of development, researchers should focus on analysis of facet level scores. Then, when data are reported bearing on the factor structure of personality in ASD, prior facet level findings may be interpreted in the light of specific data regarding the relationship between subordinate facets and broader personality factors in this clinical population.

The relative importance of factors and facets in ASD. When communicating with a larger psychological audience regarding personality in ASD it is important to note that details can be lost if the sole focus is on broad factors (Nigg, 2006). For example, the data to date support the statement that individuals with ASD differ from typically developing individuals in regards to Extraversion; however, depending upon the employed personality measure, the direction of this relationship may shift over the course of development. Data regarding facet level information allow for a discernment regarding this seeming paradox. For example, four year olds with ASD, according to one report, are significantly higher than typical peers due primarily to the Extraversion *high intensity pleasure* facet on Rothbart's measure, but not the facets of *activity*

level, impulsivity or *shyness* (Adamek et al., 2011). At school age and adolescence, however, children with ASD are lower than their peers in Extraversion related factors primarily due to higher ratings on *shyness* (Konstantanareas & Stewart, 2006) and *fear*, as well as lower ratings of *surgency* (Schwartz et al., 2009). This shifting of factor level expressions across development may be driven by a number of issues including the changes of facet level relations, such as *fear* changing from a Neuroticism to an Extraversion related facet on the CBQ (Ellis & Rothbart, 2006), a shift in behavioral expectations across development (e.g., controlling *high intensity pleasure*), or idiosyncrasies of the research sample. Additionally, whereas Adamek et al. found that four year olds with ASD were higher than typically developing children in Extraversion when he used Rothbart's CBQ, BSQ data indicates that four and five year old children with ASD are higher than typical peers in *activity level*, as well as being less *adaptable*, and *approach oriented* (Bailey et al., 2000; Hepburn & Stone, 2006), which may be interpreted as lower Extraversion related behaviors (Garon et al., 2009). The CBQ and BSQ differ in regards to the facets that they employ, particularly in that the BSQ does not measure *positive affect*. Thus, the direction of significant group differences may also be related to specific facet level details of personality measures.

The relative impact of different facets elicits the consideration of two issues. First, if the facet level traits are strongly correlated and are reflections of a broader superordinate facet, why are just a few facets driving the significant differences between children with ASD and typically developing peers in several reports? Using the Rothbart's measures as an example, data from early (Adamek et al., 2011) and middle childhood (Konstantanareas & Stewart, 2006), and adolescence (Schwartz et al., 2009) indicate that (in each instance) only one or two facets are driving the factor level difference between groups. The fact that only a limited number of facets differentiated ASD groups from typically developing groups may reflect the previously mentioned concern of a potential alternative factor structure of personality in ASD populations. If the facets level scores were as tightly coupled in the ASD groups as they were in the typically

developing groups, one might expect a greater correspondence between groups on correlated facets than is seen. For example, with an effect size of 0.75 for *shyness* discriminating ASD children from non-ASD (i.e., Konstantanareas & Stewart, 2006), one would expect that highly correlated facets would display similar significant differences from typically developing scores. Instead, it is possible, and perhaps even reasonable, to expect that the facet of *shyness* could load on the Neuroticism factor in the ASD population at this age; especially considering the fact that facets such as the Neuroticism related facets of *discomfort* and *soothability* also strongly discriminate between children with ASD and typical peers (i.e., Konstantanareas & Stewart, 2006). Furthermore, it is possible that school age children with ASD could be developmentally delayed in a manner so that *shyness* might still load on a Neuroticism factor whereas this facet loads on Extraversion those without developmental disorders.

The second issue concerns whether the consideration of factor level personality traits is informative. The importance of factor level interpretation depends on the question asked. For example, recent research from De Pauw et al. (2010) indicates that comparing the personality factor level relationships of children with and without ASD can be informative regarding questions of the spectrum nature of ASD. Investigators used the following reasoning originally proposed by Van Leeuwen, Mervielde, DeClercq, and De Fruyt (2007): If ASD symptoms lie on the extreme end of a normally distributed behavioral continuum then they should only differ from typically developing groups in mean differences; however, if a qualitative difference exists between ASD and typically developing peers, differences should also be apparent in groups means, psychometric properties (i.e., internal reliability), and correlational patterns. In this situation, their data supported the spectrum hypothesis. Furthermore, research regarding electroencephalographic (EEG) Extraversion and Neuroticism related patterns indicates a promising route for understanding heterogeneity of social abilities within ASD populations (Sutton et al., 2005). Thus, certain questions, particularly in regards to theoretical issues (e.g., the spectrum nature of ASD), may lend themselves to factor level consideration.

On the other hand, for researchers interested in questions regarding specific behavioral traits that may inform applied research questions, a focus on factor level variables may obscure crucial facet level information. Take, for example, some of the research completed with ASD children during the stages of early childhood where a somewhat counterintuitive facet level trait differentiating children with ASD involves traits related to Extraversion and approach orientation (Adamek et al., 2011; Bailey et al., 2000; Hepburn & Stone, 2006). Using the CBQ, Adamek et al. reported that children with ASD scored higher on facets related to high and low positive emotion. Using the BSQ, both Bailey et al. and Hepburn and Stone reported higher scores on *activity level*, but lower *approach* and *adaptability* facets for children with ASD. These reports indicate that children with ASD are reportedly *higher* in regards to their expression of *positive emotions* and *activity level*, yet lower *approach* orientation. Alternatively, Garon et al. (2009) reported that infants with ASD were lower in *positive emotion* facets, yet higher in *activity* oriented facets on Rothbart's infant measure of temperament. Collectively, these findings indicate that *activity level* and *positive emotions* may be decoupled in children with ASD in a manner distinct from standard conceptions of Extraversion related factors (but see Buss & Plomin, 1984). Whereas in the typically developing child, *positive emotions* correlate strongly with social *approach* to create an Extraversion factor it is possible that relative independence of these ratings differentiates children with ASD.

Numerous important issues could be outlined here (e.g., sample characteristics); however, the focus of this paper is whether and when factors or facets should be reported. If these reports had only studies factor level information, the details regarding differences between children with ASD and typically developing children would have been obscured. Furthermore, omission of facet-level information would have resulted in incomplete understanding of the seeming developmental paradox of lower *positive affect* in infants who developed ASD compared to preschoolers with ASD. Thus, while a focus on factor levels may be appropriate for certain questions (e.g., the spectrum hypothesis), it may be inappropriate to answer others.

Personality tests and factor facet relations. The push towards considering temperament and personality within common factor level frameworks allows for the development of a common language (Shiner, 1998); however, the scales measuring these broadly comparable factors consist of common and unique facet level details (see Tables 1-5 in Appendix F). As discussed in the previous section, facet level details provide important information regarding differences between individual with and without ASD, as well as which facets may inform diagnostic status (i.e., increased *activity level*, but lower *positive affect*) change across development stages within ASD. Therefore, the employment of multiple scales measuring similar and unique facets of personality is critical information for researchers to attend.

It is common for certain measures to become more popular in particular fields than others due to a variety of reasons; however, the lack of variety in measurement can stymie progress due to a restriction of the range of observed construct-relevant facets. Thus, the employment of instruments measuring different aspects of a similar factor allows for greater nuanced understanding of a particular factor in atypically developing populations. A look at Tables 1-5 is illustrative (Appendix F). These tables divide the facets of four measures commonly employed in the ASD literature to date (Rothbart, 2007; McDevitt & Carey, 1978); one measure used a single ASD study reporting factor levels scores (Hierarchical Personality Inventory for Children; HiPIC; Mervielde & De Fruyt, 2002), and two measures yet to be employed (EAS scale, Buss & Plomin, 1984; ICID; Deal, Halverson, Martin, Victor, & Baker, 2005). As can be seen, each instrument measures similar constructs, yet (with the exception of the EAS) each also measures unique facets.

In addition to validating previous findings with alternative measures, alternative scales allow one to test for unique facets that might uniquely identify ASD status. For example, parent ratings of Conscientiousness indicates high uniformity across facets in children (Konstantanares & Stewart, 2006) and adolescents (Samyn et al., 2011) in that children with ASD were significantly different from typically developing peers on each scale in a coherent manner. For

example, children with ASD were lower than typical peers in *attentional*, *activation*, and *inhibitory control* facets. Using facets theoretically subsumed under the same Conscientiousness factor from the BSQ also indicates that children with ASD score lower than typically developing peers on the Conscientiousness related facets of *persistence* and *distractibility*. Although the relationship is in the same direction (both lower), if the measures were tapping a central construct in ASD, one would expect them to be negatively related as lower *persistence* may indicate higher *distractibility* (McDevitt & Carey, 1978). Similar results might be found using scales from other measures. For example, the ICID measures a *concentration/distractibility* facet common to both the CBQ and BSQ, but includes the unique facets of *achievement orientation, organized, compliant*, and *intellect*. It is conceivable that children with ASD would generally score in a coherent manner on all the facets except for the *organized* facet, due to obsessive routine development and organization preferences common to this group. Thus, focusing on the facet level details may provide information regarding unique patterns of ASD ratings on Conscientiousness related scales.

   Purpose of the current study. As noted, research regarding the role of personality variables among populations with ASD is limited in a number of different ways. The proposed study addresses several of these issues. First, the study employs a personality instrument that has previously not been used compare children with ASD and typically developing populations: the Inventory of Children's Individual Differences-ICID short version (Deal et al., 2007). Although the ICID measures many similar facets as the BSQ and CBQ, it is also comprised of facets not captured by the other scales (Appendix F). For example, although the ICID and CBQ both measure facets regarding *activity level, positive emotions*, and *shyness*, the ICID uniquely measures *sociability*. Similarly, the facets of *sociability, positive emotions,* and *shyness* are not found on the BSQ. Second, unlike the CBQ and BSQ, the scales of the ICID were normed on children from the ages of 2 to 15. Thus, if this instrument is used in future studies with children in middle childhood or adolescence comparisons with the present study may be facilitated as

these specific facets are designed to be similar across a wider age range compared to other instruments. Finally, the discussion of these findings takes into consideration the *utility of* and the *problems with* framing personality in ASD findings in relation to superordinate factors. As such, while significant findings are discussed in regards to popular "broadband" theories regarding personality, deviations from the expected patterns are highlighted in order to accommodate alternative explanations and determine future research directions investigating unique patterns of personality development in ASD populations.

The primary research hypotheses center on the following question: Do children with ASD differ from typically developing children in early childhood on all facets of superordinate factors of the ICID in a manner that would be theoretically expected from the FFM framework? Specific hypotheses follow:

(a) When compared to same-age peers, children with ASD will show lower levels of *considerate* and *sociability* scores, but, against expectation, children with ASD will display higher levels of *positive emotion* and *activity* scores.

(b) When compared to same-age peers, children with ASD will show greater levels of *fear,* and *negative affectivity*, and *shyness* ratings.

(c) When compared to same-age peers, children with ASD will show lower levels of *achievement orientation,* but against expectation lower *distractibility* and higher *organized* scores.

(d) When compared to same-age peers, children with ASD will show lower *compliance* scores, but higher *antagonism and strong-willed* scores.

(e) When compared to same-age peers, children with ASD will show lower *intelligence* and *openness* scores.

Methods

Participants

We defined Early childhood (EC) as children whose ages were between the ages of 4 and 7. Four is a reasonable lower threshold for EC because some of the questions, such as "my child is organized," seem unlikely to apply to many children younger than four. Additionally, the floor of the autism symptom screener employed in this study is four and to screen for autism symptoms in younger ages would require using dissimilar screeners that may not be comparable. Aside from practical considerations, the ages 4 - 7 also marks a period wherein children develop the capacity to compare their behaviors to other children (Tracy & Ward, 1998) and the upper end of Piaget's preoperational stages (Woolfolk, 2010).

We recruited participants with an ASD from the Interactive Autism Network (IAN: http://www.iancommunity.org/), an organization that links researchers with families of individuals with autism who are interested in participating in research projects. IAN's website states that "All children (under the age of 18) who have been diagnosed with an ASD by a professional are eligible to participate" in research (https://www.ianresearch.org/login). Due to concern over participants receiving numerous e-mail solicitations, IAN is careful with the number of deployed research calls and employs an algorithm based off of the number of participants desired and the strength of the incentive offered by the researcher to determine the number of solicitations to make. Parents of children with ASD between the ages of 4 and 7 received three rounds of e-mails from IAN inviting them to volunteer for this study. In order to incentivize participation, all ASD participants received an opportunity to enter a drawing to win one of four $100 gift cards. The typically developing comparison group came from the norming database for the Inventory of Children's Individual Differences (ICID; Halverson et al, 2003) which by Dr. Roy Martin, an investigator on the original ICID project, made available.

Initial screening of the ASD data indicated that 108 cases were inadequate for analyses (Table 1.1). The primary reason for this was that parents did not include age information

regarding their child (106; 98.1%). Other reasons for excluding data included no ICID data (1; 0.9%) and indicating "not wanting to participate" (1; 0.9%). Analyses comparing included and screened ASD groups could not be conducted for gender, race, ethnicity, ICID data, ASD diagnosis, or AQ criteria due to less than two entries for the screened group. After the initial screening a second round of screening revealed 15 out of 155 cases who did not meet the following criteria: (a) 14 participants had Autism Quotient scores less than the recommended cut-off; (b) 1 participant's age fell outside of the age range for this study (Table 1.2). Table 1.3 shows that the included ASD group consisted of the remaining 140 early childhood participants (113 boys; 26 girls; 1 no data) who were 5.86 years of age ($SD = 1.12$) The racial demographic of the ASD group consisted primarily of Caucasian participants (126; 91.3%), with few participants of other race groups (African American- 1, 0.7%; Asian American- 0, 0%; Native American- 0, 0%; and Other- 9, 6.5%). Thirteen (10.1%) were of Latino ethnicity. Eighty-eight (62.9%) children had a diagnosis of Autism, 9 (6.4%) Autism and Other (e.g., epilepsy), 9 (6.4%) Asperger, 9 (6.4%) Asperger and Other, 31 (22.1%) PDD-NOS, and 29 (20.9%) did not answer. The comparison group consisted of 374 children (190 boys; 187 girls) who were 5.33 ($SD = 1.07$) years old. The racial demographic consisted primarily of African-American (210; 56.1%) and Caucasian (135; 36.1%) participants with a few Asian American (8; 2.1%), Native American (5; 1.3%), and Other (3; 0.8%) race groups. Three (0.8%) participants were of Latino ethnicity.

Table 1.1

Exclusion criteria for ASD cases

_____

Variables	*N* (%)
Total N	108 (100)
Total Excluded	108 (100)
AQ cut off	0 (0)
Older than 12	0 (0)
No Date of Birth	106 (98.1)
No ICID	1 (0.9)
Not Interested	1 (0.9)

Note. ASD = Autism Spectrum Disorder, AQ = Autism Quotient, ICID = Inventory of Children's Individual Difference; *N* = number of participants.

Table 1.2

Exclusion Criteria for Early Childhood ASD Group

_____

Variables	N (%)
Total N	155 (100)
Total Excluded	15 (9.6)
AQ < cut off	14 (9.0)
Older than 8	1 (0.6)
No Date of Birth	0 (0)
No ICID	0 (0)
Not Interested	0 (0)
Total Included	140 (90.3)

Note. ASD = Autism Spectrum Disorder; AQ = Autism Quotient; ICID = Inventory of Children's Individual Differences; 108 cases did not have data regarding age of child.

Table 1.3

Early Childhood Participant Characteristics

Variable	ASD (*N*; %)	Control (*N*; %)
Total N	139	374
Age (years)	5.86	5.33
Gender		
Boys	113 (81.3)	190 (50.4)
Girls	26 (18.7)	184 (49.6)
Race		
African-American	1 (0.7)	210 (56.1)
Asian- American	0 (0)	8 (2.1)
Caucasian/White	126 (91.3)	135 (36.1)
Native American	0 (0)	5 (1.3)
Other	9 (6.5)	16 (4.3)
Choose Not to Answer	2 (1.4)	3 (0.8)
Left Blank	1 (0.4)	0 (0)
Ethnicity		
Latino	13	3
Not Latino	118	371
No Answer	4	0
ASD Diagnosis		
Autism	88 (62.9)	NA
Autism+Other	9 (6.4)	NA
Asperger's	9 (6.4)	NA

Variable	ASD (*N*; %)	Control (*N*; %)
Asperger's+Other	9 (6.4)	NA
PDD-NOS	31 (22.1)	NA
PDD-NOS+Other	0 (0)	NA
ASD Diagnostician		
Psychologist, M.A.	4 (1.6)	NA
Psychologist, Ph.D.	29 (20.7)	NA
Psychiatrist, M.D.	0 (0)	NA
Neurologist, M.D.	8 (5.7)	NA
Family Physician, M.D.	22 (15.7)	NA
Pediatrician, M.D.	1 (0.4)	NA
Developmental Pediatrician, M.D.	1 (0.4)	NA
Speech Pathologist	33 (23.6)	NA
Occupational Therapist	2 (0.8)	NA
Other	3 (1.2)	NA
Team with Psychologist (M.A./Ph.D.)	23 (16.4)	NA
Team of M.D.s	0 (0)	NA
Team with M.D. and SLP or OT	12 (4.7)	NA
Team with SLP and OT	2 (0.8)	NA
Diagnostic Instrument		
ADIR	1 (0.4)	NA
ADOS	11 (7.9)	NA

Variable	ASD (*N*; %)	Control (*N*; %)
CARS	13 (5.2)	NA
SCQ	1 (0.4)	NA
Other	7 (2.8)	NA
ADIR & ADOS	7 (2.8)	NA
ADIR and/or ADOS and other	44 (17.5)	NA
CARS and/or SCQ and other	5 (2)	NA
Don't Remember	51 (20.2)	NA

Note. ASD = Autism Spectrum Disorder; ADIR = Autism Diagnostic Interview- Revised; ADOS = Autism Diagnostic Schedule; CARS = Childhood Autism Ratings Scale; M.A. = Master of Arts; M.D. = Medical Doctor; NA= Not Applicable; OT = Occupational Therapist; Ph.D. = Doctor of Philosophy; SCQ = social communication questionnaire; SLP = Speech Language Pathologist.

Measures

Demographic information collected from both ASD and typically developing parents included data regarding race, ethnicity, gender, and occupation. Parents of children with ASD also answered questions regarding the diagnostic status of household members, birth order, religion, interest in participating in future studies, source of ASD diagnosis, and diagnostic information regarding scores on intelligence tests, autism rating scales, and communication scales. Both parents of children with ASD and typical children reported information about socio-economic status (SES); however, the ASD sample gave information regarding both the parent's income whereas the typical group only reported one parent's income. Furthermore, the ASD group answered questions regarding their child's ASD status and the typically developing group did not.

Parents of children with an ASD filled out the *Autism Quotient* (AQ; Aeyung, Baron-Cohen, Wheelwright, & Allison, 2008; see Appendix C) to confirm the presence of autism symptoms in the ASD group. The AQ is a parent-report measure that consists of 50 items, is appropriate for children ages 4 – 11, and displays excellent internal (α = .97), and test-retest (r = .85) reliability. The AQ consists of four empirically derived scales: *Mind Reading* (α = .96), *Attention to Details* (α = .85), *Communication* (α = .94), and *Social Skills* (α = .90). *Mind reading* refers to children's ability to decode non-verbal communication and understand the underlying cognitive and affective bases of social behavior. *Attention to details* refers to a preference for focusing on circumscribed aspects of the physical world rather than developing an overall gestalt. *Communication* refers to children's ability to verbally interact smoothly and competently. The *social skills* scale refers to children's ability to initiate and maintain age appropriate social interactions. Research shows that the AQ is a valid non-diagnostic instrument that clearly delineates children with ASD from typically developing populations (Aeyung et al., 2008). We omitted data from this analysis from children identified as having an ASD who score below a 76 on the overall score as data supports that 95% of children with an ASD score above this point.

All parents filled out the *Inventory of Children's Individual Differences- Short Version* (ICID; Deal et al., 2007; see Appendix E), a personality test designed to measure 15 facets that can be combined to measure the FFM personality variables in children between the ages of 2 and 15. All facet scales display adequate to good internal (α = .67-.85) and good to excellent test-retest reliability (r = .85-.95). Furthermore, the ICID shows strong convergent validity in that scales correlate in the predicted manner with other personality scales (Deal et al., 2007). The *Achievement Orientation* facet measures the perceived desire to succeed of children. The *Activity Level* facet measures the amount of expressed physical energy. The *Antagonism* facet refers to children's tendency to elicit negative states from others. The *Compliance* facet measure the degree to which a child submits to instruction from others. The *Considerate* facet measures the thoughtfulness and sensitivity expressed by children in regards to others. The *Distractible* facet measures children's difficulty at sustaining attention. The *Fearful* facet measures children's tendency toward withdrawal related negative emotions. The *Intelligent* factor refers speed of learning and memory skills. The *Negative Affect* facet measures children's tendency to experience and express negatively valenced emotions. The *Openness* factor refers to a sense of imaginativeness and curiosity. The *Organized* facet measures one's tendency towards neatness, carefulness and thoughtfulness. The *Positive Emotion* facet measures children's tendency to express positive affects related to happiness. The *shyness* facet measures children's reticence regarding social interactions. The *Strong-Willed* facet measures a child's compliance and push for their own way. The *Social* facet measures a preference for social interactions.

One unique aspect of the ICID is that the facet level scores may be combined to derive measures of the FFM personality variables (Digman, 1990). Although this study does not address the FFM superordinate factors, the discussion is organized according to this popular scheme as described in Halverson et al., (2003). Extraversion is measured by related to the facets *Social*, *Positive Emotion*, *Activity Level*, and *Considerate*. Agreeableness is related to the

Compliance, Strong-Willed and Antagonism facets. Conscientiousness is related to the *Organized* and *Achievement Orientation* and *distractible* facets. Neuroticism is related to the *Shy*, *Negative Affect*, and *Fear*, facets. Openness is related to the *Intelligent* and *Openness* facet. Please note: The *Compliance* facet is a unique scale introduced by Deal et al., 2007 and *openness* was originally put with Extraversion in Halverson et al., but considering its historical pairing with intelligence, as well as their strong correlations, these are considered together.

Equivalence of paper-and-pencil and on-line questionnaires. In a pilot study of 17 parents, we investigated the concurrent validity of the AQ and ICID paper-based measures and on-line measures. Participants completed pencil and paper and on-line versions of the ICID with approximately two weeks between completing the first one and completing the second. For the ICID, the total scores for the paper and on-line measures correlated at .90; factor level scores showed strong correlations ($r = .93-.96$); and facet level scores ranged from .87 to .98, except for *Openness* which displayed lower correlations ($r = .64$). For the AQ, the total scores for the paper and on-line measures correlated at .94.

Procedure

We recruited parents of children with ASD via IAN recruitment services. Once parents gained access to the online materials they read an online informed consent form approved by the Institutional Review Board (IRB) at the University of Georgia (UGA). Since the data collected from this study does not require personally identifiable information, does not involve the direct participation of minors, and involves little to no risk, UGA's IRB deemed a signed informed consent unnecessary. Instead, after reading the informed consent, parents checked a box indicating whether they agreed or not to the conditions outlined in the informed consent. If parents disagreed to the conditions of the informed consent they were forwarded to a page thanking them for their time. If they agreed to participate in the study they were sent to a second page where they indicated whether or not their child was identified with an ASD.

Parents of children with an ASD then completed four forms. First, they filled out a diagnostic information questionnaire asking them details about their child's diagnosis (autism, Asperger's, PDD-NOS, other); the professional credentials of the individual who diagnosed their child (master's or doctoral level psychologist, licensed clinical social worker, psychiatrist, neurologist, family doctor, pediatrician, speech language pathologist, occupational therapist, and other); autism assessment employed by the diagnostician (ADI-R, ADOS, CARS, CARS2, SCQ, other, don't know); cognitive assessment employed by diagnostician (Leiter-R; Mullens; PPVT-III or IV; WISC-III; WJ-III; Stanford Binet-5, other, don't know); and behavioral assessment employed by diagnostician (ABAS I or II; SIB-R; Vineland I or II; other; don't know). [See Appendix A]. Second, parents completed a demographic questionnaire regarding the following information: child's date of birth; child's gender; race; birth order; number of siblings; maternal marital status, race, education, occupation, income, and religious affiliation; paternal marital status, race, education, occupation, income, and religious affiliation [See Appendix B]. Third, participants completed the AQ. Finally, participants filled out the ICID.

Results

Preliminary Analyses

The ASD and typical groups differed significantly from each other in regards to age (t [1, 238.32] = 4.98, $p < .001$) and gender [χ^2(1, $N = 516$) = 39.99, p < .001]. To address these significant differences, we employed a 2 (diagnostic group) X 2 (gender) Multivariate Analysis of Covariance (MANCOVA) statistically controlling for age.

Comparison of the reliability of the ICID facet level scales

Prior to analyses, we calculated Cronbach alpha coefficients to determine whether the internal reliability of personality facets was similar between the ASD and typically developing groups (see Table 1.4). George and Mallery (2003) recommend the following rule of thumb regarding the strength of internal reliability: .91-1.00- excellent, .81-.90- good, .71-.80- acceptable, .61-.70- poor, and below .60 unacceptable. For the typical group, no scales fell into the excellent range, two (*shy* and *intelligence*) fell in the good range, eight (*activity level*, *antagonism*, *considerate*, *distractible*, *negative affect*, *openness*, *sociability*, and *strong-willed*) fell in the adequate range, four (*achievement, compliance, fear*, and *shy*) fell in the questionable range, none fell in the poor range, and one (*organized*) fell in the inadequate range. For the ASD group, no scales fell into the excellent range, five (*activity level, compliance, considerate, intelligence,* and *negative affect*) fell in the good range, six (*antagonism, fear, openness, positive emotion, sociability, strong-willed*) fell in the adequate range, one (*achievement*) fell in the questionable range, one (*shy*) fell in the poor range, and two (*distractible* and *organized*) fell in the inadequate range.

In order to determine test whether the qualitative differences between internal reliabilities were meaningful in a more quantitative manner, we used the Feldt test (Feldt, 1969). The Feldt test provides a *W* statistic based off of the following formula:

$$W = \frac{1-\hat{\alpha}_2}{1-\hat{\alpha}_1}.$$

In this formula $\hat{\alpha}_2$ is the internal reliability statistic of one group and $\hat{\alpha}_1$ the internal reliability of the other. Employing a Bonferroni correction, we determined the alpha level should be set at .003 (i.e., .05/15). The internal reliabilities of the *activity level* (W[373, 138] = 1.77, *p* < .003), *compliance* (W[373, 138] = 1.58, *p* < .003), and *negative affect* (W[373, 138] = 2.27, *p* < .003) were higher in the ASD group compared to the typically developing peers. The internal reliabilities of *distractible* (W[138, 373] = 1.81, *p* < .003), and *positive emotion* (W[138, 373] = 1.50, *p* < .003) were higher in the typically developing group compared to the ASD group.

Table 1.4

Internal Reliability of Temperament Scales

_____

Temperament Facet	ASD	Strength	Comparison	Strength	*p* < .003
Achievement	.69	questionable	.70	questionable	--
Activity Level	.87	good	.77	acceptable	**
Antagonism	.74	acceptable	.79	acceptable	--
Compliance	.81	good	.70	questionable	**
Considerate	.84	good	.80	acceptable	--
Distractible	.53	unacceptable	.74	acceptable	**
Fear/Insecure	.79	acceptable	.70	questionable	--
Intelligence	.85	good	.81	good	--
Negative affect (anger)	.89	good	.75	acceptable	**
Openness	.76	acceptable	.78	acceptable	--
Organized	.52	unacceptable	.43	unacceptable	--
Positive Emotion	.76	acceptable	.84	good	**
Shy	.61	poor	.70	questionable	--
Sociability	.73	acceptable	.80	acceptable	--
Strong willed	.76	acceptable	.74	acceptable	--

Note. ASD = Autism Spectrum Disorders; Descriptive categories for internal consistency reliability are from George and Mallery (2003).

MANCOVA of personality variables

The deployment of a MANCOVA requires moderate to strong significant correlations between the tested variables (Meyers, Gampst, & Guarino, 2006), thus we calculated Pearson's correlations for both the ASD and comparison group (Appendix G). Both groups displayed patterns of moderate to strong correlations between variables that justifies the use of MANCOVA. However, as the reader may observe by attending to the upper (ASD) and lower (comparison) diagonals (Appendix G), substantially different patterns emerged for the ASD and comparison group: Box's test of covariance indicated that ASD and typical groups differed in regards to their respective covariance matrices (p < .005; see Huberty & Petosky, 2000).

Due to widespread differences in covariance matrices, we employed the more conservative Pillai's Trace omnibus statistic to determine the overall MANCOVA *F*-value as this statistic is robust to violations of unequal covariance matrices. Pillai's Trace statistics indicated no significant ASD X gender interactions [$F(1, 15) = 1.683$, $p > .05$, $\eta^2 = .06$], significant gender differences [$F(1, 15) = 1.742$, $p < .05$, $\eta^2 = .06$], and significant differences between ASD and typical children [$F(1, 15) = 39.924$, $p < .001$, $\eta^2 = .59$. No significant relationship were found regarding age: [$F(1, 15) = 1.131$, $p = .326$, $\eta^2 = .04$].

Before conducting between groups *t*-tests, we employed Levene's *F* tests to determine whether ASD and comparison groups differed in regards to their homogeneity of variance. Thirteen of the personality facets were found to be non-homogenous. Therefore, we employed Welch's *F*-tests to determine univariate differences as this statistic is considered robust to homogeneity violations.

Group Differences on Personality Facets

We employed fifteen follow up pairwise comparisons employing the Bonferroni correction to control for probability inflation to determine which facets of personality differed between ASD and control children. The Bonferroni correction takes into account the number of contrasts and divides the chosen alpha, in this case .05, by this number. Thus, for 15

comparisons differences below $p < .003$ were considered significant, but p values are reported according to their lowest value down to .001 in accordance with common reporting practices. *F*-values, means, standard deviations, and effect sizes are presented for all contrasts in Table 1.5.

Table 1.5

Means and Standard Deviations for ASD and Typical Children

Temperament Facet	ASD *M* (*SD*)	Comparison *M* (*SD*)	Gender *M* (*SD*)[a]
Achievement			
ASD Group	10.76 (4.09)	14.06 (2.63)	13.02 (3.51)
Boys	10.72 (4.11)	13.81 (2.52)	12.48 (3.63)
Girls	11.00 (4.18)	14.29 (2.72)	13.83 (3.18)
Activity Level			
ASD Group	15.96 (4.63)	16.04 (3.01)	16.02 (3.01)
Boys	16.16 (4.40)	16.40 (2.88)	16.30 (3.60)
Girls	15.31 (5.53)	15.66 (3.10)	15.61 (3.53)
Antagonism			
ASD Group	10.72 (4.38)	8.73 (3.42)	9.38 (3.85)
Boys	10.55 (4.26)	8.87 (3.17)	9.59 (3.76)
Girls	11.88 (4.65)	8.59 (3.64)	9.07 (3.96)
Compliance			
ASD Group	10.01 (4.22)	13.66 (2.58)	12.50 (3.61)
Boys	9.92 (4.20)	13.30 (2.38)	11.85 (3.69)
Girls	10.19 (4.35)	14.01 (2.72)	13.46 (3.29)
Consideration			
ASD Group	8.62 (4.01)	14.93 (2.86)	12.92 (4.38)
Boys	8.58 (4.03)	14.73 (2.81)	12.09 (4.55)
Girls	8.35 (3.24)	15.12 (2.91)	14.14 (4.38)

Temperament Facet	ASD *M* (*SD*)	Comparison *M* (*SD*)	Gender *M* (*SD*)[a]
Distractible			
ASD Group	13.68 (4.09)	10.22 (3.20)	11.29 (3.83)
Boys	13.52 (4.00)	10.57 (2.93)	11.84 (3.72)
Girls	14.12 (4.38)	9.88 (3.41)	10.49 (3.85)
Fear/Insecure			
ASD Group	16.03 (5.94)	12.56 (4.24)	13.62 (5.05)
Boys	15.73 (5.68)	12.70 (3.93)	14.01 (4.98)
Girls	16.81 (6.68)	12.43 (4.53)	13.06 (5.12)
Intelligence			
ASD Group	13.77 (5.24)	15.89 (3.01)	15.21 (3.97)
Boys	14.03 (5.11)	15.70 (2.93)	14.98 (4.09)
Girls	12.46 (5.71)	16.07 (3.08)	15.55 (3.78)
Negative (anger)			
ASD Group	14.60 (4.68)	10.23 (3.36)	11.63 (4.32)
Boys	14.46 (4.67)	10.48 (3.11)	12.19 (4.33)
Girls	15.62 (4.27)	9.99 (3.59)	10.80 (4.18)
Openness			
ASD Group	14.37 (5.57)	21.65 (3.52)	19.35 (5.45)
Boys	14.07 (5.46)	21.73 (3.40)	18.44 (5.81)
Girls	15.42 (5.97)	21.57 (3.65)	20.68 (4.59)

(continued)

Temperament Facet	ASD *M* (*SD*)	Comparison *M* (*SD*)	Gender *M* (*SD*)[a]
Organized			
ASD Group	14.26 (3.94)	15.22 (2.77)	14.92 (3.22)
Boys	14.40 (4.06)	15.03 (2.65)	14.76 (3.33)
Girls	13.69 (3.50)	15.40 (2.90)	15.16 (3.04)
Positive Emotion			
ASD Group	14.51 (4.00)	17.24 (2.90)	16.37 (3.52)
Boys	14.40 (3.88)	17.17 (2.85)	15.98 (3.60)
Girls	14.77 (4.45)	17.30 (2.96)	16.93 (3.33)
Shy			
ASD Group	20.74 (4.22)	12.26 (4.04)	14.91 (5.67)
Boys	20.42 (4.05)	12.23 (3.72)	15.75 (5.60)
Girls	21.96 (4.75)	12.27 (4.34)	13.68 (5.56)
Sociability			
ASD Group	10.74 (4.36)	20.46 (4.03)	17.41 (6.12)
Boys	10.81 (4.41)	20.30 (3.76)	16.22 (6.21)
Girls	10.50 (4.31)	20.62 (4.28)	19.16 (5.57)
Strong willed			
ASD Group	19.64 (4.91)	16.08 (4.15)	17.22 (4.71)
Boys	19.63 (4.86)	16.27 (4.05)	17.71 (4.71)
Girls	20.04 (5.03)	15.90 (4.61)	16.50 (4.61)

Note. ASD = Autism Spectrum Disorder.
[a] = Indicates that column data is collapsed across diagnostic groups.

Table 1.6

Temperament Differences between ASD and Typical Children

_____

Temperament Facet	*F* value	*p* value	η^2
Achievement			
ASD Group	69.42	<.001	.14
Gender	00.72	.398	.00
ASD x Gender	00.14	.713	.00
Activity Level			
ASD Group	00.61	.435	.00
Gender	3.39	.066	.01
ASD x Gender	00.03	.865	.00
Antagonism			
ASD Group	27.54	<.001	.06
Gender	1.32	.250	.00
ASD x Gender	3.02	.083	.01
Compliance			
ASD Group	81.89	<.001	.16
Gender	1.48	.224	.00
ASD x Gender	00.36	.552	.00
Consideration			
ASD Group	251.02	<.001	.36
Gender	00.04	.833	.00
ASD x Gender	00.60	.441	.00

(continued)

Temperament Facet	_F_ value	_p_ value	η^2
Distractible			
ASD Group	63.69	<.001	.13
Gender	0.03	.860	.00
ASD x Gender	2.06	.152	.01
Fear/Insecure			
ASD Group	35.54	<.001	.08
Gender	0.38	.536	.00
ASD x Gender	1.17	.280	.00
Intelligence			
ASD Group	27.36	<.001	.06
Gender	1.40	.237	.00
ASD x Gender	3.90	<.05	.01
Negative (anger)			
ASD Group	100.33	<.001	.19
Gender	0.51	.477	.00
ASD x Gender	3.11	.078	.01
Openness			
ASD Group	160.44	<.001	.27
Gender	1.39	.239	.00
ASD x Gender	2.16	.142	.01
Organized			
ASD Group	7.24	<.010	.02
Gender	0.12	.727	.00
ASD x Gender	1.68	.196	.00

Temperament Facet	F value	p value	η^2
Positive Emotion			
ASD Group	41.12	<.001	.09
Gender	0.36	.550	.00
ASD x Gender	0.09	.771	.00
Shy			
ASD Group	286.73	<.001	.40
Gender	2.11	.148	.01
ASD x Gender	1.89	.170	.00
Sociability			
ASD Group	346.12	<001	.44
Gender	0.00	.976	.00
ASD x Gender	0.35	.555	.00
Strong willed			
ASD Group	44.52	<.001	.09
Gender	0.00	.981	.00
ASD x Gender	0.48	.487	.00

Note. ASD = Autism Spectrum Disorder.

In regards to Extraversion oriented facets there were no gender differences or gender x ASD interactions, but analyses revealed several personality facet differences between ASD and typically developing children. Parents rated children with ASD as lower on the facet of *sociability* [F(1, 438) = 346.12, p < .001, η^2 = .44], but counter to hypotheses rated children with ASD as lower on *positive emotions* [F(1, 438) = 41.12, p < .001, η^2 = .09] and no different in *activity level* [F(1, 438) = 0.61, p = .44, η^2 = .00]. Children with ASD were also rated as lower on the *considerate* facet [F(1, 438) = 251.02, p < .001, η^2 = .36].

On Neuroticism oriented facets there were no gender differences or gender x ASD interactions, but there were several differences between ASD and typically developing children. Parents rated children with ASD as higher in on *fear* [F(1, 438) = 35.54, p < .001, η^2 = .08], *shyness* [F(1, 438) = 286.73, p < .001, η^2 = .40], and *negative affectivity* [F(1, 438) = 100.33, p < .001, η^2 = .19].

On Conscientiousness oriented facets there were no gender differences or gender x ASD interactions, but there were several differences between ASD and typically developing children. Parents rated children with ASD as lower on *achievement orientation* [F(1, 438) = 69.42, p < .001, η^2 = .14], but counter to hypothesis as higher on *distractibility* [F(1, 438) = 63.69, p < .001, η^2 = .13], and lower on *organization* skills [F(1, 438) = 7.24, p < .01, η^2 = .02].

On Agreeableness oriented facets there were no gender differences, no gender x ASD interactions, but there were several differences between ASD and typically developing children. Furthermore, parents rated children with ASD as higher on *antagonism* [F(1, 438) = 27.54, p < .001, η^2 = .06] and being *strong willed* [F(1, 438) = 44.52, p < .001, η^2 = .09], as well as having lower *compliance* [F(1, 438) = 81.89, p < .001, η^2 = .16] scores.

On Intelligence oriented facets there were no gender differences, but there was a significant ASD group x gender interaction on the *intelligence* facet [F(1, 438) = 3.90, p < .05, η^2 = .01], Furthermore, parents rated children with ASD as lower on scales measuring *intellect* [F(1, 438) = 27.36, p < .001, η^2 = .06] and *openness* [F(1, 438) = 160.44, p < .001, η^2 = .27].

Comparison of Correlations

      In order to estimate the strength and specificity of the atypical covariance patterns that the Box's test indicated, Fisher *r* to *z* transformations (http://vassarstats.net/rdiff.html) were employed. Due to having a large number (*N* = 105) of comparisons, Bonferroni corrections were employed to control for Type I errors (.05/105: *α* = .0004); however, we ultimately decided on an alpha of .001 as an alpha of .0004 would have substantially increased the probability of Type II errors. Differences above this amount up to *α* = .05 are also noted as there were numerous differences between groups at more conservative levels (*N* = 33) and future research will want to determine whether less powerful differences are consistent between groups (i.e., quasi-control for Type II errors).

      The correlations between *achievement* and *activity levels* differed significantly between ASD (*r* = -.19) and typically developing children (*r* = .19; *p* < .001). Furthermore, there were lower level differences between groups for *achievement* and *consideration* (ASD *r* = .35; Typical *r* = .58; *p* < .01), *fear* (ASD *r* = -.01; Typical *r* = -.29; *p* < .01), *intelligence* (ASD *r* = .49; Typical *r* = .64; *p* < .05), *openness* (ASD *r* = .36; Typical *r* = .51, *p* < .05), *positive emotion* (ASD *r* = .29; Typical *r* = .49, *p* < .05) and *sociability* (ASD *r* = .15; Typical *r* = .31, *p* < .05).

      In addition to the previously mentioned relationship with *achievement*, the correlations between *activity level* and *compliance* (ASD *r* = -.24; Typical *r* = .08), *intelligence* (ASD *r* = -.11; Typical *r* = .32), *openness* (ASD *r* = .01; Typical *r* = .54), *shyness* (ASD *r* = -.02; Typical *r* = -.32) and *sociability* (ASD *r* = .07; Typical *r* = .55) differed significantly between groups (all *ps* < .001). Furthermore, there were lower level differences for the correlations between *activity level* and *consideration* (ASD *r* = -.14; Typical *r* = .15; *p* < .01), *fear* (ASD *r* = -.15; Typical *r* = -.31; *p* < .05), *organized* (ASD *r* = -.22; Typical *r* = -.05; *p* < .05), and *positive emotion* (ASD *r* = .07; Typical *r* = .25; *p* < .05).

      ASD and Typical groups differed significantly for the correlations of *antagonism* and *distractible* (ASD *r* = -.03; Typical *r* = .44; *p* < .001) and *fear* (ASD *r* = -.06; Typical *r* = .36; *p* <

.001). Furthermore, there were lower level differences for the correlations between *antagonism* and *consideration* (ASD *r* = -.41; Typical *r* = -.54; *p* < .05) and *intelligence* (ASD *r* = -.08; Typical *r* = -.27; *p* < .05).

Previously mentioned were group differences for the *compliance* and *activity level* correlation. Furthermore, there were lower level group differences for correlations between *compliance* and *consideration* (ASD *r* = .49; Typical *r* = .60; *p* < .05), *fear* (ASD *r* = .00; Typical *r* = -.25; *p* < .01), and *positive emotion* (ASD *r* = .35; Typical *r* = .53; *p* < .05).

Previously mentioned were group differences for correlations between *consideration* and *achievement, activity level, antagonism*, and *compliance*. There were also significant group differences for the correlations of *consideration* and *fear* (ASD *r* = .15; Typical *r* = -.21) and *positive emotion* (ASD *r* = .39; Typical *r* = .66) for ASD and Typical peers (all *ps* < .001). Furthermore, there were lower level group differences for the correlations between *consideration* and *distractible* (ASD *r* = -.01; Typical *r* = -.29; *p* < .01), *intelligence* (ASD *r* = .26; Typical *r* = .47; *p* < .01), and *organized* (ASD *r* = .16; Typical *r* = .36; *p* < .01).

Previously mentioned group differences for correlations between *distractible* and *antagonism* and *consideration*. Furthermore, there were significant group differences for the correlations between *distractible* and *fear* (ASD *r* = .13; Typical *r* = .47), *negative emotion* (ASD *r* = -.04; Typical *r* = .40) and *strong willed* (ASD *r* = -.05; Typical *r* = .39) between ASD and Typical peers (all *ps* < .001). There were also lower level group differences for the correlations between *distractible* and *organized* (ASD *r* = -.39; Typical *r* = -.28; *p* < .05), *positive emotion* (ASD *r* = .03; Typical *r* = -.16; *p* < .01) and *shy* (ASD *r* = .15; Typical *r* = .40; *p* < .01).

Previously mentioned were group differences for correlations between *fear* and *activity, antagonism, compliance, consideration*, and *distractible*. Furthermore, there were significant group differences for the correlation between *fear* and *shy* (ASD *r* = .36; Typical *r* = .67) and *negative emotion* (ASD *r* = .13; Typical *r* = .42) (all *ps* < .001). There were also lower level group differences for the correlations between *fear* and *intelligence* (ASD *r* = -.12; Typical *r* = -

.33; *p* < .05), *openness* (ASD *r* = -.05; Typical *r* = -.29; *p* < .01), *positive emotion* (ASD *r* = -.06; Typical *r* = -.26; *p* < .05), *sociability* (ASD *r* = -.20; Typical *r* = -.47; *p* < .01), and *strong willed* (ASD *r* = .05; Typical *r* = .24; *p* < .05).

In addition to the previously mentioned group differences for correlations between *intelligence* and *achievement, activity level, antagonism, consideration*, and *fear*, there were also significant group differences for the correlations between *intelligence* and *positive emotion* (ASD *r* = .08; Typical *r* = .42; *p* < .001). There were also lower level group differences between *intelligence* and *openness* (ASD *r* = .51; Typical *r* = .65; *p* < .05) and *sociability* (ASD *r* = .16; Typical *r* = .41; *p* < .01).

Previously mentioned were group differences for correlations between *negative emotions* and *distractible* and *fear*. Additionally, there was a lower level group difference for the correlation between *negative emotion* and *strong willed* (ASD *r* = .72; Typical *r* = .60; *p* < .05).

Previously mentioned were group differences regarding the correlations between *openness* and *achievement, activity level, fear,* and *intelligence*. Additionally, there was also a significant group difference in the correlation of *openness* and *positive emotion* (ASD *r* = .14; Typical *r* = .52; *p* < .001).

Previously mentioned were group differences regarding correlations between *organized* and *activity level* and *consideration*. Additionally, there was a lower level group difference for the correlation between *organized* and *positive emotion* (ASD *r* = .04; Typical *r* = .21; *p* < .05).

Previously mentioned were groups differences regarding correlations between *positive emotion* and *achievement, activity level, compliance, consideration, distractible, fear, intelligence,* and *openness*. There was also a lower level group difference for the correlation between *positive emotion* and *sociability* (ASD *r* = .26; Typical *r* = .48; *p* < .01).

Previously mentioned were group differences between *shyness* and *activity level, distractible,* and *fear*. No other group differences were found.

Previously mentioned were group differences between *sociability* and *achievement, activity level, fear, intelligence,* and *positive emotion*. There was also a lower level group difference for the correlation of *sociability* and *strong willed* (ASD $r = -.12$; Typical $r = .08$; $p < .05$).

Discussion

This study provides information regarding whether children with ASD differ from typically developing children in early childhood on the 15 sub-scales of the ICID, a new measure of the FFM in children. Children with ASD differed significantly from typically developing children on 14 of the 15 scales. Differences between children with ASD and typically developing children ranged in effect size from small (e.g., *intelligence*, $\eta^2 = .06$) to large (e.g., *sociability*, $\eta^2 = .44$). Furthermore, the internal reliability of most of the scales of both ASD and typically developing children fell within the adequate to good range; however, there were scales for both groups that demonstrated internal reliabilities in the poor to inadequate range. The details regarding specific differences, internal reliabilities, relationships between variables and connections to the literature are discussed below. The discussion regarding the ICID facets are organized according to their purported relationship to the FFM personality factors and connections to the literature are considered according to these factor-facet relationships as outlined in Halverson et al. (2003).

Children with ASD differed significantly from typical peers on sub-scales of the ICID Extraversion factor. Parents rated children with ASD as lower on the expression of *sociability* and *positive emotions*. The finding of significant differences on *sociability* is not particularly surprising as social deficits are core to a diagnosis of ASD. On the other hand, the finding of lower *positive emotion* in ASD runs counter to the hypotheses because previous research has found children with ASD in EC to be higher in regards to *positive emotions* (Adamek et al., 2011). The differences between the present data and that of Adamek et al. likely stems from the

fact that they measured *high intensity pleasure* with items such as "becomes excited when receiving a gift" whereas the ICID measures more low intensity expressions of *positive emotion* such as "my child is loving." It should be noted, however, that Adamek et al. also found children with ASD rated as significantly higher on a *low intensity pleasure,* a facet capturing pleasure expressed during mildly stimulating activities (e.g., sitting in the sunshine). However, when reporting on behaviors related to socially oriented low intensity positive emotions (i.e., smiling and laughing) Adamek et al. reported that children with ASD were rated lower than typically developing peers. This *smiling and laughter* subscale of the CBQ, which Adamek et al. employed, is a facet of Rothbart's Conscientiousness (i.e., Effortful Control) factor and not the Extraversion (i.e., Surgency). Thus, future research should take care to note the content of scale items measuring specific positive affect as a measure of response intensity to one's physical surroundings may yield different results from those measuring more socially oriented constructs such as trait adjectives employed on the ICID. Furthermore, joint investigation of multiple personality measures would help determine the relationship between different positive affective states and their relationship to FFM factors.

In regards to Extraversion, children with ASD were also rated as lower on the *considerate* scale, which is unique to the ICID and reflects the tendency of children to consider the feelings and perspective of other people. Considering the well-established finding that individuals with ASD perform more poorly on tasks measuring theory of mind and empathy (Dapretto et al., 2006) the finding of significant differences on this scale is not particularly surprising. It is interesting to note that children with ASD were also found to be no different from typically developing peers on the *activity level* facet. As noted earlier, *activity level* may be uncorrelated with other Extraversion facets in children with ASD compared to typical children (e.g., Garon et al., 2009). Support for this proposition is found in the correlation matrix (see Appendix G) as the *activity level* facet did not correlate significantly with any of the other ICID Extraversion facets in the ASD group, but did in the typical group. This is unique to *activity level*

as each of the other facets significantly correlated with at least one other ICID Extraversion

facet in the ASD group.

Children with ASD were also rated as expressing higher levels of negative emotions on

the sub-scales of the ICID Neuroticism scale. Specifically, children with ASD were rated as

expressing higher levels of *fear, negative affect (anger),* and as being *shy.* These findings

correspond well with previous temperament research supporting elevated negative emotions in

ASD populations (e.g., Adamek et al., 2011; Hepburn et al., 2006) and *shyness* relating to the

noted difficulties that this population has with social interactions. As with the Extraversion sub-

scales, the Neuroticism sub-scales of the ICID do not display the same correlational pattern

between ASD and typically developing groups. In particular, *anger* and *fear* are uncorrelated in

the ASD group, but are significantly correlated in the typically developing group. Furthermore,

the strength of correlations between *fear* and *shyness* are weaker in the ASD group ($r = .36$)

compared to the typical group ($r = .67$). This attenuation could be due to the lower internal

reliability for the *shy* scale in the ASD group ($α = .61$), group differences in regards to sample

size, reflecting a misattribution of symptoms (i.e.*,* social deficits) to *shyness* in ASD populations,

or an attenuated relationship between *shyness* and *fear* in ASD.

Children with ASD were rated higher on the scales measuring low levels of

Agreeableness. Specifically, children with ASD were rated higher in regards to *antagonism*,

indicating a tendency to elicit negative states from others, being *strong-willed*, indicating an

insistence on wanting ones way, and lower on *compliant*, indicating a tendency to not respond

to behavioral requests from others. Only one study has measured Agreeableness in ASD

populations to date and it reported on children in Middle Childhood (MC) and did not report facet

level details (De Pauw et al., 2010). That study employed the HiPIC measuring the facets of

altruism (e.g.*,* defending the weak), *compliance* (e.g.*,* obedience), *dominance* (*e.g.*, bossiness),

egocentrism (e.g., sharing), and *irritability* (e.g.*,* quick to take offence). Although De Pauw et al.

did not report facet level details, the present findings regarding greater levels of *antagonism* and

strong-willed fits with their report that children with ASD were lower on the Agreeableness factor

of the HiPIC. In regards to their correlational patterns, children with ASD and typical displayed

similarly strong correlations between *antagonism* and *strong-willed* ($r = .59$ and .57

respectively); antagonism and compliance ($r = -.55$ and -.52 respectively); and *compliance* and

strong-willed ($r = -.33$ and -.34 respectively).

In regards to the FFM Conscientiousness factor, parents rated children with ASD as

lower on *achievement oriented* and organized, but higher on *distractible*. Only one other study

employed a measure of *achievement orientation* and *organized* (i.e. *orderliness*) personality

facets in children with ASD and they did not report facet level details. They did, however, report

that children with ASD scored lower than typical on the Conscientiousness factor of the HiPIC

(De Pauw et al.). In the present study, although the internal reliability of the *distractible* scale

was low ($α = .53$), parents in past studies rated children with ASD lower on Rothbart's attention

control scale (Adamek et al.; Konstantanareas & Stewart, 2006) and the BSQ *distractibility* scale

(Bailey et al., 2000, but see Hepburn et al., 2006). Furthermore, these present study's findings

are in line with the noted executive and attentional deficits commonly reported in ASD (e.g., Hill,

2003). Similarly, the *organized* facet displays sub-optimal internal reliability ($α = .52$). Despite

this, low organization corroborates with a broader literature indicating difficulties in organization

and planning in ASD (Kenworthy et al., 2005). Finally, children with ASD and typical groups

displayed a similar correlation pattern between the facets of Conscientiousness.

Parents rated children with ASD lower on the FFM Intelligence facets of *intellect* and

openness. Previously, De Pauw et al. measured *intellect* and *openness* (*i.e.*, *curiosity*) and

reported that parents rated children with ASD as lower than typical children on their

Intelligence/openness factor (i.e., Imagination; De Pauw et al.). The intelligence scale items

relate to having a good memory and enjoyment of learning new things where as the *openness*

scale measures ones curiosity and interest in new things. These findings resonate with the

preference for sameness and perseveration and executive deficits commonly reported in this

population. Finally, the significant ASD group x gender interaction on the *intelligence* facet fits

with finding that, compared to males with an ASD; females with ASD are proportionally more

likely to have an intellectual disability (Fombonne, 2003).

Collectively, these results indicate that the majority of the sub-scales on the ICID may be

used to measure personality facets in children with ASD. In general, most of the subscales

displayed adequate internal reliability and in scales with sub-optimal internal reliabilities mean

differences between children with ASD and typical groups fit with patterns found in the ASD

literature: Children with ASD are typically more *distractible* and *shy* than typically developing

peers. Notably, however, the correlational patterns of some the subscales of the Extraversion

and Neuroticism factors appear substantially different for the ASD and typically developing

groups, indicating potentially dissimilar factor structures in these groups. Furthermore, two of

the three subscales for the Conscientiousness factor displayed weak internal reliabilities in the

ASD group indicating that this factor may not be adequately measured in this population.

Factor-Facet Personality Relationships in ASD

As noted in the introduction, there is a growing trend in psychology to consider broad

personality constructs according to the FFM framework as such a framework may facilitate

communication and findings between fields. While this is a worthwhile goal, a cautious approach

is warranted as a primary focus on broad factors could lead to a neglect of facet level details,

leaving researchers uncertain about important facets driving factor level group differences or

whether the facets display consistent patterns befitting strongly correlated constructs. The

present data bear on this latter issue.

The implicit assumption when one compares two groups on one scale is that the scale is

measuring the same construct in both groups (i.e., measurement invariance). However, when it

comes to comparing clinical populations with non-clinical groups researchers are often faced

with a scarcity of participants in the clinical group preventing sample sizes large enough to

determine whether the factor structure of the measured construct is fundamentally similar

between the groups. It is generally recognized that a sample size of 10 or more participants per construct is necessary to measure the relevant factors with minimized error and a recent quantitative review found an average sample size to item ratio of 11:1 across 59 published reports (Henson & Roberts, 2006). For a measure such as the ICID this requires a minimum of between 150 to 165 participants with ASD to meet the minimum standards required to do an adequate analyses.

The present sample size falls short of the recommended size for factor analysis of the ASD data, but a consideration of the correlational matrix (Appendix G) provides very preliminary evidence indicating the possibility of substantial differences in the factor structure of personality between ASD and typical children and warrants further study. Of the 105 potential correlations 56 were statistically significant in the ASD group and 92 were statistically significant in the typically developing group. That is, approximately one-half of the items in the ASD group displayed significant correlations between the ICID facets whereas 88% of the typically developing group facets were correlated. Thirty-six subscale correlations were significant in one group, but not the other. Furthermore, two of the correlations show opposite correlational patterns: The correlation between *achievement orientation* and *activity level* is positive for typically developing children and negative for ASD children and the same pattern is found between *activity level* and *compliance*. Future research should employ factor analyses of larger data sets to determine whether the factor structure of personality in children with ASD is substantially similar to typically developing populations.

One facet*, activity level*, consistently showed atypical relationships with other facets in the ASD group compared to the typically developing group. In the typically developing group, *activity level* is significantly positively correlated with *achievement, compliance, consideration, intelligence, openness, positive emotion, sociability,* and *strong-willed*; and is negatively correlated with *fear*. In the ASD group, *activity level* is positively associated with *distractible* and *strong willed*; and negatively with *achievement, compliance* and *organized* (all facets of either

Conscientiousness or Agreeableness). *Activity level* is considered an Extraversion oriented facet in most conceptions of personality for typical populations, but in ASD notably displays no relationship with the other Extraversion facets. Similar atypical relationships may be inferred from studies on samples of infants *(*i.e.*,* Garon et al.) and children (i.e.*,* Adamek et al.) in that group differences between ASD and typical populations on *activity level* are either opposite the other Extraversion facets or do not discriminate between groups when other facets do. These other studies employed Rothbart's measures with ASD and across reports indicates that *activity level* may impact the development of the ASD child in a fundamentally dissimilar manner compared to typically developing children. It should be noted, however, when McDevitt and Carey's (1976) BSQ measures are employed, parents rate children with ASD higher on *activity level* in a manner consistent with other purported Extraversion facets (i.e.*,* *adaptability* and *approach*) that are not measured on the ICID or Rothbart measures. Thus, these atypical relations may be confined to the idiosyncrasies of particular scales.

The present correlations indicate that *activity level* might be a facet of Conscientiousness or Agreeableness in ASD children. Another consideration is that in ASD population's *activity level* and *sociability* remain separate constructs due to the developmental delays related to ASD symptoms. Research supports that in infancy and pre-school age children *activity level* and *sociability* are separate factors (Buss & Plomin, 1994; De Pauw et al., 2009), but become more strongly associated across development (Angleitner & Ostendorf, 1994). Thus, it is possible that the developmental delays or core symptoms associated with having an ASD impact development in a manner that prevents these personality facets from correlating.

Similar to *activity level*, the *distractibility* and *fear* facets display atypical correlational patterns in the ASD group compared to typically developing children. In the typically developing group, *distractibility* is positively correlated with *antagonism, fear, negative emotion (anger), shy,* and *strong-willed*; and negatively with *achievement, compliance, consideration, intelligence, openness, organized, positive emotion,* and *sociability*. In the ASD group, *distractibility* is

positively correlated with *activity* and negatively with *achievement, intelligent* and *organized*. Notably missing in the ASD correlations is the lack of association between *distractibility* and any of the Neuroticism or Agreeableness oriented facets, all of which are linked to this trait in the typically developing group. Likewise, *fear* in the typically developing children is positively correlated with *antagonism, distractible, negative emotion (anger), shy*, and *strong-willed*; and negatively correlated with *achievement, activity, compliance, consideration, intelligence, openness, positive emotion*, and *sociability*. In the ASD group *fear* is only positively associated with *shy* and negatively with *positive emotion*.

Overall, the correlational data (in Appendix G) indicates that the factor structure of personality in ASD may be substantially different than in typically developing children. Future research should seek to determine if the differences between the groups are substantial and if the FFM reasonably represents the factor structure of personality in ASD populations. Considering the substantial lack of correlations between the facets comprising both Extraversion and Neuroticism, it seems that these factors may be the most atypical in ASD; however, considering the widespread non-significance between ICID facets in the ASD groups indicates the overarching structure of personality may be altered and not just Extraversion and Neuroticism (see Digman, 1990). Research exploring these possibilities is needed to determine whether factor level measures of personality are similarly interpretable for ASD as in typical groups.

Limitations, Future Directions, and Conclusions

This study has a number of limitations that should be considered when interpreting its results. First, because the ASD groups' data collection was online and there was no control for distractions that could have interfered with a person's judgments. Second, a notable flaw in the design is that no data were collected regarding whether children with ASD were verbal or not. This was brought to the attention of the researchers by several parents reporting that some of the items were not filled out because they were not relevant to their non-verbal children. Another

limitation is that socio-economic status (SES) of families was not analyzed. The reason for this is that the data for the Typical and ASD groups were collected for independent projects and differed substantially in regards to specific details regarding this variable; however, data has recently been gathered on typically developing children with the same on-line protocol, including the SES scale, as the ASD group and analyses are underway addressing this important limitation. Finally, many researchers are critical of the use of temperament rating measures (e.g., Kagan, 1998) and this paper is another in a growing list of parent-rater studies of temperament in ASD. Future studies should seek to replicate these results employing *in vivo* measurement methods.

Research on personality and temperament in ASD is just beginning and shows promise to shed light on questions of interest among ASD researchers. However, as the data reported here indicates, caution should be heeded regarding the employment of scales according to the current zeitgeist in psychology of organizing information according to the FFM. To be sure, the FFM provides an excellent organizing structure to communicate results across disciplines, but a sole focus on factor level information may be limiting and the facet level data should be considered. This paper employs the usefulness of the FFM's organization scheme while avoiding the pitfalls of obscuring important facet level data. The results are promising and indicate that children with ASD are likely lower than typical peers in Extraversion, Agreeableness, Conscientiousness, and Openness/Intellect factors, as well as higher in Neuroticism. However, this conclusion requires future research investigating whether the factor structure in ASD is so similar to typically developing groups to justify comparisons.

In addition to the factor structure, future research should address the degree to which personality items differentiate children with ASD and typically developing. This approach may inform the development of screening tools which, like the AQ, tend to organize queries according to bi-polar "agree/disagree" options. Personality research investigating children has a long history of contextualizing questions in order to decrease the subjectivity of rater response

(see Rothbart, 1998). The ICID, for example, asks parents to consider their child in relationship "to an average child." By framing the question in this manner, as opposed to personal opinion, the parent is required to consider the behavior of their child in relationship to other children. As such, it is possible that ICID items, particularly the sociability scale, may differentiate children with ASD as well or better than a similar scale on a screener.

References

Adamek, L., Nichols, S., Tetenbaum, S., Bregman, J., Ponzio, C., & Carr, E. (2011). Individual temperament and problem behavior in children with autism spectrum disorders. *Focus on Autism and Other Developmental Disorders, 76*, 173-183.

Angleitner, A., & Ostendorf, F. (1994). Temperament and the Big Five factors of personality. In C., Halverson, G., Kohnstamm, & R., Martin (Eds.). *The developing structure of temperament and personality from infancy to adulthood* (pp. 69–90). Hillsdale, NJ: Erlbaum.

Austin, E. J. (2005). Personality correlates of the broader autism phenotype as assessed by the Autism Spectrum Quotient (AQ). *Personality and Individual Differences, 38,* 451–460.

Auyeung, B., Baron-Cohen, S., Wheelwright, S., & Allison, C. (2008). Development of the autism spectrum quotient – children's version (AQ-Child). *Journal of Autism and Developmental Disorders, 38*, 1230-1240.

Bachevalier, J., & Loveland, K. A. (2006). The orbitofrontal-amygdala circuit and self-regulation of social-emotional behavior in autism. *Neuroscience and Biobehavioral Reviews, 30*, 97 – 117.

Bailey, D. B., Hatton, D. D., Mesibov, G., Ament, N., & Skinner, M. (2000). Early development, temperament, and functional impairment in autism and fragile X syndrome. *Journal of Autism and Developmental Disorders, 30*, 49–59.

Baranek G. T. (1999). Autism during infancy: A retrospective video analysis of sensory-motor and social behaviors at 9–12 months of age. *Journal of Autism and Developmental Disorders, 29,* 213–224.

Baron-Cohen, S., Ring, H. A., Bullmore, E. T., Wheelwright, S., Ashwin, C., & Williams, S. C. (2000). The amygdala theory of autism. *Neuroscience and Biobehavioral Reviews 24*, 355–64.

Baron-Cohen, S., Wheelwright, S., Skinner, R., Martin, J., & Clubley, E. (2001). The autism-

spectrum quotient (AQ): Evidence from Asperger Syndrome/high-functioning autism, males and females, scientists and mathematicians. *Journal of Autism and Developmental Disorders, 31*, 5–17.

Bieberich, A. A., & Morgan, S. B. (2004). Self-regulation and affective expression during play in children with autism or Down syndrome: A short-term longitudinal study. *Journal of Autism and Developmental Disorders, 34,* 439–448.

Bouchard, T. J., & Loehlin, J. C. (2001). Genes, evolution, and personality. *Behavior Genetics, 31,* 243–273.

Bouchard, T. J., & McGue, M. (2003). Genetic and environmental influences on human psychological differences. *Journal of Neurobiology, 54*, 4–45.

Burnette, C., Henderson, H., Inge, A., Zahka, N., Schwartz, C., & Mundy, P. (2010). Anterior EEG asymmetry and the modifier model of autism. *Journal of Autism and Developmental Disorders, 41,* 1112-1124.

Buss, A. H., & Plomin, R. (1984). *Temperament: Early developing personality traits*. Hillsdale, NJ: Erlbaum.

Capps, L. Kasari, C., Yirmiya, N., & Sigman, M. (1993). Parental perception of emotional expressiveness in children with autism. *Journal of Consulting and Clinical Psychology, 61*, 475–484.

Clark, L. A. (2005). Temperament as a unifying basis for personality and psychopathology. *Journal of Abnormal Psychology, 114,* 505–521.

Cloninger, C. R., Svrakic, D. M., & Przybeck, T. R. (1993). A psychobiological model of temperament and character. *Archives of General Psychiatry, 50*, 975-990.

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112,* 155-159.

Constantino, J. N., Gruber, C. P., Davis, S., Hayes, S., Passanante, N., & Przybeck, T. (2004). The factor structure of autistic traits. *Journal of Child Psychology and Psychiatry, 45,* 719-726.

Constantino, J. & Todd, R. (2003). Autistic trait in the general population: A twin study. *Archives of General Psychiatry, 60,* 524–530.

Courchesne, E., Press G., & Young-Courchesne, R. (1993). Parietal lobe abnormalities detected with MR in patients with infantile autism. *American Journal of Roentgenology, 160*, 387–393.

Dapretto, M., Davies, M.S., Pfeifer, J.H., Scott, A.A., Sigman, M., Bookheimer, S.Y., & Iacoboni, M. (2006). Understanding emotions in others: Mirror neuron dysfunction in children with autism spectrum disorders. *Nature Neuroscience, 9*, 28–30.

Deal, J. E., Halverson, C. F., Martin, R. P., Victor, J., & Baker, S. (2007). The Inventory of Children's Individual Differences: Development and validation of a short version. *Journal of Personality Assessment, 89*, 162–166.

De Fruyt, F., Bartels, M., Van Leeuwen, K., De Clercq, B., Decuyper, M., & Mervielde, I. (2006). Five types of personality continuity in childhood and adolescence. *Journal of Personality and Social Psychology, 91,* 538–52.

De Pauw, S., Mervielde, I., & Van Leeuwen, K. G. (2009). How are traits related to problem behavior in preschoolers? Similarities and contrasts between temperament and personality. *Journal of Abnormal Child Psychology, 37*, 309–325.

De Pauw, S., & Mervielde, I. (2010). Temperament, personality and developmental psychopathology: A review based on the conceptual dimensions underlying childhood traits. *Child Psychiatry and Human Development, 41,* 313–329.

Detterman, D. K., & Daniel, M. H. (1989). Correlations of mental tests with each other and with cognitive variables are highest for low IQ groups. *Intelligence, 13,* 349–359.

DeYoung, C. G., Hirsh, J. B., Shane, M. S., Papademetris, X., Rajeevan, N., & Gray, J. R. (2010). Testing predictions from personality neuroscience: brain structure and the big five. *Psychological Science, 21,* 820–828.

DeYoung, C. G., Peterson, J. B., & Higgins, D. M. (2005). Sources of openness/intellect:

Cognitive and neuropsychological correlates of the fifth factor of personality. *Journal of Personality, 73,* 825–858.

DeYoung, C. G., Shamosh, N. A., Green, A. E., Braver, T. S., & Gray, J. R. (2009). Intellect as distinct from Openness: Differences revealed by fMRI of working memory. *Journal of Personality and Social Psychology, 97,* 883–892.

Digman, J. M. (1990). Personality structure: Emergence of the Five-Factor Model. Annual Review of Psychology, 41, 417-40.

DiLalla, E. F., & Jones, S. (2001). Genetic and environmental influences on temperament in preschoolers. In V., Molfese, & D., Molfese (Eds.). *Temperament and personality development across the life span* (pp. 33–55). Mahwah, NJ: Erlbaum.

Ellis, L. K., & Rothbart, M. K. (2001). *Revision of the early adolescent temperament questionnaire.* Poster presented at the 2001 Biennial Meeting of the Society for Research in Child Development, Minneapolis, MN.

Feldt, L. (1969). A test of the hypothesis that Cronbach's alpha or Kuder-Richardson coefficient is the same for two tests administered to the same sample. *Psychometrika, 34*, 363-373.

Fombonne, E. (2003). Epidemiological surveys of autism and other pervasive developmental disorders. *Journal of Autism and Developmental Disorders, 33*, 365-382.

Fortenberry, C., Grist, C., & McCord, D. (2011). Personality trait difference between typically developing children and those diagnosed with autism spectrum disorder. *Individual Difference Research, 9*, 73-83.

Frazier, T. W., Youngstrom, E. A., Kubu, C. S., Sinclair, L., & Rezai, A. (2008). Exploratory and confirmatory factor analysis of the autism diagnostic interview-revised. *Journal of Autism and Developmental Disorders, 38,* 474–480.

Garon, N., Bryson, S., Zwaigenbaum, L., Smith, I., Brian, J., Roberts, W., & Szatmari, P . (2009). Temperament and its relationship to autistic symptoms in a high-risk infant sib cohort. *Journal of Abnormal Child Psychology, 37*, 59–78.

George, D., & Mallery, P. (2003). *SPSS for Windows step by step: A simple guide and reference. 11.0 update (4th ed.).* Boston: Allyn & Bacon.

Gosling, S. (2001). From mice to men: What can we learn about personality from animal research? *Psychological Bulletin, 127*, 45-86.

Gosling, S. D., & John, O. P. (1999). Personality dimensions in nonhuman animals: A cross-species review. *Current Directions in Psychological Science, 8*, 69–75.

Grimm, L. G., & Yarnold, P. R. (1995). *Reading and understanding multivariate statistics.* Washington, DC: American Psychological Association.

Halverson, C. F., Kohnstamm, G. A., & Martin, R. P. (Eds.). (1994). *The developing structure of temperament and personality from infancy to adulthood.* Hillsdale, NJ: Erlbaum.

Halverson, C., Havill, V., Deal, J., Victor, J., Pavlopolous, V., Besevigus, E., & Wen, L. (2003). Personality structure as derived from parental ratings of free descriptions of children: The Inventory of Children's Individual Differences. *Journal of Personality, 71*, 995-1026.

Henson, R, & Roberts, K. (2006). Use of exploratory factor analysis in published research. *Educational and Psychological Measurement, 66*, 393-416.

Hepburn, S. L., & Stone, W. L. (2006). Using Carey temperament scales to assess behavioral style in children with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 36,* 637–642.

Hill, E. L. (2004). Executive dysfunction in autism. *Trends in Cognition Science, 8*, 26–32.

Hoekstra, R. A., Bartels, M., Verweij, C. J., & Boomsma, D. I. (2007). Heritability of autistic traits in the general population. *Archives of Pediatric and Adolescent Medicine, 161*, 372–377.

Howell, D. C. (2007). *Statistical methods for psychology.* Belmont, CA: Thompson Wadsworth.

Huberty, C. J., & Petoskey, M. D. (2000). Multivariate analysis of variance and covariance. In H., Tinsley, & S., Brown (Eds.). *Handbook of applied multivariate statistics and mathematical modeling.* New York: Academic Press.

Kenworthy, L. E., Black, D. O., Wallace, G. L., Ahluvalia, T., Wagner, A. E., & Sirian, L. M.

(2005). Disorganization: The forgotten executive dysfunction in high-functioning autism spectrum disorders. *Developmental Neuropsychology, 28*, 809–827.

King, J.E., & Figueredo, A.J. (1997). The five-factor model plus dominance in chimpanzee personality. *Journal of Research on Personality, 31*, 257-271.

Konstantareas, M., & Papageorgiou, V. (2006). Effects of temperament, symptom severity and level of functioning on maternal stress in Greek children and youth with ASD*. Autism, 10,* 593-607.

Konstantareas, M. M., & Stewart, K. (2006). Affect regulation and temperament in children with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 36,* 143–153.

Kunihira, Y., Senju, A., Dairoku, H., Wakabayashi, A., & Hasegawa, T. (2006). 'Autistic' traits in non-autistic Japanese populations: relationships with personality traits and cognitive ability. *Journal of Autism and Developmental Disorders, 36*, 553–66.

Martin, R. P., & Bridger, R. (1999). *The temperament assessment battery for children-revised.* Athens, Ga.: School Psychology Clinic Publishing.

McAdams, D. P., & Olson, B. D. (2009). Personality development: Continuity and change over the life course. *Annual Review of Psychology, 61*, 5.1-5.26.

McCrae, R. R., Costa, P. T., Ostendorf, F., Angleitner, A., Hrebickova, M., Avia, M. D., …Peter, B. (2000). Nature over nurture: Temperament, personality, and life span development. *Journal of Personality and Social Psychology, 78*, 173–186.

Mervielde, I., & De Fruyt, F. (2002). Assessing children's traits with the hierarchical personality inventory for children. In B., De Raad, & M., Perugini (Eds.). *Big Five Assessment* (pp. 129–146). Seattle: Hogrefe & Huber.

Mervielde, I., De Clercq, B., De Fruyt, F., & Van Leeuwen, K. (2005). Temperament, personality, and developmental psychopathology as childhood antecedents of personality disorders. *Journal of Personality Disorders, 19*, 171–201.

Meyers, L.S., Gamst, G., & Guarino, A. (2006). *Applied multivariate research: Design and interpretation.* Thousand Oaks, CA: Sage Publishers.

Mundy, P.C., Henderson, H.A., Inge, A.P., & Coman, D.C. (2007). The modifier model of autism and social development in higher functioning children. *Research and Practice for Persons with Severe Disabilities, 32,* 1–16.

Muris, P., & Ollendick, T. H. (2005). The role of temperament in the etiology of child psychopathology. *Clinical Child and Family Psychology Review, 8*, 271–289.

Nigg, J. T. (2006). Temperament and developmental psychopathology. *Journal of Child Psychology and Psychiatry, and Allied Disciplines, 47,* 395–422.

Ozonoff, S., Garcia, N., Clark, E., & Lainhart, J. E. (2005). MMPI-2 personality profiles of high-functioning adults with autism spectrum disorders. *Assessment, 12*, 86–95.

Putnam, S. P., Gartstein, M. A., & Rothbart, M. K. (2006). Measurement of fine-grained aspects of toddler temperament: The early childhood behavior questionnaire*. Infant Behavior and Development, 29*, 386-401.

Redcay, E., & Courchesne, E., (2005). When is the brain enlarged in autism? A meta-analysis of all brain size reports. *Biological Psychiatry, 58*, 1–9.

Rivers, J.W., & Stoneman, Z. (2008). Child temperaments, differential parenting, and the sibling relationships of children with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 38,* 1740-1750.

Roberts, B. W., & DelVecchio, W. F. (2000). The rank-order consistency of personality traits from childhood to old age: A quantitative review of longitudinal studies. *Psychological Bulletin, 126,* 3–25.

Rothbart, M. K., Ahadi, S. A., Hershey, K. L., & Fisher, P. (2001). Investigations of temperament at three to seven years: The children's behavior questionnaire. *Child Development, 72*, 1394–1408.

Rothbart, M. K. (2007). Temperament, development, and personality. *Current Directions in*

Psychological Science, 16, 207–212.

Samyn, V., Roeyers, H., & Bijttebier, P. (2011). Effortful control in typically developing boys and in boys with ADHD or autism spectrum disorder. *Research on Developmental Disability 32*, 483–490.

Saudino, K. J. (2005). Behavioral genetics and child temperament. *Journal of Developmental and Behavioral Pediatrics, 26*, 214–223.

Saulsman, L. M., & Page, A. C. (2004). The five-factor model and personality disorder empirical literature: A meta-analytic review. *Clinical Psychology Review, 23*, 1055–1085.

Schwartz, C. B., Henderson, H. A., Inge, A. P., Zahka, N. E., Coman, D. C., Kojkowski, N. M., …. Mundy, P. (2009). Temperament as a predictor of symptomotology and adaptive functioning in adolescents with high-functioning autism. *Journal of Autism and Developmental Disorders, 39*, 842–855.

Shiner, R., (1998). How shall we speak of children's personality in middle childhood? A preliminary taxonomy. *Psychological Bulletin, 124*, 308-332.

Shiner, R., & Caspi, A. (2003). Personality differences in childhood and adolescence: measurement, development, and consequences. *Journal of Child Psychology and Psychiatry, and Allied Disciplines, 44*, 2–32.

Siegel, D. J., Minshew, N. J., & Goldstein, G. (1996). Wechsler IQ profiles in diagnosis of high-functioning autism. *Journal of Autism and Developmental Disorders, 26*, 389–406.

Spearman, C. (1927). *The abilities of man*. London: Macmillan.

Sutton, S. K., Burnette, C. P., Mundy, P. C., Meyer, J., Vaughan, A., Sanders, C., & Yale, M. (2005). Resting cortical brain activity and social behavior in higher functioning children with autism. *Journal of Child Psychology and Psychiatry, and Allied Disciplines, 46*, 211–222.

Thomas, A., & Chess, S. (1977). *Temperament and development*. New York, NY: Brunner/Mazel.

Tracey, T., & Ward, C. (1998). The structure of children's interests and competence

    perceptions. *Journal of Counseling Psychology, 45*, 290-303.

Van Leeuwen, K. G., Mervielde, I., De Clercq, B. J., & De Fruyt, F. (2007). Extending the

    spectrum idea: Child personality, parenting and psychopathology. *European Journal of*

    Personality, 21, 63–89.

Wakabayashi, A., Baron-Cohen, S., & Wheelwright, S. (2006). Are autistic traits an independent

    personality dimension? A study of the Autism-Spectrum Quotient (AQ) and the NEO-PI-

    R. *Personality and Individual Differences, 41*, 873–883.

Woolfolk, A. (2010) *Educational Psychology*. Upper Saddle River, NJ: Pearson

    Education, Inc.

Zentner, M., & Bates, J. E. (2008). Child Temperament: An integrative review of concepts,

    research programs, and measures. *European Journal of Developmental Science, 2*, 7-

    37.

Zwaigenbaum, L., Bryson, S., Rogers, T., Roberts, W., Brian, J., & Szatmari, P. (2005).

    Behavioral manifestations of autism in the first year of life. *International Journal of*

    Developmental Neuroscience, 23, 143–152.

CHAPTER 3

A COMPARISON OF CHILDREN IN MIDDLE CHILDHOOD WITH AUTISM AND TYPICALLY

DEVELOPING POPULATIONS ON THE PERSONALITY FACET SCORES ON THE

INVENTORY OF CHILDREN'S INDIVIDUAL DIFFERENCES

Abstract

Personality is an understudied construct in the autism literature and in the handful studies to date few have investigated gender differences. Furthermore, most researchers have relied on instruments designed to measure either Thomas and Chess or Rothbart's conceptualizations of personality. This study measured personality with the new Inventory of Children's Individual Differences- Short Form (ICID; Deal, Halverson, Martin, Victor, & Baker, 2005) and sought to determine if facets on this scale differentiate children with ASD from typical children, as well as determine gender differences. A 2 (ASD versus typical) X 2 (Gender) age controlled MANCOVA comparing 113 ASD (93 boys; 20 girls) and 372 control children (163 boys; 209 girls) between the ages of 8 and 12 (Middle Childhood; MC) is reported. Data from ASD children was collected on-line via the Interactive Autism Network (IAN) and data from typical children was taken from the ICID norming sample data. The internal reliabilities for the activity level was significantly higher in the ASD group and the *achievement, compliance, distractible, intelligence*, and *openness*, reliabilities were higher in the control group. Significant gender X diagnostic status interactions were found for *antagonism, consideration, intelligence, negative emotion (anger), positive emotion* and strong willed, indicating greater "difficult temperament" in girls with an ASD. Diagnostic group differences were found with ASD children scoring lower on *achievement, compliance, consideration , openness, positive emotion,* and *sociability* and higher on *antagonism, distractible, fear/, negative emotion (anger), shy*, and *strong willed*. No group differences were found for activity level or organized. These results indicate that in MC girls with ASD are perceived by their parents as being more *antagonistic, angry*, and *strong willed* and as expressing less *consideration* and *positive emotions* than their boy counterparts and typical genders (who did not tend to differ from one another, except for in negative emotion). Girls with ASD are also perceived as less intellectually capable.

INDEX WORDS: Autism, Personalty, Middle Childhood, Temperament

Introduction

Autism spectrum disorders (ASD) are a group of disorders defined by developmental deficits in language and social abilities and abnormal perseverative interests and/or motor stereotypies. The term *spectrum* in this definitional term reflects a growing consensus among researchers that the atypical socio-linguistic development, atypical cognitions, and affective responsiveness of individuals with ASD represents extreme ends of normally distributed traits within the typical population (Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001; Stewart & Austin, 2009). Indeed, there is a growing research base displaying that ASD traits are found ranging from sub-clinical levels to none at all within the typically developing population, with a higher prevalence in males compared to females (Baron-Cohen et al., 2001). This realization has led researchers to wonder about whether personality variables, which are also unevenly distributed across gender (Else-Quest, Hyde, Goldsmith, & Van Hulle, 2007) are related to ASD symptomology, both in clinical (De Pauw, Mervielde, & De Fruyt, 2009) and typically developing populations (Austin, 2005). Thus, the last decade has witnessed a growing interest among researchers in the relationship between personality and temperament in the development of ASD symptomology (Baily, Hatton, Mesibov, Ament, and Skinner, 2000; Burnette et al., 2010; De Pauw, Mervielde, Van Leeuwen, & De Clerque, 2010; Mundy, Henderson, Inge, & Coman, 2007; Garon et al., 2009; Hepburn & Stone, 2006; Konstantanareas & Papageourngio, 2006; Konstantanareas and Stewart, 2006; Rivers & Stoneman, 2008; Samyn, Roeyers, & Bijttbier, 2011; Schwartz et al., 2009; Sutton, et al., 2005; Zwaigenbaum et al., 2005).

The increasing interest regarding the role of personality in ASD can be framed within a larger context within the field of psychology. A number of researchers now maintain that several universal "core" personality factors are known and, as such, clinicians and research psychologists now have a common language by which they may frame their research findings (Clark, 2005; De Pauw & Mervielde, 2010; Nigg, 2006; Rothbart, 2007; Shiner, 1998; Zenter &

Bates, 2008). The obvious utility of this cross-disciplinary communication being that the behavioral repertoires commonly found in different pathological conditions may be considered in relation to those of typically developing individuals (Nigg, 2006). Furthermore, communication across fields has the potential to spur unique research questions within the fields of developmental, personality, and clinical psychology that might not have otherwise been asked.

Many discussions to date have focused on employing the Five Factor Model (FFM) of personality to frame conversations (DePauw & Mervielde, 2010). This model maintains that the following five personality variables are found universally: Extraversion, Neuroticism, Conscientiousness, Agreeableness, and Openness (Digman, 1990; Mc Crae & Costa, 1987). Extraversion broadly refers to ones preference for interacting socially and enjoying the company of others. Neuroticism refers to ones tendency to feel and express negatively valenced emotions. Conscientiousness refers to one's capacity/tendency to control ones impulses and behave in a dependable manner. Agreeableness refers to ones preference for warm and engaging social relations. Openness refers to one's interest and engagement in artistic, intellectual, and cultural endeavors. Although some analyses have reported more factors (Cheung et al., 2001), these are generally thought to be unique to the populations studied and the larger body of research supports the universality (though not necessarily the totality) of these five factors (Digman, 1990; Mc Adams, 2005).

During this larger discussion, several conceptual analyses report that the superordinate factors of different temperament theories conceptually fit within the FFM (DePauw & Mervielde, 2010; Muris & Ollendick, 2005; Zenter & Bates, 2005). For example, Rothbart (2007) maintains that her temperament factors of Surgency, Negative Affectivity, and Effortful Control are precursors of the FFM factors Extraversion, Neuroticism, and Conscientiousness. Furthermore, Rothbart's three factor theory has recently been subjected to conceptual analysis along with other temperament and clinical measures commonly employed in the ASD literature (Garon et al., 2009). The analysis maintains that Rothbart's factors are generally equivalent with factors

from other commonly employed scales (Bieberich & Morgan, 1998; Rothbart & Bates, 1998; Tellegen, 1985; Thomas & Chess, 1977) all of which have facets that are remarkably similar to those found the FFM and Rothbart's Extraversion, Neuroticism, and/or Conscientiousness scales.

In addition to their conceptual overlap, there is a growing literature indicating that the FFM factors should be considered temperamental variables (Zenter & Bates, 2008). Using a framework developed by Zenter and Bates wherein they compiled common criterion for temperament definitions, it appears that the FFM factors largely meet many temperament theorists definitional criterion in that the FFM factors are early appearing (Mervielde & De Fruyt, 2002), biologically based (Bouchard & Loehlin, 2001; Bouchard & McGue, 2003; De Young, et al., 2010), present in other species (Gosling & John, 1999; Gosling, 2001; Nettle, 2006), enduring (Roberts & Del Vecchio, 2000), and predictive of conceptually coherent outcomes (De Pauw & Mervielde, 2010). Additionally, although several temperament theorists emphasize the importance of specific behavioral variables (e.g., latency, duration) in their conceptual orientations and measures (Rothbart, Ahadi, Hershey, & Fisher, 2001), others (similar to the FFM; McCrae & Costa, 1987) do not (Buss & Plomin, 1984). Furthermore, conceptually related FFM facets have been found to jointly load with temperament measures on common factors in the manner predicted by researchers who maintain that these are congruent constructs (De Pauw, Mervielde, & Van Lieshout, 2007). It should be noted, however, that the loading of facets on predicted FFM factors appears more consistently in adults (Agleitner & Ostendorf, 1994). Considering the notable similarities between the FFM and temperament, for the remainder of this review the term *personality* refers to both temperament and the FFM and discussion is framed according to the popular FFM terminology. Furthermore, so the reader may clearly discriminate between them, personality factors are capitalized and facets are italicized.

There are a number of issues that should be addressed by ASD researchers when considering ASD findings in the light of the broader discussion to consider psychopathological

conditions in relationship to overarching personality dimensions. First, there is the potential that a focus on factor level traits may deter researchers from considering important facet level information. Second, comparison groups should be more carefully considered. Third, there is great diversity in the number of personality and temperament scales that may be employed by ASD researchers and care should be taken when considering the facet level dimensions of those scales. Since several recent reports have thoroughly reviewed the literature regarding personality and temperament in ASD (De Pauw et al., 2009; Garon et al., 2009; Mundy, 2007; Schwartz et al., 2009), the remainder of this literature review is framed around these specific issues and a selective review regarding relevant portions of the literature. Furthermore, the present conversation is framed in regards to instruments developed for non-clinical populations, have been stringently tested according to psychometric standards and normed accordingly. It does not include clinical temperament batteries (e.g., The Minnesota Multiphasic Personality Inventory; Ozonoff, Garcia, Clark, & Lainhart, 2005) or electroencephalographic (EEG) data (e.g., Burnette et al., 2010; Sutton et al., 2005). Readers interested in a thorough historical review of this literature are encouraged to read the previously cited works.

   Factor and facet level considerations. Employing superordinate factors to discuss differences between individuals with pathological conditions and typically developing populations may be helpful at a broad level in terms of communicating between fields and mapping the relative position of pathological groups (Nigg, 2006); however, there are a number of potential pitfalls that ASD researchers should consider. In particular, the utility of stating that individuals with ASD are lower or higher than typically developing populations in regards to any given factor seems limited for answering certain important questions. That is, knowing that individuals with ASD are lower than typically developing groups in regards to a factor like Extraversion, for example, conveys little information regarding what should be done about this situation. Thus, focusing on broad personality factors is unlikely to inform applied inquiries, two

major foci of ASD research. On the other hand, a focus on the facet levels is may reveal critical information relevant to these ASD research strands.

Recent research from Garon et al. (2009) highlights the importance of focusing on the constituent facets of temperament scales instead of broad factor levels. In this study Garon et al. employed Rothbart's Toddler Behavior Assessment Questionnaire-Revised (TBAQ; Rothbart et al., 2003) to measure the temperament of infants with ASD, their non-ASD siblings, and typically developing peers. Instead of simply employing Rothbart et al.'s factor level scale assignments to compare groups on temperament factors, Garon et al. employed a discriminant function analysis to determine which of the 13 facet level scales discriminated infants with ASD from their siblings and peers. The analysis revealed two discriminant functions respectively labeled Behavioral Approach and Emotion Regulation. Although conceptually these two discriminant functions appear similar to Rothbart's Extraversion (Surgency) and Conscientiousness (Effortful Control) factors, they are quite different. The TBAQ Extraversion scale includes the facets *positive anticipation, activity level*, and *high intensity pleasure*, whereas Garon et al.'s Behavioral Approach discriminant function included *positive anticipation, activity level* and *attentional shifting.* Furthermore, the TBAQ Conscientiousness factor includes the facets *attentional focusing, attentional shifting, inhibitory control, low intensity pleasure*, and *perceptual sensitivity*, whereas Garon et al.'s Emotion Regulation factor included these plus the facets *social fear, anger, soothability, positive anticipation, high intensity pleasure*, and *low intensity pleasure*. The Behavior Approach function best discriminated ASD from sibling and typical groups (ASD lower in approach) with *activity level* and *positive anticipation* showing strongest loadings. The Emotion Regulation function also discriminated ASD from sibling and typical groups (with ASD lower) with Conscientiousness facets (e.g., *inhibitory control*) showing strongest loadings followed by Extraversion facets (e.g., *high intensity pleasure*) and Neuroticism facets (e.g., *fear*).

A look at Garon et al.'s facet level data allows for a more fine grained analysis than could have occurred had they simply reported the superordinate factors. Notably, in this age group the facet level scales measuring the Extraversion factor seem like they might not be correlating among the ASD infants in the same manner as in the typically developing populations. In particular, scores on the *activity level* scale are in the opposite direction of scores on the *positive anticipation* and *high intensity pleasure* scales. Compare this to the typically developing infants where, as expected, scores on these three scales were related in the positive direction that would be anticipated. As Garon et al. note, "children diagnosed with ASD… had a pattern of high motor activity coupled with low positive anticipation (p. 71)." Thus, in children with ASD the Extraversion facet of motor activity appears to potentially be decoupled from the facets measuring positive affect. This supports the position of Buss and Plomin's (1984) non-FFM conception of Extraversion who maintain that the facets of *energy* and *positive affectivity* are separate in preschoolers (see also De Pauw et al., 2009), although in older age groups they do become unified into a broader Extraversion factor (Agleitner & Ostendorf, 1994).

The pattern of higher activity levels has also been found when employing the BSQ in preschool children with ASD (Bailey et al., 2000; Hepburn & Stone, 2006); however, Adamek et al. (2011) reported no difference between ASD and typically developing preschoolers when using Rothbart's CBQ. Furthermore, contrary to findings from Garon et al., Adamek et al.'s data indicated that by preschool age, children with ASD were *higher* than typically developing peers in regards to the CBQ *high intensity pleasure*. This is interesting as data from early childhood (Konstantanareas & Stewart, 2006) and adolescence (Schwartz et al., 2009) indicates no differences between children with ASD and typically developing peers in regards to the *high intensity pleasure* facet. Unfortunately, on Rothbart's measures the facet of *positive anticipation* is not measured in children older than 3 years of age, so no data bears on whether the pattern of higher *activity level* and low *positive anticipation* continues to differentiate children with ASD from typically developing peers in early childhood and beyond.

By reporting these facet level details, Garon et al.'s data opens up connections to future specific lines of research regarding potential factor structure differences between children with ASD and typically developing groups (i.e., atypical correlations between facet level scales), as well as issues related to measuring personality across development in ASD groups. Furthermore, these facet level details have the potential to inform applied questions in a way that a factor level analysis would not allow. This is not to say, however, that factor level analyses do not have their place. For example, DePauw et al., (2009) recently reported data showing how factor level personality information could be used to answer questions related to spectrum nature of ASD. Likewise, recent EEG data indicates that broadband factors can provide insights into the heterogeneity of social skills in ASD populations (Sutton et al., 2005). Instead, studies aimed at the factor level are unlikely to answer meaningful questions related to applied questions, like early identification (see Garon et al., 2009) to the same degree that facet level studies may. Furthermore, a factor level analysis may have revealed expected lower ratings of Extraversion in the ASD group, but would have masked the atypical pattern of *high motor activity* but low *positive affect* ratings.

Scales employed in ASD personality research. The choice of scales employed in any given study reflects an important decision by researchers, as the scope of their findings may be limited by the chosen instrument. It is a generally held axiom in psychology that the most thorough way to understand a given phenomenon is to employ multiple instruments measuring the construct of interest (Kagan, 1998); however, often certain instruments may become more commonly employed than others due to a number of factors, including their visibility in the literature and their relationship to seminal theories. In the literature regarding ASD and personality variables, scales from two theoretical backgrounds are prominent. The first is McDevitt and Carey's (1978) BSQ, a subset of the Carey Temperament Scales which measures Thomas and Chess's (1977) seminal nine-factor theory of temperament in children. The second includes several scales measuring Rothbart's (2007) three-factor theory of temperament, with

slightly different scales aimed at measuring Extraversion, Neuroticism, and Conscientiousness related variables for infants, preschoolers, school age children, and adolescents. Besides scales from these two theories, other studies have employed scales from clinical instruments (Ozonoff et al., 2005) or emotion expression (Capps, Kasari, Yirmiya, & Sigman, 1993) that overlap with personality functioning (see Schwartz et al., 2009 for a review) and a handful of studies have employed instruments from other theories such as the FFM (De Pauw et al., 2009).

As noted previously, there is a growing recognition among clinical and personality psychologists that many facets from different measures of temperament are conceptually similar to subcomponents of the FFM of personality (Muris & Ollendick, 2005). Although the conceptual overlap is remarkable, the fact is that different instruments capture different facet level details. Tables 1-5 (Appendix F) organize the facets of the BSQ; Rothbart's ECBQ, CBQ, and EATQ; the FFM as measured by the Hierarchical Personality Inventory for Children (HiPIC; Mervielde & De Fruyt, 2002), Buss and Plomin's (1984) EAS scales; and the FFM as measured by the ICID (Deal et al., 2007). Tables are organized according to the reported conceptual relations of each scale to the FFM. As can be seen, scales measure common and unique facets of each superordinate FFM factor. Crucially, scales differ in regards to the unique aspects of the FFM factors that they purportedly measure. For example, in regards to Extraversion all scales include facets related to *energy* or *activity level* and *shyness* or *sociability*, but the BSQ, HiPIC, CBQ, and EATQ each respectively measure at least one unique facet. On the other hand, for Conscientiousness all instruments (except the EAS) measure facets related to individual differences in *attention* or *distractibility*; however, all Rothbart's measures include a facet measuring *inhibitory control* that is not included on the other scales. Also, the two FFM scales includes facets measuring *achievement orientation* and *orderliness* not present on any temperament scale, as well as facets unique from each other and the temperament scales.

It seems, therefore, that various instruments measure similar factors at a conceptual level; however, the different facet level details are important to consider. For example, although

Garon et al.'s data indicated that infants with ASD appear to display a unique profile in regards to their higher *activity level* and lower reported *positive affect* the opposite trend in preschoolers was reported by Adamek et al. (2011). Other published preschool personality data is of little help in determining whether either of these patterns are more representative as only the BSQ is employed, which does not include scales specifically measuring *positive affectivity*. Thus, although it supports Garon et al.'s findings regarding higher *activity level*, the findings of Bailey et al. (2000) and Hepburn and Stone (2006) cannot speak to the role of *positive emotion* expression as the BSQ does not measure this facet. Furthermore, drawing generalizations from the literature regarding facet level details in school age and adolescent children with ASD are limited as in each of these developmental groups only one of the two respective studies reported to date have included facet level information (Konstantanareas & Stewart, 2006; Samyn et al., 2011).

In the school age studies Konstantanareas and Stewart (2006) and De Pauw et al. (2009) reported that children with ASD were lower than typical peers in regards to CBQ measured Extraversion and Conscientiousness, and higher in Neuroticism. De Pauw et al. reported similar results using the HiPIC, plus lower Agreeableness and Openness ratings on this measure. Konstantanareas and Stewart's data indicated that differences in Extraversion were driven by higher levels of *shyness*, but no differences in *high-intensity-pleasure*, *surgency*, or *impulsivity*; differences in Neuroticism were driven by greater levels of *discomfort* and lower *soothability*, but no differences in reported *anger, fear* or *sadness*; and differences in Conscientiousness were driven by lower ratings on all scales. De Pauw et al.'s study sought to determine answer to whether FFM factors are related to patterns of differences between ASD and typically developing peers. Therefore, a facet level analysis was not necessarily pertinent to their particular research question.

Purpose of the current study. The purpose of the current study to expand the research base aimed at understanding potential differences in temperament between Middle Childhood

aged individuals with ASD from typically developing peers by employing a previously unused

FFM instrument, the ICID. Although the ICID measures many similar facets as the BSQ and

CBQ, it is also comprised of facets not captured by the other scales (see Table 1-5 in appendix).

For example, although the ICID and CBQ both measure facets regarding *activity level, positive*

emotions, and *shyness*, the ICID uniquely measures *sociability*. Similarly, the facets of

sociability, positive emotions, and *shyness* are not found on the BSQ. Employing the ICID

allows for independent replication of previous facet level findings, allowing a determination of

whether these facets differ between children with ASD and typically developing groups or if

differences found using the CBQ or BSQ represents unique aspects of that particular

instrument. Second, unlike Rothbart's instruments and the BSQ, which were normed on

separate childhood groups at different stages of development, the scales of the ICID were

normed on children from the ages of 2 to 15. Thus, if this instrument is used in future studies

with children in middle childhood or adolescence comparisons with the present study may be

facilitated as these specific facets are designed to be similar across a wider age range

compared to other instruments. Finally, the discussion of these findings takes into consideration

both the utility of, and the problems with, framing personality in ASD findings in relation to

superordinate factors. As such, while significant findings are discussed in regards to popular

"broadband" theories of personality, deviations from the expected patterns are specifically

highlighted in order to accommodate alternative explanations and determine future research

directions investigating unique patterns of personality development in ASD populations.

  The primary research hypotheses center on the following question: Do Middle Childhood

(MC) aged children (ages 8-12) with ASD differ from typically developing children on the facets

of the ICID in a manner that would be theoretically expected from the FFM framework? The

following are hypothesized:

(a) Children with ASD will show lower levels of *positive emotion, considerate* and *sociability*, but against expectation in that children will display higher levels of *activity* scores when compared to same age peers.

(b) Children with ASD will show no differences from typical children in *fear*, and *negative affectivity*, and lower *shyness* ratings when compared to same age peers.

(c) Children with ASD will show lower *achievement orientation* facet scores, but lower *distractibility* and higher *organized* scores when compared to same age peers.

(d) Children with ASD will show lower *compliance,* but higher *antagonism* and *strong-willed* scores when compared to same age peers.

(e) Children with ASD will show lower *intelligence* and *openness* scores, when compared to same age peers.

Methods

Participants

We selected participants if there ages were in Middle Childhood, presently operationally defined as ages 8 to 12. This is justified as previous researchers studying personality development employed this range for their operational criteria (Shiner, Masten & Roberts, 2003).

We recruited participants with an ASD from the Interactive Autism Network (IAN: http://www.iancommunity.org/), an organization that links researchers with families of individuals with autism who are interested in participating in research projects. IAN's website states that "All children (under the age of 18) who have been diagnosed with an ASD by a professional are eligible to participate" in research (https://www.ianresearch.org/login). Due to concern over participants receiving numerous e-mail solicitations, IAN is careful with the number of deployed research calls and employs an algorithm based off of the number of participants desired and the strength of the incentive offered by the researcher to determine the number of solicitations to make. IAN sent parents of children with ASD between the ages of 8 and 12 four rounds of e-

mails from IAN inviting them to volunteer for this study. In order to incentivize participation, all ASD participants had the opportunity to enter their names in a drawing to win one of four $100 gift cards. The typically developing comparison group came from the norming database for the Inventory of Children's Individual Difference's (ICID; Halverson et al, 2003) which Dr. Roy Martin, an investigator on the original ICID project, made available.

Initial screening of the ASD data indicated that 108 cases inadequate for analyses (Table 2.1). The primary reason for this was that parents did not include age information regarding their child (106; 98.1%). Other reasons included no ICID data (1; 0.9%) and indicating a not wanting to participate (1; 0.9%). After the initial screening a second round of screening revealed 30 out of 143 cases who did not meet the following criteria (Table 2.2): 12 had Autism Quotient scores less than the recommended cut-off and 18 were older than upper age limit of 12 (see Measures section). Analyses comparing included and screened ASD groups could not be conducted for gender, race, ethnicity, ICID data, ASD diagnosis, or AQ criteria due to less than five entries for the screened group. Table 2.3 shows that the included ASD group consisted of the remaining 113 middle childhood participants (93 boys; 20 girls; 1 no data) who were 9.21 years of age (SD = 1.15) The racial demographic of the ASD group consisted primarily of Caucasian participants (97; 85.8%), with few participants of other race groups (African American- 3, 2.7%; Asian American- 1, 0.9%; Native American- 1, 0.9%; and Other- 9, 8.0%). Sixteen (14.2%) were of Latino ethnicity. Fifty Nine (52.2%) children had a diagnosis of Autism, 11 (9.7%) Autism and Other (e.g., epilepsy), 14 (12.4%) Asperger, 2 (0.8%) Asperger and Other, 25 (22.1%) PDD-NOS, and 2 (0.8%) did not answer. The comparison group consisted of 372 children (163 boys; 209 girls) who were 10.02 (SD = 1.38) years old. The racial demographic consisted primarily of African-American (254; 68.3%) and Caucasian (111; 29.8%) participants with no Asian American or Native American children, and 7 "Other" (3.3%) race groups. Two (0.5%) participants were of Latino ethnicity.

Table 2.1

Exclusion Criteria for ASD Cases without Age Data

_____

Variables	N (%)
Total N	108 (100)
Total Excluded	108 (100)
AQ < cut off	0 (0)
Older than 12	0 (0)
No Date of Birth	106 (98.1)
No ICID	1 (0.9)
Not Interested	1 (0.9)

Note. ASD = autism spectrum disorders; AQ = autism quotient; ICID = Inventory of Children's Individual Differences.

Table 2.2

Exclusion Criteria for Middle Childhood ASD Groups

_____

Variables	N (%)
Total N	143 (100)
Total Excluded	30 (21)
AQ < cut off	12 (8.4)
Older than 12	18 (12.6)
No Date of Birth	0 (0)
No ICID	0 (0)
Not Interested	0 (0)
Total Included	113 (90.3)

Note. ASD = autism spectrum disorders; AQ = autism quotient; ICID = Inventory of Children's Individual Differences; 108 cases did not have data regarding the age of their child.

Table 2.3: Middle Childhood Participant Characteristics

Variable	ASD (*N*; %)	Control (*N*; %)
Total *N*	113	372
Age (years)	9.21 (1.15)	10.02 (1.38)
Gender		
Boys	93 (82.3)	163 (43.8)
Girls	20 (17.7)	209 (56.2)
Race		
African-American	3 (2.7)	254 (68.3)
Asian- American	1 (0.9)	0 (0)
Caucasian/White	97 (85.8)	111 (29.8)
Native American	1 (0.9)	0 (0)
Other	9 (8.0)	7 (3.3)
Choose Not to Answer	2 (1.8)	0 (0)
Ethnicity		
Latino	16	2
Not Latino	91	370
No Answer	6	0
ASD Diagnosis		
Autism	59 (52.2)	NA
Autism+Other	11 (9.7)	NA
Asperger's	14 (12.4)	NA
Asperger's+Other	2 (0.8)	NA
PDD-NOS	25 (22.1)	NA

(continued)

Variable	ASD (*N*; %)	Control (*N*; %)
PDD-NOS+Other	0 (0)	NA
ASD Diagnostician		
Psychologist, M.A.	5 (4.4)	NA
Psychologist, Ph.D.	30 (25.5)	NA
Psychiatrist, M.D.	3 (1.2)	NA
Neurologist, M.D.	7 (6.2)	NA
Family Physician, M.D.	11 (9.7)	NA
Pediatrician, M.D.	2 (0.8)	NA
Developmental Pediatrician, M.D.	3 (1.2)	NA
Speech Pathologist	27 (23.9)	NA
Occupational Therapist	0 (0)	NA
Other	0 (0)	NA
Team with Psychologist (M.A./Ph.D.)	15 (13.3)	NA
Team of M.D.s	3 (2.8)	NA
Team with M.D. and SLP or OT	7 (6.2)	NA
Team with SLP and OT	0 (0)	NA
Diagnostic Instrument		
ADIR	0 (0)	NA
ADOS	8 (3.2)	NA
CARS	6 (2.4)	NA
SCQ	1 (0.4)	NA
Other	7 (2.8)	NA
ADIR & ADOS	3 (1.2)	NA

(continued)

Variable	ASD (*N*; %)	Control (*N*; %)
ADIR and/or ADOS and other	34 (13.5)	NA
CARS and/or SCQ and other	4 (1.6)	NA
Don't Remember	49 (19.4)	NA

Note. ASD = Autism Spectrum Disorder ; ADIR = Autism Diagnostic Interview- Revised; ADOS = Autism Diagnostic Schedule; CARS = Childhood Autism Ratings Scale; M.A. = Master of Arts; M.D. = Medical Doctor; NA = Not applicable OT = Occupational Therapist; Ph.D. = Doctor of Philosophy; SCQ = social communication questionnaire; SLP = Speech Language Pathologist.

The ASD and typical groups differed significantly from each other in regards to age (t [1, 219.10] = -6.28, $p < .001$) and gender composition [χ^2 (1, $N = 485$) = 51.50, $p < .001$). In order to .address these significant differences, the analyses below employs a 2 (diagnostic group) X 2 (gender) Multivariate Analysis of Covariance (MANCOVA) statistically controlling for age.

Measures

Parents of children with ASD between the ages of 8 and 11 filled out the Autism Quotient-Children's Version (AQ-C; Aeyung, Baron-Cohen, Wheelwright, & Allison, 2008; see Appendix C) to screen for autism symptoms in the ASD group in children between the ages of 8 and 11. The AQ is a parent-report measure that consists of 50 items, is appropriate for children ages 4 – 11, and displays excellent internal ($\alpha = .97$), and test-retest ($r = .85$) reliability. The AQ consists of four empirically derived scales: *Mind Reading* ($\alpha = .96$), *Attention to Details* ($\alpha = .85$), *Communication* ($\alpha = .94$), and *Social Skills* ($\alpha = .90$). *Mind reading* refers to children's ability to decode non-verbal communication and understand the underlying cognitive and affective bases of social behavior. *Attention to details* refers to a preference for focusing on circumscribed aspects of the physical world rather than developing an overall gestalt. *Communication* refers to children's ability to verbally interact smoothly and competently. *Social skills* refers children's ability to initiate and maintain age appropriate social interactions. Research shows that the AQ is a valid non-diagnostic instrument whose score clearly delineate children with ASD from typically developing populations (Aeyung et al., 2008). Children identified as having an ASD who score below a 76 on the overall score was omitted from this analysis as data supports that 95% of children with an ASD score above this point.

Parents of children with an ASD who were 12 years old filled out the Autism Quotient-Adolescent form (AQ-A; Baron-Cohen, Hoeksatra, Knickmeyer, & Wheelwright, 2006; see Appendix D) to screen for autism symptoms in 12 year olds in the ASD population. The AQ-A is a parent-report measure that consists of 50 items, is appropriate for children ages 12 – 15, and displays good internal ($\alpha = .79$) and test-retest ($r = .92$) reliability. The AQ consists of five

empirically derived scales: *Imagination* (α = .81), *Attention to Details* (α = .66), *Attention Switching* (α = .76), *Communication* (α = .82), and *Social* (α = .88). *Imagination* refers to children's ability to decode non-verbal communication and understand the underlying cognitive and affective bases of social behavior. *Attention to details* refers to a preference for focusing on circumscribed aspects of the physical world rather than developing an overall gestalt. *Attention switching* refers to an individual's ability smoothly transition from one's current focus of attention to a currently unattended foci. *Communication* refers to children's ability to verbally interact smoothly and competently. *Social* refers children's ability to initiate and maintain age appropriate social interactions. Research shows that the AQ is a valid non-diagnostic instrument whose score clearly delineate children with ASD from typically developing populations (Baron-Cohen et al., 2008). Children identified as having an ASD who score below a 66 on the overall score were omitted from this analysis as data supports that the majority of children with an ASD score above this point.

All parents filled out the Inventory of Children's Individual Differences- Short Version (ICID; Deal et al., 2007; see Appendix E), a personality test designed to measure 15 facets that can be combined to measure the FFM personality variables in children between the ages of 2 and 15. All facet scales display adequate to good internal (α = .67-.85) and good to excellent test-retest reliability (*r* = .85-.95). Furthermore, the ICID shows strong convergent validity in that scales correlate in the predicted manner with other personality scales (Deal et al., 2007). The *Achievement Orientation* facet measures the perceived desire to succeed of children. The *Activity Level* facet measures the amount of expressed physical energy. The *Antagonism* facet refers to children's tendency to elicit negative states from others. The *Compliant* facet measure the degree to which a child submits to instruction from others. The *Considerate* facet measures the thoughtfulness and sensitivity expressed by children in regards to others. The *Distractible* facet measures children's difficulty at sustaining attention. The *Fearful* facet measures children's tendency toward withdrawal related negative emotions. The *Intelligent* factor refers speed of

learning and memory skills. The *Negative Affect* facet measures children's tendency to experience and express anger oriented emotions. The *Openness* factor refers to a sense of imaginativeness and curiosity. The *Organized* facet measures one's tendency towards neatness, carefulness and thoughtfulness. The *Positive Emotion* facet measures children's tendency to express positive affects related to happiness. The *Shyness* facet measures children's reticence regarding social interactions. The Social facet measures a preference for social interactions. The *Strong-Willed* facet measures a child's compliance and push for their own way.

One unique aspect of the ICID is that the facet level scores may be combined to derive measures of the FFM personality variables (Digman, 1990). Although the proposed study does not analyze the FFM superordinate factors, the discussion is organized according to this popular scheme as described in Halverson et al. (2003). Extraversion is to the facets *Strong-willed, Social, Positive Emotion, Activity Level*, and *Considerate.* Agreeableness is related to the *Compliance, Strong-Willed* and *Antagonism* facets. Conscientiousness is related to the *Organized* and *Achievement Orientation* and distractible facets. Neuroticism is related to the *Shy, Negative Affect*, and *Fear,* facets. Openness is related to the *Intelligent* and *Openness* facet.

Equivalence of paper-and-pencil and on-line questionnaires.

In a pilot study of 17 parents, the concurrent validity of the AQ and ICID paper-based measures and on-line measures was investigated. For the ICID, the total scores for the paper and on-line measures correlated at .90; factor level scores showed strong correlations ($r = .93$-.96); and facet level scores ranged from .87 to .98, except for *Openness* which displayed lower correlations ($r = .64$). For the AQ, the total scores for the paper and on-line measures correlated at .94.

Procedure

Once parents gained access to the online materials they read an online informed consent form that has been approved by the Institutional Review Board (IRB) at the University of Georgia (UGA). Since the data collected from this study does not require personally identifiable information, does not involve the direct participation of minors, and involves little to no risk, UGA's IRB deemed a signed informed consent unnecessary. Instead, after reading the informed consent, parent checked one of two boxes indicating whether they agree or not to the conditions outlined in the informed consent. If parents disagreed with the conditions of the informed consent they were forwarded to a page thanking them for their time. If they agreed to participate in the study they were sent to a second page where they indicated the ASD diagnostic status of their child.

Parents of children with an ASD then completed four on-line forms. First, they filled out a diagnostic information questionnaire asking them details about their child's particular diagnosis (autism, Asperger's, PDD-NOS, other); the professional credentials of the individual who diagnosed their child (master's or doctoral level psychologist, licensed clinical social worker, psychiatrist, neurologist, family doctor, pediatrician, speech language pathologist, occupational therapist, and other); autism assessment employed by the diagnostician (ADI-R, ADOS, CARS, CARS2, SCQ, other, don't know); cognitive assessment employed by diagnostician (Leiter-R; Mullens; PPVT-III or IV; WISC-III; WJ-III; Stanford Binet-5, other, don't know); and behavioral assessment employed by diagnostician (ABAS I or II; SIB-R; Vineland I or II; other; don't know). [See Appendix A]. Second, parents completed a demographic questionnaire regarding the following information: Birthday; gender; race; birth order; number of siblings; maternal marital status, race, education, occupation, income, and religious affiliation; paternal marital status, race, education, occupation, income, and religious affiliation [See Appendix B]. Third, participants fill out the AQ-C or AQ-A. Finally, participants filled out the ICID.

Results

Comparison of the reliability of the ICID facet level scales

Prior to analyses, we calculated Cronbach alphas to determine whether the internal

reliability of personality facets was similar between the ASD and typically developing groups

(see Table 2.4). George and Mallery (2003) recommend the following rule of thumb regarding

the strength of internal reliability: .91-1.00- excellent, .81-.90- good, .71-.80- acceptable, .61-.70-

poor, and below .60 unacceptable. For the typical group, no scales fell into the excellent range,

six (*achievement, activity, considerate, intelligence, organized,* and *sociability*) fell in the good

range, six (*compliance, distractible, fear, negative affect, openness*, and *strong-willed*) fell in the

acceptable range, two (*antagonism* and *shy*) fell in the questionable range, and one (*organized*)

fell in the unacceptable range. For the ASD group, one (*activity level*) scale fell into the

excellent range, one (*negative affect*) fell in the good range, seven (*antagonism, compliance,*

considerate, fear, positive emotion, sociability, and *strong-willed*) fell in the adequate range,

three (*achievement, intelligence*, and *openness*) fell in the questionable range, and three

(*distractible, organized*, and *shy*) fell in the unacceptable range.

In order to determine test whether the qualitative differences were meaningful in a more

quantitative manner, we employed the Feldt test (Feldt, 1969). The Feldt test provides a W

statistic based off of the following formula:

$$W = \frac{1 - \hat{\alpha}_2}{1 - \hat{\alpha}_1} \, .$$

In this formula $\hat{\alpha}_1$ is the internal reliability statistic of one group and $\hat{\alpha}_2$ the internal reliability of

the other. The internal reliability of *activity level* (W[112, 371] = 2.00, *p* < .003) was higher in the

ASD group compared to the typically developing peers. The internal reliabilities of *achievement*

(W[371, 112] = 2.75, *p* < .003), *distractible* (W[371, 112] = 2.65, *p* < .001), *intelligence* (W[371,

112] = 2.13, *p* < .001), *openness* (W[371, 112] = 1.67, *p* < .001), and *shyness* (W[371, 112] =

2.27, *p* < .001) were higher in the typically developing group compared to the ASD group.

Table 2.4

Internal Reliability of Temperament Scales (MC)

_____

Temperament Facet	ASD	Strength	Comparison	Strength	*p* < .003
Achievement	.67	questionable	.78	good	**
Activity Level	.91	excellent	.82	good	**
Antagonism	.75	acceptable	.70	questionable	--
Compliance	.72	acceptable	.78	acceptable	--
Considerate	.79	acceptable	.85	good	--
Distractible	.39	unacceptable	.77	acceptable	**
Fear/Insecure	.77	acceptable	.73	acceptable	--
Intelligence	.66	questionable	.84	good	**
Negative affect (anger)	.85	good	.80	acceptable	--
Openness	.65	questionable	.79	acceptable	**
Organized	.46	unacceptable	.59	poor	--
Positive Emotion	.80	acceptable	.85	good	--
Shy	.32	unacceptable	.70	questionable	**
Sociability	.76	acceptable	.83	good	--
Strong willed	.73	acceptable	.77	acceptable	--

Note. ASD = Autism Spectrum Disorders; Descriptive categories for internal consistency reliability are from George and Mallery (2003).

MANCOVA of personality variables

The deployment of a MANCOVA requires moderate to strong significant correlations between the tested variables (Meyers, Gampst, & Guarino, 2006), thus we calculated Pearson's correlations for both the ASD and comparison group (see Appendix G). Both groups displayed patterns of moderate to strong correlations between variables that justifies the use of MANCOVA. However, as the reader may observe by attending to the upper (ASD) and lower (comparison) diagonals (Appendix G), these patterns are dissimilar for the ASD and comparison group: Box's test of covariance indicated that ASD and typical groups differed in regards to their respective covariance matrices ($p <.005$; see Huberty & Petosky, 2000). Thus, we employed the more conservative Pillai's Trace omnibus statistics to determine the overall MANCOVA *F*-value as this statistic is robust to violations of unequal covariance matrices. Pillai's Trace statistics indicated significant ASD X gender interactions [$F(1, 15) = 2.032$, $p < .05$, $\eta^2 = .07$], significant gender differences [$F(1, 15) = 1.321$, $p < .05$, $\eta^2 = .05$], and significant differences between ASD and typical children: [$F(1, 15) = 39.574$, $p < .001$, $\eta^2 = .59$. A significant relationship was also found regarding the relationship of age and temperament [$F(1, 15) = 1.762$, $p < .05$, $\eta^2 = .06$].

Due to widespread differences in regards to correlational patterns (see *Comparison of correlation matrices* below) we employed Levene's *F* tests to determine whether ASD and comparison groups differed in regards to their homogeneity of variance. Thirteen of the personality facets were non-homogenous. Therefore, we employed Welsch's *F*-tests to determine univariate differences as this statistic is considered robust to homogeneity violations.

Group Differences on Personality Facets

We employed fifteen follow up pairwise comparisons employing the Bonferroni corrections to control for probability inflation to determine which facets of personality differed between ASD and control children. The Bonferroni correction requires that the alpha criterion set deemed appropriate by the researcher, in this case $p < .05$, is divided by the number of comparisons. Thus, in this study an alpha of .003 is required to be considered statistically

significant. Details regarding *F*-values, means, standard deviations, and effect sizes are found in

Table 2.5.

Table 2.5

Means and Standard Deviations for Temperament: ASD and typical (MC)

_____

Temperament Facet	ASD *M* (*SD*)	Comparison *M* (*SD*)	Gender *M* (*SD*)[a]
Achievement			
ASD Group	9.23 (3.98)	14.26 (3.30)	12.94 (4.13)
Boys	9.43 (4.00)	13.98 (3.38)	12.16 (4.27)
Girls	8.30 (3.84)	14.48 (3.22)	13.86 (3.77)
Activity Level			
ASD Group	14.19 (5.20)	14.95 (3.44)	14.75 (3.98)
Boys	14.11 (5.01)	15.32 (3.40)	14.84 (4.16)
Girls	14.60 (6.13)	14.66 (3.44)	14.66 (3.44)
Antagonism			
ASD Group	11.12 (4.52)	8.00 (3.31)	8.82 (3.91)
Boys	10.89 (4.51)	8.50 (3.29)	9.46 (3.99)
Girls	12.20 (4.51)	7.61 (3.29)	8.08 (3.69)
Compliance			
ASD Group	8.79 (3.96)	14.08 (3.02)	12.69 (4.03)
Boys	9.02 (4.06)	13.94 (3.11)	11.97 (4.27)
Girls	7.70 (3.29)	14.18 (2.95)	13.53 (3.56)
Consideration			
ASD Group	8.58 (4.02)	15.45 (3.18)	13.65 (4.56)
Boys	8.81 (4.00)	15.13 (3.30)	12.59 (4.74)
Girls	7.55 (4.08)	15.69 (3.06)	14.87 (4.01)

Temperament Facet	ASD *M* (*SD*)	Comparison *M* (*SD*)	Gender *M* (*SD*)[a]
Distractible			
ASD Group	13.17 (3.95)	10.59 (3.75)	11.26 (3.97)
Boys	13.32 (3.58)	10.90 (3.37)	11.87 (3.65)
Girls	12.45 (5.38)	10.35 (4.02)	10.56 (4.21)
Fear/Insecure			
ASD Group	16.89 (6.35)	12.20 (4.38)	13.43 (5.38)
Boys	16.86 (3.89)	12.65 (4.44)	14.34 (5.68)
Girls	17.00 (6.31)	11.85 (4.32)	12.37 (4.79)
Intelligence			
ASD Group	12.49 (4.48)	15.30 (3.43)	14.56 (3.93)
Boys	12.74 (4.58)	14.94 (3.42)	14.06 (4.07)
Girls	11.30 (3.85)	15.56 (3.43)	15.14 (3.70)
Negative (Anger)			
ASD Group	14.51 (4.90)	10.04 (3.79)	11.21 (4.55)
Boys	13.94 (4.90)	10.40 (3.74)	11.82 (4.58)
Girls	17.20 (3.98)	9.76 (3.82)	10.51 (4.43)
Openness			
ASD Group	13.87 (5.22)	20.61 (3.95)	18.84 (5.23)
Boys	13.88 (5.33)	20.76 (4.31)	18.00 (5.81)
Girls	13.80 (4.79)	20.49 (3.65)	19.81 (4.27)
Organized			
ASD Group	14.09 (3.90)	14.74 (3.39)	14.57 (3.53)
Boys	14.23 (3.88)	14.72 (3.28)	14.52 (3.54)
Girls	13.45 (4.01)	14.75 (3.47)	14.62 (3.54)

Temperament Facet	ASD *M* (*SD*)	Comparison *M* (*SD*)	Gender *M* (*SD*)[a]
Positive Emotion			
ASD Group	13.86 (4.08)	17.18 (3.06)	16.31 (3.66)
Boys	14.10 (4.07)	16.84 (3.22)	15.74 (3.82)
Girls	12.75 (4.02)	17.44 (2.92)	16.96 (3.34)
Shy			
ASD Group	21.09 (3.81)	11.86 (4.19)	14.28 (5.77)
Boys	21.05 (3.68)	12.19 (4.36)	15.74 (5.97)
Girls	21.25 (4.49)	11.60 (4.50)	12.57 (5.02)
Sociability			
ASD Group	9.82 (4.16)	20.46 (4.14)	17.67 (6.25)
Boys	9.95 (3.98)	20.22 (4.25)	16.10 (6.52)
Girls	9.25 (5.00)	20.64 (4.05)	19.50 (5.38)
Strong willed			
ASD Group	20.15 (4.57)	15.43 (4.69)	16.67 (5.09)
Boys	19.86 (4.37)	16.03 (4.55)	17.56 (4.84)
Girls	21.50 (5.32)	14.97 (5.10)	15.62 (5.19)

Note. ASD = Autism Spectrum Disorder.

[a] = Indicates data collapsed across diagnostic groups.

Table 2.6

Temperament differences between ASD and typical (MC)

_____

Temperament Facet	*F* value	*p* value	η^2
Achievement			
ASD Group	118.21	.001	.22
Gender	00.52	.473	.00
ASD X gender	3.11	.079	.01
Activity Level			
ASD Group	1.71	.192	.00
Gender	0.02	.899	.00
ASD X gender	1.18	.278	.00
Antagonism			
ASD Group	44.08	.001	.09
Gender	0.24	.628	.00
ASD X gender	5.06	<.05	.01
Compliance			
ASD Group	151.18	.001	.26
Gender	1.60	.207	.00
ASD X gender	3.16	.076	.01
Consideration			
ASD Group	227.39	.001	.35
Gender	00.65	.421	.00
ASD X gender	4.02	<.05	.01

(continued)

Temperament Facet	F value	p value[a]	η^2
Distractible			
ASD Group	15.59	.001	.04
Gender	1.73	.189	.00
ASD X gender	0.07	.789	.00
Fear/Insecure			
ASD Group	44.50	.001	.10
Gender	0.22	.642	.00
ASD X gender	0.51	.477	.00
Intelligence			
ASD Group	43.12	.001	.09
Gender	0.58	.448	.00
ASD X gender	4.04	< .05	.01
Negative (Anger)			
ASD Group	92.20	.001	.18
Gender	5.81	<.050	.01
ASD X gender	12.81	<.001	.03
Openness			
ASD Group	142.54	.001	.25
Gender	0.04	.835	.00
ASD X gender	0.05	.820	.00

(continued)

Temperament Facet	F value	p value[a]	η^2
Organized			
ASD Group	3.03	.082	.01
Gender	0.63	.429	.00
ASD X gender	0.73	.392	.00
Positive Emotion			
ASD Group	66.30	.001	.14
Gender	0.65	.421	.00
ASD X gender	4.51	<.050	.01
Shy			
ASD Group	259.24	.001	.38
Gender	0.09	.759	.00
ASD X gender	0.54	.462	.00
Sociability			
ASD Group	355.95	.001	.46
Gender	0.06	.814	.00
ASD X gender	0.99	.321	.00
Strong willed			
ASD Group	61.88	.001	.13
Gender	0.25	.617	.00
ASD X gender	4.27	<.050	.00

Note. ASD = Autism Spectrum Disorders.

In regards to Extraversion oriented facets, no gender differences were found, two gender x ASD interactions were found, and there were several differences between ASD and typically developing children. A significant interaction was found on the *considerate* facet [(F(1, 426) = 4.02, $p < .05$, $\eta^2 = .01$] and consideration of the means indicates that parents rated girls with ASD as less compliant than ASD boys, but no differences in the typically developing children. A significant interaction was also found for the *positive emotion* facet [(F(1, 426) = 4.51, $p < .05$, $\eta^2 = .01$] and consideration of the means indicates girls with ASD are rated as expressing fewer *positive emotions* than all other children. Regarding differences between ASD and typical children, parents rated children with ASD as lower on the facet of *sociability* [F(1, 426) = 355.95, $p < .001$, $\eta^2 = .46$], lower on *positive emotions* [F(1, 426) = 66.30, $p < .001$, $\eta^2 = .14$] and no different in *activity level* [F(1, 426) = 1.71, $p = .192$, $\eta^2 = .00$]. Parents also rated children with ASD as lower on the *considerate* [F(1, 426) = 227.39, $p < .001$, $\eta^2 = .35$] facet.

On Neuroticism oriented facets, one gender difference was found, one gender x ASD interactions was found, and there were several differences between ASD and typically developing children. A significant interaction was found on the *negative affectivity* facet [(F(1, 426) = 12.81, $p < .05$, $\eta^2 = .03$] and consideration of the means indicates an interaction wherein parents rated girls with ASD as having higher *negative affectivity* than ASD boys whereas parents rated typically developing girls are rated as lower than typical boys. *Negative affectivity* also displayed significant gender difference across diagnostic groups [F(1, 426) = 5.81, $p < .05$, $\eta^2 = .01$]. Regarding diagnostic group differences, parents rated children with ASD as higher on *fear* [F(1, 426) = 44.50, $p < .001$, $\eta^2 = .10$], *shyness* [F(1, 426) = 259.24, $p < .001$, $\eta^2 = .38$], and *negative affectivity* [F(1, 426) = 92.20, $p < .001$, $\eta^2 = .18$].

On Conscientiousness oriented facets, no gender differences or interactions were found, and two significant differences between diagnostic groups were found. Children with ASD were rated as lower on *achievement orientation* [F(1, 426) = 118.21, $p < .001$, $\eta^2 = .22$], but counter to

hypothesis were rated as higher on *distractibility* [$F(1, 426) = 15.59$, $p < .001$, $\eta^2 = .04$] and no different on *organization* [$F(1, 426) = 3.03$, $p = .082$, $\eta^2 = .01$] skills.

On Agreeableness oriented facets, no gender differences were found. Furthermore, two significant interactions were found and two significant differences between diagnostic groups were found. A significant interaction was found on the *antagonism* facet [($F(1, 426) = 5.06$, $p < .05$, $\eta^2 = .01$] and consideration of the means indicates an interaction wherein parents rated girls with ASD as having higher *antagonism* scores than ASD boys whereas the genders in the typically developing group did not differ. A significant interaction was also found on the *strong willed* facet [($F(1, 426) = 4.27$, $p < .05$, $\eta^2 = .00$] and consideration of the means indicates an interaction wherein parents rated girls with ASD as having higher *antagonism* scores than ASD boys whereas the genders in the typically developing group did not differ. Regarding differences between diagnostic groups, parents rated children with ASD as higher on *antagonism* [$F(1, 426) = 44.08$, $p < .001$, $\eta^2 = .09$] and being *strong willed* [$F(1, 426) = 61.88$, $p < .001$, $\eta^2 = .13$], as well as having lower *compliance* [$F(1, 426) = 151.18$, $p < .001$, $\eta^2 = .26$] scores.

Finally, on Intellect oriented facets, no gender differences or interactions were found, and one significant difference between diagnostic groups was found. A significant interaction was found on the *intelligence* facet [($F(1, 426) = 4.04$, $p < .05$, $\eta^2 = .01$] and consideration of the means indicates an interaction wherein parents rated girls with ASD as having lower *intelligence* scores than boys whereas the genders in the typically developing group do not differ. Regarding diagnostic groups, children with ASD were rated as lower on scales measuring *intellect* [$F(1, 426) = 43.12$, $p < .001$, $\eta^2 = .09$] and *openness* [$F(1, 426) = 142.54$, $p < .001$, $\eta^2 = .25$].

Comparison of correlation matrices

In order to estimate the strength and specificity of covariance differences indicated by the Box's test, Fisher *r* to *z* transformations (http://vassarstats.net/rdiff.html) were employed to

compare the facet correlations of children with ASD and Typical children. Due to the large number ($N = 105$) of comparisons, Bonferroni corrections were considered to control for Type I errors (.05/105: $α = .0004$); however, this stringent alpha level increases the probability of Type II errors, so an alpha of .001 was considered an appropriate balance. Differences above this amount are noted as there were numerous differences between groups at more conservative levels ($N = 35$) and future research will want to determine whether less powerful differences are consistent between groups (i.e., quasi-control for Type II errors).

Children with ASD differed significantly from Typical children for the correlations between *achievement* and *consideration* (ASD $r = .31$; Typical $r = .58$) and *distractible* (ASD $r = -.22$; Typical $r = -.52$) ($p < .001$). Furthermore, there were lower level group differences for the correlations between *achievement* and *activity level* (ASD $r = .05$; Typical $r = .25$; $p < .05$), *fear* (ASD $r = -.09$; Typical $r = -.28$; $p < .05$), *openness* (ASD $r = .22$; Typical $r = .42$, $p < .05$), *organized* (ASD $r = .34$; Typical $r = .53$, $p < .05$), *positive emotion* (ASD $r = .25$; Typical $r = .53$; $p < .01$), shy (ASD $r = -.09$; Typical $r = -.31$; $p < .05$), and *strong willed* (ASD $r = -.19$; Typical $r = -.37$; $p < .05$).

In addition to the previously mentioned relationship with *achievement,* there were significant group differences for the correlations between *activity level* and *consideration* (ASD $r = -.16$; Typical $r = .21$), *shy* (ASD $r = .05$; Typical $r = -.28$) and *sociability* (ASD $r = .24$; Typical $r = .58$) (all $ps < .001$). Furthermore, there were lower level differences for the correlations between *activity level* and *antagonism* (ASD $r = .15$; Typical $r = -.12$; $p < .01$), *compliance* (ASD $r = -.10$; Typical $r = .20$; $p < .01$), *intelligence* (ASD $r = .13$; Typical $r = 28$; $p < .05$), *fear* (ASD $r = -.08$; Typical $r = -.22$; $p < .05$), and *openness* (ASD $r = .19$; Typical $r = .49$; $p < .01$).

In addition to the previously mentioned relationship between *antagonism* and *activity level*, there were significant between group differences for the correlations of *antagonism* and *intelligence* (ASD $r = -.03$; Typical $r = -.36$), *openness* (ASD $r = .15$; Typical $r = -.24$) and *sociability* (ASD $r = -.01$; Typical $r = -.36$) (all $ps < .001$). Furthermore, there were lower level

differences for the correlations between *antagonism* and *distractible* (ASD *r* = .27; Typical *r* =

.44; *p* < .05), *fear* (ASD *r* = .20; Typical *r* = .37; *p* < .05), and *shy* (ASD *r* = .16; Typical *r* = .45; *p*

< .01).

       In addition to the previously mentioned relationship between *compliance* and *activity*

level, there were significant differences between groups for *compliance* and *intelligence* (ASD *r*

= .25; Typical *r* = .57) and *positive emotion* (ASD *r* = .23; Typical *r* = .56) (all *ps* < .001).

Furthermore, there were lower level group differences for correlations between *compliance* and

consideration (ASD *r* = .39; Typical *r* = .61; *p* < .01), *distractible* (ASD *r* = -.25; Typical *r* = -.49; *p*

< .01), *fear* (ASD *r* = -.09; Typical *r* = -.28; *p* < .05), and *organized* (ASD *r* = .32; Typical *r* = .54;

p < .01).

       Previously mentioned were differences in group relationships between *consideration*

and *achievement, activity level*, and *compliance*. Furthermore, there were significant differences

between *consideration* and *intelligence* (ASD *r* = .00; Typical *r* = .41), *positive emotion* (ASD *r* =

.49; Typical *r* = .73), and *sociability* (ASD *r* = .01; Typical *r* = .50) (all *ps* < .001). There were also

lower level group differences for the correlations between *consideration* and *distractible* (ASD *r*

= -.04; Typical *r* = -.30; *p* < .01), *fear* (ASD *r* = .01; Typical *r* = -.29; *p* < .01), *openness* (ASD *r* =

.14; *Typical r* = .44; *p* < .01), and *shy* (ASD *r* = -.15; Typical *r* = -.35; *p* < .05).

       Previously mentioned were group differences for correlations between *distractible* and

achievement, antagonism, compliance, and *consideration*. Furthermore, there were significant

group differences for the correlations between *distractible* and *strong willed* (ASD *r* = .15;

Typical *r* = .51; *p* < .001). There were also lower level group differences for the correlations

between *distractible* and *fear* (ASD *r* = .08; Typical *r* = .39; *p* < .01), *intelligence* (ASD *r* = -.29;

Typical *r* = -.49; *p* < .05), *positive emotion* (ASD *r* = -.07; Typical *r* = -.29; *p* < .05), *shy* (ASD *r* =

.12; Typical *r* = .36; *p* < .01), and *sociability* (ASD *r* = .06; Typical *r* = -.13; *p* < .05).

       Previously mentioned were group differences for the relationships between *fear* and

achievement, antagonism, compliance, consideration, and *distractible*. There were significant

group differences for the correlations between *fear* and *intelligence* (ASD $r = .00$; Typical $r = -.40$), *openness* (ASD $r = .26$; Typical $r = -.24$), *shy* (ASD $r = .13$; Typical $r = .62$), and *sociability* (ASD $r = -.13$; Typical $r = -.51$) (all $ps < .001$). There were also lower level group differences found for the correlations between *fear* and *positive emotion* (ASD $r = -.13$; Typical $r = -.36$; $p < .05$).

In addition to the previously mentioned group differences for correlations between *intelligence* and *achievement, antagonism, compliance, consideration*, and *fear*, there was a significant group difference for the correlation between *intelligence* and *positive emotion* (ASD $r = .01$; Typical $r = .45$). There were also lower level group differences found between *intelligence* and *negative emotion* (ASD $r = .02$; Typical $r = -.30$; $p < .01$), *shy* (ASD $r = -.09$; Typical $r = -.41$; $p < .01$), *sociability* (ASD $r = .23$; Typical $r = .45$; $p < .01$) and *strong willed* (ASD $r = .12$; Typical $r = -.12$; $p < .05$).

Previously mentioned were group differences regarding the relationship between *negative emotion* and *intelligence*. There were also a lower level group difference for the correlations between *negative emotion* and *openness* (ASD $r = .16$; Typical $r = -.12$; $p < .01$), *shy* (ASD $r = .21$; Typical $r = .46$; $p < .01$), and *strong willed* (ASD $r = .54$; Typical $r = .67$; $p < .05$).

Previously mentioned were group differences regarding the correlations between *openness* and *achievement, activity level, antagonism, consideration, fear*, and *negative emotion*. Additionally, there was a significant group difference between the correlation of *openness* and *positive emotion* (ASD $r = -.05$; Typical $r = .46$; $p < .001$). Furthermore, there was a lower level group difference for the correlations between *openness* and *sociability* (ASD $r = .36$; Typical $r = .54$; $p < .05$).

Previously mentioned were group differences regarding correlations between *organized* and *achievement* and *compliance*. There was also a lower level group difference for the correlation between *organized* and *sociability* (ASD $r = -.12$; Typical $r = .09$; $p < .05$).

Previously mentioned were groups differences regarding correlations between *positive emotion* and *achievement, compliance, consideration, distractible, fear, intelligence,* and *openness.* There was a significant group difference for the correlation between *positive emotion* and *sociability* (ASD *r* = .01; Typical *r* = .50; *p* < .001). There was a lower level group found between *positive emotion* and *shy* (ASD *r* = -.10; Typical *r* = -.39; *p* < .01).

Previously mentioned were group differences between *shyness* and *achievement, activity level, antagonism, consideration, distractible, fear, intelligence, negative emotion*, and *positive emotion.* No other group differences were found. Also, previously mentioned were group differences between *sociability* and *activity level, antagonism, consideration, distractible, fear, intelligence, openness, organized,* and *positive emotion.* There were no other group differences. Finally, previously mentioned were group differences between *strong willed* and *achievement, distractible, intelligence, negative emotion*, and *organized.* No other group differences were found.

Discussion

This study employed a new personality measure, the ICID, in order to determine whether children with ASD differed significantly from typical peers during the period of Middle Childhood (MC) on the 15 facet level scales of this measure. Significant differences were found on 13 of the 15 sub-scales and the effect size between groups ranged from small (e.g., *distractible, η^2* = .04) to large (e.g., *sociability, η^2* = .46). An interesting finding is that several gender X ASD diagnostic status interactions were found indicating that girls with ASD were higher in regards to *anger, antagonism*, and *strong willed*, as well as less *conscientious* and *intelligent* compared to all other groups. Overall, the internal reliability of subscales for both ASD and typically developing children fell in the adequate to excellent range; although both had a handful of scales with truly poor reliabilities (i.e., *α* < .60). The ensuing discussion elaborates first on gender interactions, then on specific group differences and internal reliability issues, and finally

issues related to atypical covariance patterns. As noted, ICID facet discussions are organized around the original FFM conceptualization from Halverson et al. (2003).

Parents rated girls with ASD as more angry, antagonistic, and strong willed, and displaying lower levels of positive emotions and conscientious behaviors compared to both typically developing children of either gender or boys with ASD, who also tended to be higher than typical children. This finding gives the impression that girls with ASD may, on average, have more "difficult temperaments" in middle childhood compared to other children (Thomas & Chess, 1977; see Jaffari-Bimmell et al., 2007 for recent data regarding difficult temperament in older age groups). This finding fits in with a growing literature indicating that children with ASD display higher levels of challenging and aggressive behaviors compared to typically developing children (for a recent reviews, see Kozlowski, Matson, & Riese, 2012; Kozlowski & Matson, 2012). Although the evidence, to date, is incomplete regarding gender differences in this realm, recent research from Worley and Matson (2011) found that parents rated females with ASD as higher on the following items: spiteful, vindictive, revengeful, and wants to get back at others.

The present report combined with those from Worley and Matson indicates that negative emotionality, particularly anger leading to aggressiveness, could be a core cause for another gender difference that has been noted in the ASD literature: Many reports indicate that females with ASD have higher levels or social problems compared to males with ASD (for a recent discussion see Rivet & Matson, 2011). It seems likely that a propensity towards angry affect combined with a less than average capacity for empathizing and inferring the mental states of others (e.g., Dapretto et al., 2006) might be a potential causal factor in gender differences between males and females on the core ASD symptom of social difficulties. Future research should employ path modeling or structural equation modeling techniques to determine whether a greater tendency towards angry affect is a core causal variable leading to aggressive interactions impacting the perceived social abilities of girls with ASD. Furthermore, *in vivo* studies comparing boys and girls with ASD during challenging tasks with caretakers (e.g.,

caretaker requesting a child clean up their toys) are needed to determine whether reported gender differences reflect true behavioral differences. It is possible that aspects of the rater, such traditional cultural values regarding gender roles, could impact their perception of aggressive children so that anger and aggression in boys is seen as normal, but is aberrant in girls.

In addition to the noted gender interactions, several main effects of ASD status and personality were found. For example, several facets comprising the construct of Extraversion distinguished children with ASD from typically developing children. Unsurprisingly, parents rated children with ASD as less *sociable* than typically developing peers. Likewise, parents rate children with ASD as less *considerate*, a scale measuring ones tendency to consider the internal feeling states of others, a notable difficulty for many individuals with ASD. Furthermore, children with ASD were rated as lower in *positive emotion*, which seems to contradict previous findings from Adamek et al. (2011), but upon closer inspection is more understandable. Adamek et al. found significant differences on their measures of both the facets of *high intensity pleasure* and *low intensity pleasure* which respectively measure the expression of excitement oriented affect and expressed pleasure from low stimulation activities, such as lying in the sun. The ICID, on the other hand measures how "sweet" or "loving" the parent perceives their child to act. Thus, these measures of affect likely tap different positive emotions with the Rothbart scales measuring the elicitation of relatively non-social events and the ICID more socially oriented affective states.

Another interesting finding is that children with ASD were no different from typically developing peers on the *activity level* facet. *Activity level* measures, as reported by other research groups (Adamek et al.; Garon et al., 2009) give the impression that this facet may not relate to other measures in ASD populations in the same manner as typical populations. Appendix G is illustrative: While *activity level* significantly correlated with 11 other ICID subscales ($rs = .12 - .58$) in the typically developing group, it was only correlated with *openness*

(r = .19) and *sociability* (r = .24) in the ASD group with substantially attenuated correlation coefficients compared to typical (rs = .49 and .58 respectively). Similarly, *sociability* lacks significant correlations with *antagonism, consideration, distractible, fear, negative affect-anger, organized* and *positive emotion* subscales that are significantly correlated in the typically developing group. Similar patterns of non-correlations in ASD compared to the typically developing group are found for the *considerate* and *positive emotion* facets.

Subscales of the Neuroticism factor on the ICID also distinguished children with ASD from typically developing children in that parents rated children with ASD as higher in regards to expressing *fear, negative affect (anger),* and being *shy.* These significant differences resonate with previous personality/temperament research. Furthermore, atypical correlational patterns were found between the Neuroticism facets. Particularly curious is the non-significant correlation between *fear* and *shyness* (r = .13) compared to the strong correlation in typically developing peers (r = .62). *Fear* and *shyness* are highly related constructs as fear is thought to impact the amount of shyness one expresses in social situations (Kagan, 1994); however, the correlation is possibly attenuated due to its poor internal reliability of *shyness* in the ASD group (α = .32). Another atypical correlational pattern includes reversed correlations between *fear* and *openness* in the ASD group (r = .26) compared to the typically developing group (r = -.24). Notably, the *fear* measure on the ICID includes socially oriented items (*e.g.*, lacks confidence) and may be related to social anxiety, which recent evidence indicates is atypically related to approach orientation in ASD population. Specifically, children with ASD whose EEG patterns indicate higher approach orientation also experience greater levels of social anxiety, which is the opposite pattern found in typical populations (Sutton et al., 2005). Openness is related to an approach orientation for new experiences and ideas, which for an individual with ASD may lead to a greater awareness of oneself in their social world, including their personal idiosyncrasies which, once aware, could engender social anxiety. Future research investigating this relationship may prove fruitful.

The sub-scales of the Agreeableness factor on the ICID also elicited significant differences between children with ASD compared to those without. Children with ASD were rated as higher on the *antagonism* and *strong-willed* facets, and lower on *compliance.* These respectively relate to tendencies to disturb others, to push in order to obtain one's own way, and how submissive a child is to another's requests. These findings are in accordance with previous research regarding aggression, insistence on sameness, following directions in children with ASD, as well as one study reporting a sample of children with ASD as being lower on a measure of Agreeableness (De Pauw et al., 2010). Like Extraversion and Neuroticism facets, *antagonism* and *strong-willed* both displayed atypical correlational patterns for ASD groups. Compared to 14 significant correlations between *antagonism* in typically developing children, only nine of the ASD group's sub-scales were significantly correlated. Likewise, for *strong-willed* 12 significant correlations between subscales were found for typically developing children and seven for ASD.

Parents rated children with ASD as displaying worse performance than typically developing children on the facets of the Conscientiousness factor. Compared to the typical group, children with ASD were rated as less *achievement oriented* and more *distractible*, but no different on the *organized* facet. These findings generally fit with previous research indicating that children with ASD perform more poorly on Conscientiousness factors (e.g., De Pauw et al., 2010; Konstantanareas & Stewart, 2006) and facets (e.g., Adamek et al., 2011; Samyn et al., 2011). It should be noted, however, that the internal reliability was low for all three scales in the ASD group (*achievement α* = .67; *distractible α* = .39; *organized α* = .46) and the *organized* scale was low (*α* = .59) in the typically developing group. This study stands with one other (Hepburn & Stone, 2006) in the reporting of facet level internal reliabilities and one of the two Conscientiousness oriented facets (*persistence*) in their study also displayed relatively weak internal reliabilities in both the ASD (*α* =.64) and typical group (*α* = .60). Thus, it may be that the facets of Conscientiousness may not be adequately measured in ASD populations compared to

typically developing. As noted in previous paragraphs, these facets also display atypical correlations with the other ICID facets. *Achievement*, in the typical population, is significantly correlated with all 14 other facets, but in the ASD is only significantly correlated with 11 other facets. And some of the significant correlations are notably reduced compared to the typically developing group (e.g., *achievement-intelligence* correlation), even with both of the other Conscientiousness sub-facets. Similarly, *distractible* and *organized* each have significant correlations with 13 ICID facets in the typical group, but fewer in the ASD group; with several significant attenuated correlations.

The measurement of the facets of the Intellect/Openness factor in ASD is unique to this study. One other study has reported data showing that children with ASD are lower than typical children on this factor, but they did not report facet level details (De Pauw et al., 2010). The present data indicate that children with ASD are rated as lower on the *intelligence* scale, which measures parent's perceptions of their children's memory and learning abilities, and the *openness* scale, which measures parent's perceptions of their children's preference for new ideas and curiosity. As with the other scales, *openness* and *intelligence* display atypical correlational patterns with the other ICID facets in the ASD group. Whereas in the typical population the *intelligence* and *organized* facets correlate respectively with 13 and 12 of the other facets; in the ASD group they each only correlate with six other facets. As noted previously, in the case of *openness* the significant correlation with *fear* is positive for ASD, but is negative in the typically developing group. Additionally, as in previous facet correlations, several of the significant correlations in the ASD group are relatively attenuated compared to the typical group. Finally, the significant ASD group x gender interaction indicating lower *intelligence* ratings for girls with an ASD is likely related to higher levels of intellectual disability found in girls with ASD compared to boys (Rivet & Matson, 2011).

The weight of evidence discussed thus far indicates that the ICID may be used to measure personality facets in ASD populations: Most facet scales displayed similar internal

reliabilities in the ASD and typically developing groups and the differences between groups corroborate well with other known facts about ASD populations. It should be noted, however, that two of the three subscales of the Conscientiousness factor displayed unacceptably low internal reliabilities, indicating that the measure of this FFM construct may not be appropriate to use with ASD populations. Furthermore, all of the facets displayed atypical correlational patterns with the other ICID items indicating that co-variance among facets in the ASD populations may be fundamentally dissimilar than typical populations. Collectively, these atypical correlational patterns invite a closer consideration of the structure of personality in ASD groups.

Factor-Facet Personality Relationships in ASD

This study is situated within a living conversation in psychology regarding the employment of the FFM as a meta-construct for discussing individual differences between human groups, both cultural and clinical. One particularly important goal of this enterprise is to aid communication between the sub-disciplines of psychology; however, a tension can exist between the goals of inter-disciplinary communication and the specific goals within individual fields. In ASD research, the understanding of personality may inform various sub-goals within the field including broad theoretical goals, such as understanding the "spectrum" nature of ASD, and applied goals, such differentiating sub-groups within the ASD spectrum or detecting developmental trajectories. As noted earlier, a focus on the broad FFM factors may obscure informative facet level information. Furthermore, there is the question of whether the broad FFM best describes the factor-facet relationships in this clinical population. If it does not, then forcing ASD data into a FFM mold could result in accepting a model that facilitates communication between disciplines, yet stymies progress within its own discipline and results in less reliable information for all interested parties.

The correlational data presented in this study indicates the possibility that the FFM does not fit well with the facet inter-relationships in the ASD group. Crucially, this is a hypothesis that awaits the appropriate statistical analyses, not a firm conclusion gathered from the present data.

The present data set does not meet the recommended 10 participants to each scale that is widely recognized as the minimum sample size required to adequately perform the factor analytic tests this form of question requires; however, the widespread atypical correlational patterns between the ASD and typically developing groups responses invites this discussion.

A brief glance at the correlation matrix (Appendix G) clearly indicates that the top set of correlations is different than the bottom. The top set consists of ICID facet inter-correlations from the typically developing group and 97 of the 105 correlations are bolded for significance; whereas in the bottom row, where data from the ASD group is presented, only 51 of the correlations are significant. Another way to look at this is that 46 inter-facet correlations failed to meet significance in the ASD group compared to the typically developing group, despite having adequate power to detect significant relationships. In addition to these failures in significance, many of the significant correlations in the ASD group are substantially less powerful than the correlations in the typically developing group. Also, in one instance the correlation between *openness* and *fear*, displays an opposite significant relationship between groups. Collectively, the evidence indicates that the co-variance patterns of ASD populations may be substantially different from typically developing populations, which could result in different factors.

This possibility is corroborated by other published evidence indicating atypical relationships between aspects of personality, particularly from Mundy's research group that maintains typically developing psychological processes, such as personality, may be modified by the core ASD traits and lead to atypical expressions (e.g., Sutton et al., 2005; Mundy, 2007). This group reported the left-right frontal asymmetry patterns in ASD populations display atypical relationships with social-anxiety. In typical populations greater left sided activity is associated with positive affective states and greater right sided EEG activity is associated with an increased experience of negative affective states, such as anxiety; however, in children with ASD greater left sided activity is associated with anxiety. Left-right frontal asymmetry is thought to indicate basic response and reinforcement tendencies with left frontal regions associated with reward

sensitivity and right frontal regions associated with punishment sensitivity (Whittle, Allen, Lubman, & Yu, 2006). Furthermore, these regional differences are related to scope of attention with the right side activity associated with a broader attentional scope and the left side with a more narrowed attentional scope (for review and critique, see Harmon-Jones & Gable, 2008; Gable & Harmon-Jones, 2010). A narrowed attentional scope is relatively common in children with ASD (Happe & Frith, 2006) and could potentially impact schema development regarding the child's place in the world. For example, a child with ASD with greater right activity may have a greater reward orientation leading her to engage the world more than a child with greater left activity. Furthermore, this hypothetical child may have a broader scope of attention which changes their developmental trajectory in that, in addition to greater engagement with the surrounding world, the broader scope of attention allows the child to develop more relational schemas. These relational schemas could include the child as an actor with a greater sense of self-consciousness regarding their social standing and difficulties related to having an ASD. *Fear* items on the ICID and other instruments that tend to capture social anxiety would then appear to behave atypically with items, such as openness, which tend to relate to an approach orientation.

The previous scenario is hypothetical and awaits empirical investigation, but it does provide a theoretical entry point to discuss the manner in which personality may unfold atypically in this population leading to a different factor structure in ASD populations. In the typically developing populations, the FFM is nested within a larger two factor model consisting of alpha, or plasticity, and beta, or stability (see Digman, 1990 for discussion). The alpha components are the Extraversion and Intellect/Openness factors that are respectively related to an approach oriented engagement with social and cultural-intellectual interests. The beta factors include Neuroticism, Agreeableness, and Conscientiousness in which low scores are related decreased stability in social relationships and/or the ability to manage one's personal goals and behaviors. It may be that in ASD populations there is a large subgroup with greater self-

consciousness due to greater right frontal functioning resulting in a fundamentally different factor structure connecting alpha traits (e.g., openness) to beta traits (e.g., neuroticism) that do not correlate strongly in typical populations. For example, a greater sense of self within ones surrounding, including ones shortcomings, could change the affective responses of children with ASD so that socially oriented fears become associated with greater plasticity of behavior, or at least unrelated to other stability factors. Across children with ASD, this could lead to the atypical patterns reported here and result in a fundamentally different factor structure. Future research should seek to determine whether this is the case and situate the discussion in regards to the complexities of studying the factor structure of personality in a rarified population such as ASD. For example, it is possible that studying the factor structure of any sub-population, such as extraverts or introverts, may result in fundamentally different atypical factor structures and extricating ASD populations from the greater universe of participants simply capitalizes on a truncation of variance that exists for any sub-population.

With that potential limitation in mind, the results of the correlation matrix comparisons (Appendix G) indicate a promising route for future research regarding whether the factor structure of personality is fundamentally similar in ASD populations as in typical. It may be that some factors remain the same and that others change. Furthermore, it might be that five-factors are fundamentally similar, but the overarching alpha and beta factors are atypical in ASD populations leading to atypical correlation patterns between facets, but similar factor structures for the individual factors. The fact that in most cases, facets in the ASD group share the expected correlations with the other facets for the FFM factor indicates that this may be a distinct possibility.

Limitations, Conclusions, and Future Directions

The data reported here is limited in a number of ways. First, the findings reported here are limited to discussions of children in the middle childhood ages. As such, extrapolations regarding temperament in infancy, early childhood, adolescence, and beyond are inappropriate.

It may be that children with ASD continue to display the same pattern of temperament in older groups and this awaits further research. Second, autism symptomology was not measured in the typically developing group. As such, the present study did not screen out participants who may be at risk of having an ASD. Thus, some of the differences between groups may be attenuated due to the typically developing sample reporting on children with elevated ASD symptoms. Third, although this study's norm group comparisons are closer together in years compared to previous reports, approximately a decade separates these groups. Relatedly, the norm group parents responded to pencil-paper versions of the ICID, whereas the ASD group responded on-line. Furthermore, because of the decade difference and the employment of different types of questions, socio-economic status (SES) was not considered in this study. A follow up data collection, however, has just been completed on typically developing children that will allow for an analysis controlling for this important variable. Thus, future research should seek to replicate these findings with a more contemporaneous sample via the same on-line data collection method.

Personality is a promising venue to consider questions in the ASD literature. The findings of this study indicate that girls display personality patterns indicative of a "difficult temperament" more than boys with ASD and typical children of either gender. Furthermore, children with ASD differ from typical children on personality in a manner that fits with other findings in the broader ASD literature. Critically, a number of variables, such as *positive emotion, fear, negative emotion (anger),* and *activity level* can measured in infancy and the atypical inter-relations between these variables may provide clues to applied issues in ASD. Furthermore, the general findings in this report are bolstered by a companion study of ASD children in Early Childhood with almost identical results. The ICID may be used to study personality in children as young as 2 and as old as 15. Thus it is an ideal instrument to use for longitudinal studies and future research should consider employing for this purpose to track temperament change differences in ASD compared to typical populations.

References

Adamek, L., Nichols, S., Tetenbaum, S., Bregman, J., Ponzio, C., & Carr, E. (2011). Individual Temperament and Problem Behavior in Children With Autism Spectrum Disorders. *Focus on Autism and Other Developmental Disorders, 76*, 173-183.

Austin, E. J. (2005). Personality correlates of the broader autism phenotype as assessed by the Autism Spectrum Quotient (AQ). *Personality and Individual Differences, 38*, 451–460.

Auyeung, B., Baron-Cohen, S., Wheelwright, S., & Allison, C. (2008). Development of the autism spectrum quotient – children's version (AQ-Child). *Journal of Autism and Developmental Disorders, 38,* 1230-1240.

Baron-Cohen, S., Hoekstra, R. A., Knickmeyer, R., & Wheelwright, S. (2006). The Autism-Spectrum Quotient (AQ)--adolescent version. *Journal of Autism and Developmental Disorders, 36,* 343-350.

Baron-Cohen, S., Wheelwright, S., Skinner, R., Martin, J., & Clubley, E. (2001). The autism-spectrum quotient (AQ): Evidence from Asperger Syndrome/high-functioning autism, males and females, scientists and mathematicians. *Journal of Autism and Developmental Disorders, 31*, 5–17.

Bailey, D. B., Hatton, D. D., Mesibov, G., Ament, N., & Skinner, M. (2000). Early development, temperament, and functional impairment in autism and fragile X syndrome. *Journal of Autism and Developmental Disorders, 30*, 49–59.

Berk, L. E. (2007). *Development through the Lifespan*. Boston, MA: Allyn and Bacon.

Bieberich, A. A., & Morgan, S. B. (1998). Affective expression in children with autism or Down syndrome. *Journal of Autism and Developmental Disorders, 28*, 333–338.

Bouchard, T. J., & Loehlin, J. C. (2001). Genes, evolution, and personality. *Behavior Genetics, 31*, 243–273.

Bouchard, T. J., & McGue, M. (2003). Genetic and environmental influences on human psychological differences. *Journal of Neurobiology, 54*, 4–45.

Burnette, C., Henderson, H., Inge, A., Zahka, N., Schwartz, C., & Mundy, P. (2010). Anterior EEG asymmetry and the modifier model of autism. *Journal of Autism and Developmental Disorders, 41*, 1112-1124.

Buss, A. H., & Plomin, R. (1984). *Temperament: Early developing personality traits.* Hillsdale, NJ: Erlbaum.

Capps, L. Kasari, C., Yirmiya, N., & Sigman, M. (1993). Parental perception of emotional expressiveness in children with autism. *Journal of Consulting and Clinical Psychology, 61*, 475–484.

Cheung, F. M., Leung, K., Zang, J. X., Sun, H. F., Gan,Y. Q., Song,W. Z., & Xie, D. (2001). Indigenous Chinese personality constructs: Is the five-factor model complete? *Journal of Cross-Cultural Psychology, 32,* 407-433.

Clark, L. A. (2005). Temperament as a unifying basis for personality and psychopathology. *Journal of Abnormal Psychology, 114*, 505–521.

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112,* 155-159.

Dapretto, M., Davies, M.S., Pfeifer, J.H., Scott, A.A., Sigman, M., Bookheimer, S.Y., & Iacoboni, M. (2006). Understanding emotions in others: Mirror neuron dysfunction in children with autism spectrum disorders. *Nature Neuroscience, 9*, 28–30.

Deal, J. E., Halverson, C. F., Martin, R. P., Victor, J., & Baker, S. (2007). The Inventory of Children's Individual Differences: Development and validation of a short version. *Journal of Personality Assessment, 89*, 162–166.

De Pauw, S., Mervielde, I., & Van Leeuwen, K. G. (2009). How are traits related to problem behavior in preschoolers? Similarities and contrasts between temperament and personality. *Journal of Abnormal Child Psychology, 37*, 309–325.

De Pauw, S. & Mervielde, I. (2010). Temperament, personality and developmental psychopathology: A review based on the conceptual dimensions underlying childhood traits. *Child Psychiatry and Human Development, 41*, 313–329.

Digman, J. M. (1990). Personality structure: Emergence of the Five-Factor Model. *Annual Review of Psychology, 41*, 417-40.

Digman, J. (1997). Higher order factors of the Big Five. *Journal of Personality and Social Psychology, 73*, 1246-1257.

Else-Quest, N., Hyde, J., Goldsmith, H., & Van Hulle, C. (2006). Gender differences in temperament: A meta-analysis. *Psychological Bulletin, 132*, 33–72.

Fombonne, E. (2003). Epidemiological surveys of autism and other pervasive developmental disorders. *Journal of Autism and Developmental Disorders, 33,* 365-382.

Feldt, L. (1969). A test of the hypothesis that Cronbach's alpha or Kuder-Richardson coefficient is the same for two tests administered to the same sample. *Psychometrika, 34*, 363-373.

Gable, P., & Harmon-Jones, E. (2010). The motivational dimensional model of affect: Implications for breadth of attention, memory, and cognitive categorization. *Cognition & Emotion, 24,* 322–337.

Garon, N., Bryson, S., Zwaigenbaum, L., Smith, I., Brian, J., Roberts, W., & Szatmari, P. (2009). Temperament and its relationship to autistic symptoms in a high-risk infant sib cohort. *Journal of Abnormal Child Psychology, 37*, 59–78.

Gartstein, M. A., & Marmion, J. (2008). Fear and positive affectivity in infancy: Convergence/discrepancy between parent-report and laboratory-based indicators. *Infant Behavior and Development, 31*, 227-238.

George, D., & Mallery, P. (2003). *SPSS for Windows step by step: A simple guide and reference. 11.0 update (4th ed.).* Boston: Allyn & Bacon.

Gosling, S. (2001). From mice to men: What can we learn about personality from animal research? *Psychological Bulletin, 127*, 45-86.

Gosling, S. D., & John, O. P. (1999). Personality dimensions in nonhuman animals: A cross-species review. *Current Directions in Psychological Science, 8*, 69–75.

Halverson, C., Havill, V., Deal, J., Victor, J., Pavlopolous, V., … Wen, L. (2003). Personality

structure as derived from parental ratings of free descriptions of children: The Inventory of Children's Individual Differences. *Journal of Personality, 71*, 995-1026.

Harmon-Jones, E., & Gable, P. A. (2008). Incorporating motivational intensity and direction into the study of emotions: Implications for brain mechanisms of emotion and cognition emotion interactions. *Netherlands Journal of Psychology, 64,* 132-142.

Henson, R, & Roberts, K. (2006). Use of exploratory factor analysis in published research. *Educational and Psychological Measurement, 66*, 393-416.

Hepburn, S. L., & Stone, W. L. (2006). Using Carey temperament scales to assess behavioral style in children with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 36*, 637–642.

Howell, D. C. (2007). *Statistical methods for psychology*. Belmont, CA: Thompson Wadsworth.

Huberty, C. J., & Petoskey, M. D. (2000). Multivariate analysis of variance and covariance. In H., Tinsley, & S., Brown (Eds.). *Handbook of applied multivariate statistics and mathematical modeling.* New York: Academic Press.

Jaffari-Bimmel, N., Juffer, F., van IJzendoorn, M., Bakersman-Kranenburg, M., & Mooijaart, A. (2006). Social development from infancy to adolescence: Longitudinal and concurrent factors in an adoption sample. *Developmental Psychology, 42*, 1143-1153.

Kagan, J. (1994). *Galen's Prophecy*. New York: Basic Books.

Konstantareas, M., & Papageorgiou, V. (2006). Effects of temperament, symptom severity and level of functioning on maternal stress in Greek children and youth with ASD. *Autism, 10*, 593-607.

Konstantareas, M. M., & Stewart, K. (2006). Affect regulation and temperament in children with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 36*, 143–153.

McCrae, R. R., & Costa, P. T. (1987). Validation of the 5-factor model of personality across instruments and observers. *Journal of Personality and Social Psychology, 52*, 81–90.

McAdams, D. P., & Olson, B. D. (2009). Personality development: Continuity and change over the life course. *Annual Review of Psychology, 61*, 5.1-5.26.

Meadan, H., Stoner, J., & Angell, M. (2010) Review of Literature Related to the Social, Emotional, and Behavioural Adjustment of Siblings of Individuals with Autism Spectrum Disorder. *Journal of Developmental and Physical Disability. 22,* 83-100.

Mervielde, I., & De Fruyt, F. (2002). Assessing children's traits with the hierarchical personality inventory for children. In B., De Raad, & M., Perugini (Eds.). *Big Five Assessment* (pp. 129–146). Seattle: Hogrefe & Huber.

Meyers, L.S., Gamst, G., & Guarino, A. (2006). *Applied multivariate research: Design and interpretation.* Thousand Oaks, CA: Sage Publishers.

Mundy, P.C., Henderson, H.A., Inge, A.P., & Coman, D.C. (2007). The modifier model of autism and social development in higher functioning children. *Research and Practice for Persons with Severe Disabilities, 32*, 1–16.

Muris, P., & Ollendick, T. H. (2005). The role of temperament in the etiology of child psychopathology. *Clinical Child and Family Psychology Review, 8*, 271–289.

Nettle, D. (2006). The evolution of personality variation in humans and other animals. *American Psychologist, 61,* 622-631.

Nigg, J. T. (2006). Temperament and developmental psychopathology. *Journal of Child Psychology and Psychiatry, and Allied Disciplines, 47*, 395–422.

Rivers, J.W., & Stoneman, Z. (2008). Child temperaments, differential parenting, and the sibling relationships of children with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 38*, 1740-1750.

Rivet, T., & Matson, J., (2011). Review of gender differences in core symptomatology in autism spectrum disorders. *Research in Autism Spectrum Disorders, 5*, 957–976.

Roberts, B. W., & DelVecchio, W. F. (2000). The rank-order consistency of personality traits from childhood to old age: A quantitative review of longitudinal studies. *Psychological*

Bulletin, 126, 3–25.

Rothbart, M., & Bates, J. (1998). Temperament. In W., Damon & N., Eisenberg (Eds.).

    Handbook of child psychology: Social. emotional, and personality' development (Vol. 3,

    pp. 105-176). New York: Wiley.

Rothbart, M. K., Ahadi, S. A., Hershey, K. L., & Fisher, P. (2001). Investigations of

    temperament at three to seven years: The children's behavior questionnaire. *Child*

    Development, 72, 1394–1408.

Rothbart, M. K. (2007). Temperament, development, and personality. *Current Directions in*

    Psychological Science, 16, 207–212.

Samyn, V., Roeyers, H., & Bijttebier, P. (2011). Effortful control in typically developing boys and

    in boys with ADHD or autism spectrum disorder. *Research on Developmental Disability*

    32, 483–490.

Schwartz, C. B., Henderson, H. A., Inge, A. P., Zahka, N. E., Coman, D. C., Kojkowski, N. M.,

    …. Mundy, P. (2009). Temperament as a predictor of symptomotology and adaptive

    functioning in adolescents with high-functioning autism. *Journal of Autism and*

    Developmental Disorders, 39, 842–855.

Shiner, R., (1998). How shall we speak of children's personality in middle childhood? A

    preliminary taxonomy. *Psychological Bulletin, 124*, 308-332.

Shiner, R., Masten, A., & Roberts, J. (2003). Childhood personality foreshadows adult

    personality and life outcomes two decades later. *Journal of Personality, 71*, 1145-1170.

Stewart, M., & Austin, E. (2009). The structure of the autism spectrum quotient (AQ): Evidence

    from a student sample in Scotland. *Personality and Individual Differences, 47,* 224–228.

Sutton, S. K., Burnette, C. P., Mundy, P. C., Meyer, J., Vaughan, A., Sanders, C., & Yale, M.

    (2005). Resting cortical brain activity and social behavior in higher functioning children

    with autism. *Journal of Child Psychology and Psychiatry, and Allied Disciplines, 46*, 211–

    222.

Thomas, A., & Chess, S. (1977). *Temperament and development.* New York: Brunner/Mazel.

Whittle, S., Allen, N. B., Lubman, D. I., & Yu¨cel, M. (2006). The neurobiological basis of temperament: Towards a better understanding of psychopathology. *Neuroscience and Biobehavioral Reviews, 30,* 511–525.

Worley, J., & Matson, J. (2011). Psychiatric symptoms in children diagnosed with an autism spectrum disorder: An examination of gender differences. *Research in Autism Spectrum Disorders, 5*, 1086–1091.

Zentner, M. & Bates, J. E. (2008). Child Temperament: An integrative review of concepts, research programs, and measures. *European Journal of Developmental Science, 2*, 7-37.

Zwaigenbaum, L., Bryson, S., Rogers, T., Roberts, W., Brian, J., & Szatmari, P. (2005). Behavioral manifestations of autism in the first year of life. *International Journal of Developmental Neuroscience, 23*, 143–152.

CHAPTER 4:

CONCLUSIONS

Summary of Findings

The primary goal of these two dissertation studies was to determine the usefulness of the Inventory of Children's Individual Differences-Short Form (ICID; Deal) for differentiating children with autism spectrum disorder (ASD) from typically developing children. In both studies this, goal was accomplished via the employment of a 2 (diagnostic group) X 2 (gender) MANCOVA statistically controlling for the age of participants. Across children in the Early Childhood (EC) stage of development (Study One) and the Middle Childhood (MC) stage of development (Study Two) we garnered evidence indicating that children with ASD may be differentiated from typically developing children according to their facet scores on a measure of personality. Across both studies children with ASD during EC and MC displayed the following pattern of scores compared to typically developing peers: 1) Higher reported levels of antagonism, *distractibility, fear, negative emotion (anger), shyness,* and *strong-willed*; and 2) lower reported levels of *achievement, compliance, consideration, intelligence, openness, positive emotion,* and *sociability*. No group differences were found for either *activity level* for both age groups, and *organization* skills showed non-significantly trended towards lower in ASD during EC. Furthermore, across both studies the three item scale for the *sociability* facet displayed the largest effect size.

In addition to group differences, both studies support that some inter-relationships between the items on particular personality facets, as well as the correlations between the facets themselves, differed substantially between groups of children with ASD and typically developing children. In both studies, compared to the typically developing group the internal reliability of the *distractible* and shy scales were significantly lower in the ASD group and fell below established standards for adequate reliability. In regards to the relationships between facets, both studies found that *activity level*, a purported "basic" personality facet measured as

young as infancy and a consistent correlate of the broad personality trait of Extraversion (Buss & Plomin, 1994), did not correlate with other personality facets in the ASD group in the same manner that it did in the typically developing group. Of particular interest, is the fact that across EC and MC *activity level* displayed mostly non-significant relationships with other Extraversion related facets, with one significant correlation during MC with *sociability* that was significantly lower in the ASD group compared to the typically developing group. Similar non-significant or weakly significant correlations for the ASD group compared to the typically developing were found during EC and MC between the Neuroticism facets of *fear* and *shyness.*

Studies one and two did differ to some degree in regards to which particular facets displayed weaker internal reliabilities and which inter-facet relationships were weaker or non-significant in the ASD group compared to the typically developing group. For example, during MC, but not EC, the internal reliabilities of the *achievement, compliance, intelligence*, and *openness* scales were significantly lower in the ASD group compared to the typically developing group. Furthermore, in study one, during EC correlational patterns were found in opposite directions for ASD compared to typically developing groups for the facets of *activity level* and *achievement*, as well as the *activity level* and *compliance* facets. These were not found during MC. During MC, but not EC, significantly different inversed correlational patterns between ASD and typically developing groups were found between the facets of *fear* and *openness.*

Collectively, these atypical correlational patterns at the item and facet levels indicate that the factor structure of personality may be fundamentally different in ASD populations compared to typically developing populations. The differences, however, may be age or developmental stage specific. Future research should seek to determine whether differences exist between the factor structure of purportedly "basic" personality variables in children with ASD and typically developing children.

There were also significant gender X ASD interactions in both studies. First, in both studies parents rated girls with an ASD significantly higher than boys with an ASD and typically

developing children of either gender on the *intelligence* facet. This is likely related to the well-known gender disparity in cognitive functioning in ASD populations (Rivet & Matson, 2011).The results of study two, but not study one, indicated that parents rated girls with ASD as higher than boys with ASD and typically developing children of either gender on the facets of *negative affect (anger), antagonism*, and strong willed, as well as lower on the facets of *positive emotion, compliance* and *intelligence*, with *anger* displaying the greatest effect size. This pattern is conceptually similar to Thomas and Chess's (1977) classic conception of the "difficult" child.

Future Directions

The findings of these studies indicate several fruitful venues for future research. In particular, the present findings indicate that measurement invariance investigations comparing the factor structures of personality in ASD and typically developing groups would be informative. The present state of affairs in research on personality in ASD involves taking established measures, comparing groups, and assuming that the construct measured is fundamentally similar across groups. The present study indicates that this assumption, for some constructs, may be unwarranted and continuing with this presumption could lead to spurious conclusions.

In line with measurement invariance approaches, further investigating the relationship between *activity level, positive emotion*, and *sociability* in ASD infants seems warranted. In typically developing populations, these three facets are early forming, highly correlated, and thought to be core aspects of the emerging factor of Extraversion (Buss & Plomin, 1994); however, in the presently reported studies, and previous reports, these facets are decoupled in ASD. It may be that in ASD populations autism screeners could employ measures of these constructs for developing scales that distinguish children that develop ASD and those that do not.

One final area of future research involves the relationship between gender and negative emotionality in ASD populations. While there is some data to support our findings regarding higher levels of anger and aggression in girls with ASD the data collected to date involves

second person ratings of the individual. This could present a problem as a number of factors could impact the view of the rater regarding the behavior of children. In particular, it is possible that gender values and attitudes could negatively impact temperament ratings of ASD girls. For example, if parents' cultural values maintain that girls are expected to be sweet, but aggression is okay for boys, anger and aggression exhibited by a girl may be rated higher than a boy, even if the actual levels are similar. Thus, *in vivo* research measuring the actual behaviors of boys and girls may establish whether the second party ratings indicating more difficult personalities in girls with ASD actually reflect true behaviors or personal values/attitudes held by the rater.

References

Buss, A. H., & Plomin, R. (1984). *Temperament: Early developing personality traits.* Hillsdale, NJ: Erlbaum.

Rivet, T., & Matson, J., (2011). Review of gender differences in core symptomatology in autism spectrum disorders. *Research in Autism Spectrum Disorders, 5*, 957–976.

Thomas, A., & Chess, S. (1977). *Temperament and development.* New York: Brunner/Mazel.

APPENDIX A: AUTISM DIAGNOSTIC FORM

My child received a diagnosis of (check one):

Autism (Autistic Disorder) _____

Aspergers Syndrome (Asperger's Disorder) _____

Pervasive Developmental Disorder, Not Otherwise Specified (PDD-NOS)_____

Autism Spectrum Disorder (ASD)_____

Other (Please Specify)_____

This diagnosis was made by a (check all that apply):

Master's Degree level psychologist_____

Doctoral (Ed.D. or Ph.D.) Degree level psychologist_____

Licensed Clinical Social Worker or Clinical Social Worker (LCSW/CSW)_____

Psychiatrist (M.D.) _____

Neurologist (M.D.) _____

Family Physician (M.D.) _____

Pediatrician (M.D.) _____

Developmental Pediatrician (M.D.) _____

Speech Language Pathologist (SLP) _____

Occupational Therapist (OT) _____

Other_____

Instruments used to inform diagnoses (check all that apply):

Autism Diagnostic Interview-Revised (ADI-R) _____   Total Score____

Autism Diagnostic Observation Schedule (ADOS) _____ Total Score____

Childhood Autism Rating Scale (CARS or CARS-2) _____ Total Score_____

Social Communication Questionnaire (SCQ) _____ Total Score_____

Other(s)_____ Total Score____

Instruments used to measure functioning (check all that apply):

IQ/Language:

Leiter-R   ____   Total Score _____

Mullen Scales of Early Learning (Mullen) _____   Total Score

Peabody Picture Vocabulary Test-III or IV _____ Total Score_____

Woodcock-Johnson Tests of Cognitive Ability (W-J-III) _____ Total Score____

Weschler Intelligence Scale for Children (WISC)_____ Total Score____

Stanford Binet-5 _____ Total Score_____

Other _____ Total Score_____

Adaptive Behavior:

Adaptive Behavior Assessment Scale (ABAS/ABAS-2) _____   Total Score _____

Scales of Independent Behavior – Revised (SIB-R)   _____   Total Score _____

Vineland Adaptive Behavior Scales (Vineland/Vineland-2) ____   Total Score _____

Other _____ Total Score_____

APPENDIX B: DEMOGRAPHIC INFORMATION

Child Information

Child's date of birth _____/_____/_____

(month)   (day)   (year)

Child's gender (Check One) _____ male _____ female

Child's race (Check One) _____African American

_____White/Caucasian

_____ Asian American

_____ Native American

_____ Other (Please Specify):_____

Child's Ethnicity (Check One)_____Latino

_____non-Latino

_____ Other (Please Specify):_____

Birth order of child: Firstborn_____, Second_____, Third_____, Other (please specify)_____

Number of Siblings: _____

Mother's information

Mother's marital status:_____ married _____ divorced _____separated _____ single

Mother's race (Check One)   _____African American

_____White/Caucasian

_____ Asian American

_____ Native American

_____ Other (Please Specify):_____

Mother's Ethnicity (Check One)   _____Latino

_____non-Latino

_____ Other (Please Specify):_____

Mother's education (Check One):

_____ did not complete high school

_____ high school degree

_____ Associate's degree

_____ Bachelor's degree

_____ Master's degree

_____ Doctoral degree

Mother's occupation: _____

Mother's yearly income (Check one):

____<$22,000 _____$22,001-$39,999_____ $40,000-$59,999____ $60,000-$79,999___

$80,000 and over

Mother's religious preference: _____

Father's information

Father's marital status:_____ married _____ divorced _____separated _____ single

Father's race (Check One)   _____African American

_____White/Caucasian

_____ Asian American

_____ Native American

_____ Other (Please Specify):_____

Father's Ethnicity (Check One)   _____Latino

_____non-Latino

_____ Other (Please Specify):_____

Father's education (Check One):

_____ did not complete high school

_____ high school degree

_____ Associate's degree

_____ Bachelor's degree

_____ Master's degree

_____ Doctoral degree

Father's occupation: _____

Father's yearly income (Check one):

____<$22,000 _____$22,001-$39,999_____ $40,000-$59,999____ $60,000-$79,999___

$80,000 and over

Father's religious preference: _____

APPENDIX C: AUTISM QUOTIENT- CHILDREN"S VERSION

NOTE: This questionnaire is to be completed by the parent/guardian of each child aged 4 and

above. Please complete all three pages.

Name ……………………………………………

Date of Birth (Month in words) ………………   Today's date (Month in words)……………..

Address………………………………………………………………………………………….

Please answer each of the following questions about your child or the person who is under your

care by ticking a box that reflects your answer to the question most appropriately. If

there is any question that you feel not able to comment, please ask your son, daughter,

partner or the person to answer.

Definitely Agree   Slightly Agree Slightly Disagree   Definitely Disagree

1.   S/he prefers to do things with others rather than on her/his own.

2.   S/he prefers to do things the same way over and over again.

3.   If s/he tries to imagine something, s/he finds it very easy to create a picture in her/his

mind.

4.   S/he frequently gets so strongly absorbed in one thing that s/he loses sight of other

things.

5.   S/he often notices small sounds when others do not.

6.   S/he usually notices house numbers or similar strings of information.

7.   S/he has difficulty understanding rules for polite behaviour.

8.   When s/he is read a story, s/he can easily imagine what the characters might look like.

9.   S/he is fascinated by dates.

10.   In a social group, s/he can easily keep track of several different people's conversations.

11.   S/he finds social situations easy.

12.   S/he tends to notice details that others do not.

13.   S/he would rather go to a library than a birthday party.

Definitely Agree   Slightly Agree Slightly Disagree   Definitely Disagree

14.   S/he finds making up stories easy.

15.   S/he is drawn more strongly to people than to things.

16.   S/he tends to have very strong interests, which s/he gets upset about if s/he can't

pursue.

17.   S/he enjoys social chit-chat.

18.   When s/he talks, it isn't always easy for others to get a word in edgeways.

19.   S/he is fascinated by numbers.

20.   When s/he is read a story, s/he finds it difficult to work out the characters' intentions or

feelings.

21.   S/he doesn't particularly enjoy fictional stories.

22.   S/he finds it hard to make new friends.

23.   S/he notices patterns in things all the time.

24.   S/he would rather go to the cinema than a museum.

25.   It does not upset him/her if his/her daily routine is disturbed.

26.   S/he doesn't know how to keep a conversation going with her/his peers.

27.   S/he finds it easy to "read between the lines" when someone is talking to her/him.

28.   S/he usually concentrates more on the whole picture, rather than the small details.

29.   S/he is not very good at remembering phone numbers.

30.   S/he doesn't usually notice small changes in a situation, or a person's appearance.

31.   S/he knows how to tell if someone listening to him/her is getting bored.

32.   S/he finds it easy to go back and forth between different activities.

33.   When s/he talk on the phone, s/he is not sure when it's her/his turn to speak.

Definitely Agree   Slightly Agree   Slightly Disagree   Definitely Disagree

34.   S/he enjoys doing things spontaneously.

35.   S/he is often the last to understand the point of a joke.

36.   S/he finds it easy to work out what someone is thinking or feeling just by looking at their face.

37.   If there is an interruption, s/he can switch back to what s/he was doing very quickly.

38.   S/he is good at social chit-chat.

39.   People often tell her/him that s/he keeps going on and on about the same thing.

40.   When s/he was in preschool, s/he used to enjoy playing games involving pretending with other children.

41.   S/he likes to collect information about categories of things (e.g. types of car, types of bird, types of train, types of plant, etc.).

42.   S/he finds it difficult to imagine what it would be like to be someone else.

43.   S/he likes to plan any activities s/he participates in carefully.

44.   S/he enjoys social occasions.

45.   S/he finds it difficult to work out people's intentions.

46.   New situations make him/her anxious.

47.   S/he enjoys meeting new people.

48.   S/he is good at taking care not to hurt other people's feelings.

49.   S/he is not very good at remembering people's date of birth.

50.   S/he finds it very to easy to play games with children that involve pretending.

☐BA-SBC-SW-CA

APPENDIX D: AUTISM QUOTIENT: ADOLESCENT VERSION

The Adolescent Autism Spectrum Quotient (AQ)

Ages 12-15 years

SPECIMEN, FOR RESEARCH USE ONLY.

For full details, please see:

S. Baron-Cohen, R. Hoekstra, R. Knickmeyer, S. Wheelwright, (2006)

The Autism Spectrum Quotient (AQ) – Adolescent Version

Journal of Autism and Developmental Disorders.

Name:......................................   Sex:...

Date of birth:................................   Today's Date...............................

How to fill out the questionnaire

Below is a list of statements about your child. Please read each statement very carefully and

rate how strongly you agree or disagree by selecting the appropriate option opposite

each question.

 DO NOT MISS ANY STATEMENT OUT [i.e., Please complete every questions].

Examples

E1. S/he is willing to take risks.

definitely

agree   slightly

agree   slightly

disagree   definitely

disagree

E2. S/he likes playing board games.

definitely

agree   slightly

agree   slightly

disagree   definitely

disagree

E3. S/he finds learning to play musical instruments easy.   definitely

agree   slightly

agree   slightly

disagree   definitely

disagree

E4. S/he is fascinated by other cultures.   definitely

agree   slightly

agree   slightly

disagree   definitely

disagree

Definitely Agree   Slightly Agree Slightly Disagree   Definitely Disagree

1.   S/he prefers to do things with others rather than on her/his own.

2.   S/he prefers to do things the same way over and over again.

3.   If s/he tries to imagine something, s/he finds it very easy to create a picture in her/his mind.

4.   S/he frequently gets so strongly absorbed in one thing that s/he loses sight of other things.

5.   S/he often notices small sounds when others do not.

6.   S/he usually notices car number plates or similar strings of information.

7.   Other people frequently tell her/him that what s/he has said is impolite, even though s/he thinks it is polite.

8.   When s/he is reading a story, s/he can easily imagine what the characters might look like.

9.   S/he is fascinated by dates.

10.   In a social group, s/he can easily keep track of several different people's conversations.

11.   S/he finds social situations easy.

12.   S/he tends to notice details that others do not.

13.   S/he would rather go to a library than a party.

14.   S/he finds making up stories easy.

15.   S/he finds her/himself drawn more strongly to people than to things.

16. S/he tends to have very strong interests, which s/he gets upset about if s/he can't pursue.

17. S/he enjoys social chit-chat.

18. When s/he talks, it isn't always easy for others to get a word in edgeways.

19. S/he is fascinated by numbers.

20. When s/he is reading a story, s/he finds it difficult to work out the characters' intentions.

21. S/he doesn't particularly enjoy reading fiction.

22. S/he finds it hard to make new friends.

23. S/he notices patterns in things all the time.

24. S/he would rather go to the theatre than a museum.

25. It does not upset him/her if his/her daily routine is disturbed.

26. S/he frequently finds that s/he doesn't know how to keep a conversation going.

27. S/he finds it easy to "read between the lines" when someone is talking to her/him.

28. S/he usually concentrates more on the whole picture, rather than the small details.

29. S/he is not very good at remembering phone numbers.

30. S/he doesn't usually notice small changes in a situation, or a person's appearance.

31. S/he knows how to tell if someone listening to him/her is getting bored.

32. S/he finds it easy to do more than one thing at once.

33.   When s/he talks on the phone, s/he is not sure when it's her/his turn to speak.

34.   S/he enjoys doing things spontaneously.

35.   S/he is often the last to understand the point of a joke.

36.   S/he finds it easy to work out what someone is thinking or feeling just by looking at their face.

37.   If there is an interruption, s/he can switch back to what s/he was doing very quickly.

38.   S/he is good at social chit-chat.

39.   People often tell her/him that s/he keeps going on and on about the same thing.

40.   When s/he was younger, s/he used to enjoy playing games involving pretending with other children.

41.   S/he likes to collect information about categories of things (e.g. types of car, types of bird, types of train, types of plant, etc.).

42.   S/he finds it difficult to imagine what it would be like to be someone else.

43.   S/he likes to plan any activities s/he participates in carefully.

44.   S/he enjoys social occasions.

45.   S/he finds it difficult to work out people's intentions.

46.   New situations make him/her anxious.

47.   S/he enjoys meeting new people.

48.   S/he is a good diplomat.

49.   S/he is not very good at remembering people's date of birth.

50.   S/he finds it very to easy to play games with children that involve pretending.

☐ MRC-SBC/SJW Feb 1998

APPENDIX E: INVENTORY OF CHILDREN'S INDIVIDUAL DIFFERENCES- SHORT VERSION

Please read each statement. Look at the scale and circle the number that corresponds to the

degree that you think that statement describes your child in comparison to other child

his/her age.

1 = Much less than the average child or not at all

2 = Less than the average child

3 = Slightly less than the average child

4 = Same as the average child

5 = Slightly more than the average child

6 = More than the average child

7 = Much more than the average child

My Child….

1.   Is self-disciplined ……………………………….. 1   2   3   4   5
                6   7

2.   Is energetic …………………………………….…   1   2   3   4   5
                6   7

3.   Is mean……………………………………………   1   2   3   4   5
                6   7

4   Is obedient ………………………….…   1   2   3   4   5   6   7

5.   Is thoughtful of others …………………………….. 1   2   3   4   5
                6   7

6.   Has a short attention span……………………….   1   2   3   4
           5   6   7

7. Is insecure ……………………………………… 1   2   3   4   5
      6   7

8. Is quick to learn …………………………….. 1   2   3   4   5
      6   7

9. Is irritable ………………………………….… 1   2   3   4   5
      6   7

10. Has a lot of imagination ……………………… 1   2   3   4   5
      6   7

11. Is disorganized ……………………………… 1   2   3   4   5
      6   7

12. Is a joy to be with ………………………….… 1   2   3   4   5
      6   7

13. Is withdrawn ………………………………..… 1   2   3   4   5
      6   7

14. Is sociable …………………………………… 1   2   3   4   5
      6   7

15. Is stubborn …………………………………... 1   2   3   4   5
      6   7

16. Is a hard worker ……………………………... 1   2   3   4   5
      6   7

17. Is always on the move ……………………….1   2   3   4   5
      6   7

18. Is rude ………………………………………... 1   2   3   4   5
      6   7

19. Is considerate ……………………………….. 1   2   3   4   5
      6   7

20. Is easily distracted ……………………………….. 1　　2　　3　　4　　5

　　　　6　　7

21. Is fearful ……..…………………………………1 2　　3　　4　　5　　6

　　　　7

22. Has a good memory ………………………………1　　2　　3　　4　　5

　　　　6　　7

23. Is quick-tempered ……　　　1　　2　　3　　4　　5　　6　　7

24. Is interested in new things ……………………………　　　1　　2　　3　　4

　　　　5　　6　　7

25. Is organized …………………………………….. 1　　2　　3　　4　　5

　　　　6　　7

26. Is sweet ………………………………………… 1　　2　　3　　4　　5

　　　　6　　7

27. Is slow to warm up to new people or situations …………　　1　　2　　3　　4

　　　　5　　6　　7

28. Is outgoing …………………………………….. 1　　2　　3　　4　　5

　　　　6　　7

29. Is hard-headed ………………………………… 1　　2　　3　　4　　5

　　　　6　　7

30. Has a drive to do better …………………………………　　1　　2　　3　　4

　　　　5　　6　　7

31. Is active physically …………………………….. 1　　2　　3　　4　　5

　　　　6　　7

32. Is disobedient …………………………………. 1　　2　　3　　4　　5

　　　　6　　7

33. Is dependable and trustworthy …………………………   1   2   3   4

        5   6   7

34. Is sensitive to others' feelings …………………………1   2   3   4   5

        6   7

35. Forgets things easily ………………………………… 1   2   3   4   5

        6   7

36. Is afraid of a lot of things ……………………………… 1   2   3   4   5

        6   7

37. Has good thinking abilities …………………………… 1   2   3   4   5

        6   7

38. Gets angry easily ……………………………………... 1   2   3   4   5

        6   7

39. Is curious …………………………………………….. 1   2   3   4   5

        6   7

40. Keeps things neat and tidy …………………………….   1   2   3   4

        5   6   7

41. Is loving …………………………………………….. 1   2   3   4   5

        6   7

42. Has difficulty making friends ………………………… 1   2   3   4   5

        6   7

43. Loves to be with other people …………………………   1   2   3   4

        5   6   7

44. Wants things his/her own way………………………… 1   2   3   4   5

        6   7

45. Lacks confidence …………………………………… 1   2   3   4   5

        6   7

46. Likes to ask questions …………………………….. 1   2   3   4   5

        6   7

47. Does things carefully and with thought ……….……   1   2   3   4

        5   6   7

48. Has difficulty adjusting to new situations ……………   1   2   3   4

        5   6   7

49. Makes friends easily ……………………   1   2   3   4   5   6

        7

50. Manipulates to get his/her own way ……………………   1   2   3   4

        5   6   7

ICID_S Scoring

Scale and Item   Item Number

Achievement Orientation:

    self-disciplined   1

    a hard worker   16

    a drive to do better   30

Activity Level

    energetic   2

    always on the move   17

    active physically   31

Antagonism

    mean   3

    rude   18

    disobedient   32

Compliance

    obedient   4

    self-disciplined   1

    dependable and trustworthy   33

Considerate

    thoughtful of others   5

    considerate   19

    sensitive to others' feelings   34

Distractible

    a short attention span   6

    easily distracted   20

    forgets things easily   35

Fearful/Insecure

    insecure   7

    fearful   21

    afraid of a lot of things   36

    lacks confidence   45

Intelligent

    quick to learn   8

    a good memory   22

    good thinking abilities   37

Negative Affect

    irritable   9

    quick-tempered   23

    gets angry easily   38

Openness to Experience

    a lot of imagination   10

    interested in new things   24

    curious   39

    likes to ask questions   46

Organized

    disorganized   11R

    organized   25

    keeps things neat and tidy   40

    does things carefully and with thought   47

Positive Emotions

    a joy to be with   12

    sweet   26

    loving   41

Shy

    withdrawn   13

    slow to warm up to new people or situations   27

    difficulty making friends   42

    difficulty adjusting to new situations   48

Sociable

    sociable   14

    outgoing   28

    loves to be with other people 43

    makes friends easily   49

Strong-Willed

    stubborn   15

    hard-headed   29

    wants things his/her own way 44

    manipulates to get his/her own way 50

FACET SCORING

Neurotocism = strong + shy   + negaff + fear + distr + antag.

Extraversion = strong + social + posemo + open + actlev - shy + consid.

Openness = intel + achori + open.

Agreeableness = posemo + consid - strong - negaff - antag.

Conscientiousness = org + achori - distr.

APPENDIX F: COMPARISON LIST OF TEMPERAMENT AND PERSONALITY MEASURES

Extraversion Oriented Scales

Author	Measure	Factor	Facets	Abbreviated Sample Item
Mervielde et al.	**HiPIC**	**Extraversion**	Energy	has excessive energy
			Expressiveness	keeps feelings to self
			Optimism	sees the sunny side
			Shyness	establishes contact with classmates
Deal et al.	**ICID**	**Extraversion**	Activity Level	is energetic
			Positive Emotions	is loving
			Shy	is withdrawn
			Sociability	is outgoing
Rothbart	**ECBQ**	**Surgency**	Activity Level	often taps/drums fingers
			High intensity Pleasure	excited when receiving gift
			Positive Anticipation	excited by news of visiting friend
			Sociability	seeks out company of children
Rothbart	**CBQ**	**Surgency**	Activity Level	always seems to be in a hurry
			High Intensity Pleasure	likes adventurous activities
			Impulsivity	rushes into an activity
			Shyness	prefers to watch others
			Smiling/Laugher	laughs a lot at jokes
Rothbart	**EATQ**	**Surgency**	Fear	worries about family members
			High Intensity Pleasure	not afraid to try risky sport
			Shyness	shy about meeting people
Mc Devitt	**BSQ**	**NA**	Adaptability	bothered when plans change
			Activity Level	runs ahead when parents waling
			Approach/Withdrawal	outgoing with strangers
Buss Plomin	**EAS**	**Activity Sociablility/Shyness**	Activity	prefers quiet inactive games
			Shyness	tends to be shy

	Sociability	likes being with people

Note. BSQ = Behavior Style Questionnaire; CBQ = Child Behavior Questionnaire; EAS = Emotionality Activity Sociability Questionnaire; HiPIC = Hierarchical Personality Inventory for Children; ICID = Inventory of Children's Individual Differences; NA = Not applicable.

Neuroticism Oriented Scales

Author	Measure	Factor	Facets	Abbreviated Sample Item
Mervielde et al.	**HiPIC**	**Emotional Stability**	Anxiety	quick to worry
			Self Confidence	easily makes decisions
Deal et al.	**ICID**	**Neuroticism**	Distractible	forgets things
			Fearful	lacks confidence
			Negative Affect	is irritable
Rothbart	**ECBQ**	**Negative Affectivity**	Discomfort	squirms while being dressed
			Fear	fearful of loud sounds
			Frustration	becomes angry when told "no"
			Impulsivity	moves quickly
			Motor Activation	swings foot during reading time
			Perceptual Sensitivity	notices changes in others appearance
			Sadness	becomes sad when object removed
			Shyness	engages with unfamiliar child
			Soothability	calms down quickly
Rothbart	**CBQ**	**Negative Affectivity**	Anger	angry when can't find something
			Discomfort	upset by a little cut
			Fear	afraid of loud noises
			Sadness	cries when hears a sad story
			Soothability	easy to soothe
Rothbart	**EATQ**	**Negative Affectivity**	Frustration	slams door when angry
			Irritability	gets irritated when criticized
Mc Devitt	**BSQ**	**NA**	Adaptability	becomes upset if missed program
			Rhythmicity	becomes sleepy at bedtime
			Threshold of Response	sensitive to noises
			Quality of mood	cries and whines when frustrated
Buss Plomin	**EAS**	**Emotionality**	Anger	hot tempered

Distress	frequently distressed	
Fear	easily frightened	

Note. BSQ = Behavior Style Questionnaire; CBQ = Child Behavior Questionnaire; EAS = Emotionality Activity Sociability Questionnaire; HiPIC = Hierarchical Personality Inventory for Children; ICID = Inventory of Children's Individual Differences; NA = Not applicable.

Conscientiousness Oriented Scales

Author	Measure	Factor	Facets	Abbreviated Sample Item
Mervielde et al.	**HiPIC**	**Conscientious**	Achievement Oriented	always wants to "shine"
			Concentration	sustains attention while working
			Orderliness	leaves things lying around
			Perseverance	perseveres until achieves goals
Deal et al.	**ICID**	**Conscientious**	Achievement Oriented	is hard worker
			Compliant	is compliant
			Distractible	has short attention span
			Intellect	is quick to learn
			Organized	does things carefully/thoughtfully
Rothbart	**ECBQ**	**Effortful Control**	Attention Focusing	distracted when playing alone
			Attentional Shifting	looks when another person points
			Cuddliness	snuggles when being carried
			Inhibitory Control	how often stop when told "no"
			Low Intensity Pleasure	enjoys sitting in sunshine
Rothbart	**CBQ**	**Effortful Control**	Attentional Focusing	distracted when listening to a story
			Inhibitory Control	good at following instructions
			Low Intensity Pleasure	likes being sung to
			Perceptual Sensitivity	listens to even quiet sounds
Rothbart	**EATQ**	**Effortful Control**	Activation Control	finishes homework before it's due
			Affiliation	enjoys exchanging hugs with others
			Attention	finds it easy to concentrate
			Inhibitory Control	able to inhibit laughter
Mc Devitt	**BSQ**	**NA**	Distractibility	becomes engrossed in activity
			Persistence	loses interest in new toy or game
			Threshold of Response	
Buss & Plomin	**EAS**	NA		

Note. BSQ = Behavior Style Questionnaire; CBQ = Child Behavior Questionnaire; EAS = Emotionality Activity Sociability Questionnaire; HiPIC = Hierarchical Personality Inventory for Children; ICID = Inventory of Children's Individual Differences; NA = Not applicable.

Agreeableness Oriented Scales

Author	Measure	Factor	Facets	Abbreviated Sample Item
Mervielde et al.	**HiPIC**	**Benevolence**	Altruism	defends the weak
			Compliance	obeys without protest
			Dominance	acts like the boss
			Egocentrism	shares with others
			Irritability	takes offense quickly
Deal et al.	**ICID**	**Agreeableness**	Compliant	is obedient
			Considerate	sensitive to others feelings
			Positive Emotion	is sweet
Rothbart	**ECBQ**	**NA**		
Rothbart	**CBQ**	**NA**		
Rothbart	**EATQ**	**NA**		
Mc Devitt et al.	**BSQ**	**NA**		
Buss Plomin	**EAS**	**NA**		

Note. BSQ = Behavior Style Questionnaire; CBQ = Child Behavior Questionnaire; EAS = Emotionality Activity Sociability Questionnaire; HiPIC = Hierarchical Personality Inventory for Children; ICID = Inventory of Children's Individual Differences; NA = Not applicable.

Openness Oriented Scales

Author	Measure	Factor	Facets	Abbreviated Sample Item
Mervielde et al.	**HiPIC**	**Imagination**	Creativity Curiosity Intellect	pleasure from creating likes to learn new things quick to understand
Deal et al.	**ICID**	**Openness**	Achievement Orientation Intelligent Openness	self-disciplined good memory is curious
Rothbart	**ECBQ**	**NA**		
Rothbart	**CBQ**	**NA**		
Rothbart	**EATQ**	**NA**		
Mc Devitt et al.	**BSQ**	**NA**		
Buss Plomin	**EAS**	**NA**		

Note. BSQ = Behavior Style Questionnaire; CBQ = Child Behavior Questionnaire; EAS = Emotionality Activity Sociability Questionnaire; HiPIC = Hierarchical Personality Inventory for Children; ICID = Inventory of Children's Individual Differences; NA = Not applicable.

APPENDIX G: CORRELATION MATRICES FOR STUDY ONE AND TWO

Correlation Matrix for Study One

Correlations between temperament facets (ASD bottom diagonal, typical top diagonal)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	FFM FACTOR
1.	Achievement		**.19**[*]	-.39	.88	.58[a]	-.47	-29[#a]	*.64*[b]	-.29	.51[b]	.47	.49[b]	-.25	.31[#b]	-.22	CON
2.	Activity	**-.19**[*]		.09	**.08**[*]	*.15*[#a]	-.02[^b]	**-.31**[#b]	*.32*[#*]	.06	**.54**[#*]	-.05[^b]	**.25**[#b]	**-.32**[#*]	**.55**[#*]	.20	EXT
3.	Antagonism	-.42	.09		-.52	**-.54**[b]	**.44**[#*]	**.36**[#*]	**-.27**[#b]	.58	**-.14**[#]	-.24	-.51	.34	**-.13**[#]	.57	AGR
4.	Compliance	.89	**-.24**[*]	-.55		**.60**[b]	-.42	**-.25**[#a]	.57	-.37	.39	.45	**.53**[b]	-.22	.28	-.34	AGR
5.	Consideration	.35[a]	*-.14*[#a]	**-.41**[b]	**.49**[b]		**-.29**[#a]	**-.21**[#]	**.47**[a]	-.33	.48	**.36**[#a]	.66[*]	-.22	.37	-.24	EXT
6.	Distractible	-.40	**.18**[^b]	-.03[#*]	-.39	-.01[#a]		**.44**[#*]	-.42	**.40**[#*]	**-.22**[#]	**-.28**[b]	*-.16*[#a]	**.40**[#]	**-.14**[#]	**.39**[#*]	CON
7.	Fear	-.01[#a]	-.15[#b]	*-.06*[#*]	.00[#a]	*.15*[#]	.13[#*]		**-.33**[b]	**.42**[#*]	**-.29**[#]	-.07	**-.26**[#b]	.67[*]	**-.47**[a]	**.24**[#b]	NEG
8.	Intelligence	**.49**[b]	*-.11*[#*]	-.08[#b]	.48	.26[a]	-.39	-.12[b]		**-.14#**	**.65**[b]	.38	**.42**[#*]	-.29	**.41**[#a]	.01	OPN
9.	Negative Emo	-.18	.06	**.59**	-.36	-.28	-.04[#*]	.13[#*]	-.01#		-.05	-.07	-.34	**.40**	-.10	**.60**[b]	NEG
10.	Openness	.36[b]	.01[#*]	-.04[#]	.40	.45	-.10[#]	-.05[#a]	**.51**[b]	-.12		**.21**[#b]	**.52**[#*]	-.27	.56	**.11**[#]	OPN
11.	Organized	**.54**	**-.22**[^b]	-.17	.51	.16[#a]	**-.39**[b]	-.00	**.34**	-.04	.05[#b]		**.21**[#b]	.07	.09	**-.17**[#]	CON
12.	Positive Emo	.29[b]	.07[#b]	-.46	.35[b]	.39[*]	*.03*[#a]	-.06[#b]	.08[#*]	-.36	.14[#*]	.04[#b]		**-.30**[#]	**.48**[a]	**-.21**[a]	EXT
13.	Shy	-.18	-.02[#*]	**.20**	-.24	-.27	.15[#a]	**.36**[*]	-.17	.28	-.43	-.09	-.17[#]		-.60	.23	NEG
14.	Sociability	.15[#b]	.07[#*]	-.07[#]	.17	.35	-.02[#]	**-.20**[a]	.16[#a]	-.14	**.47**	.06	**.26**[a]	-.57		.08[b]	EXT
15.	Strong willed	-.19	.20	**.59**	-.33	-.28	*-.05*[#*]	.05[#b]	.05	**.72**[b]	-.02[#]	-.08[#]	**-.32**[a]	.27	-.12[b]		AGR
FFM Factor		CON	EXT	AGR	AGR	EXT	CON	NEG	OPN	NEG	OPN	CON	EXT	NEG	EXT	AGR	

Note. Bolded items represent statistically significant correlations between two facets (*p* < .05); Underlined items indicate different directions of statistical significance in ASD and typical children (*p* < .05); Italicized items indicate different directions of correlations where the typical group is significant (*p* < .05), but the ASD is not; [#] = significant correlation in the typical group (*p* < .05), but not in the ASD; [^] = statistically significant correlation in the ASD group (*p* < .05), but not in the typical; AGR = Agreeableness; CON = Conscientiousness; EXT = Extraversion; NEG = Neuroticism; Negative Emo = *Negative Emotion (anger)*; Positive Emo = *Positive Emotion*; OPN = Openness; FFM = Five Factor Model. All p values in lower legend represent significant differences in correlations between ASD and Typical children. *p* < .001. [a] *p* < .01. [b] *p* < .05.

Correlation Matrix for Study Two

Correlations between Temperament Facets for MC (ASD Bottom Diagonal, Typical Top Diagonal)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	FFM FACTOR
1. Achievement		.25[#b]	-.47	.91	.58[*]	-.52[*]	-.28[#b]	.61[*]	-.35	.42[b]	.53[#b]	.53[a]	-.31[#b]	.35	-.37[b]	CON
2. Activity	.05[#b]		-.12[#a]	.20[#a]	.21[#*]	.04	-.22[#b]	.28[#b]	-.00	.49[a]	.03	.23[#]	-.28[#*]	.58[*]	.16[#]	EXT
3. Antagonism	-.37	.15[#a]		-.52	-.64[b]	.44	.37[a]	-.36[*]	.64	-.24[#*]	-.22	-.57	.45[#a]	-.36[#*]	.57	AGR
4. Compliance	.88	-.10[#a]	-.57		.61[a]	-.49[a]	-.28[#b]	.57[*]	-.41	.35[b]	.54[a]	.56[*]	-.29[#]	.33	-.41	AGR
5. Consideration	.31[*]	-.16[#*]	-.50[b]	.39[a]		-.30[#a]	-.29[#a]	.41[#*]	-.46	.44[#a]	.24	.73[*]	-.35[#b]	.50[#*]	-.38	EXT
6. Distractible	-.22[*]	.14	.27[b]	-.25[a]	-.04#[a]		.39[#a]	-.49[b]	.44	-.03	-.47	-.29[#b]	.36[#a]	-.13[#b]	.51[#*]	CON
7. Fear	-.09[#b]	-.08[#b]	.20[a]	-.09[#b]	.01[#a]	.08[#a]		-.40[#*]	.45	<u>-.24</u>	-.12	-.36[#b]	.62[#*]	-.51[#*]	.31[#]	NEG
8. Intelligence	.33[*]	.13[#b]	-.03[#*]	.25[*]	-.00[#*]	-.29[b]	-.00[#*]		-.30[#a]	.53	.38	.45[*]	-.41[#a]	.45[a]	-.12	OPN
9. Negative (anger)	-.25	.10	.58	-.40	-.36	.32	.30	.02[#a]		-.12[#a]	-.21	-.42	.46[a]	-.25[#]	.67[b]	NEG
10. Openness	.22[b]	.19[a]	.15[#*]	.20[b]	.14[#a]	.05	<u>.26[*]</u>	.45	.16[#a]		.12[#]	.46[#*]	-.31[#]	.54[b]	.11[#]	OPN
11. Organized	.34[b]	-.09	-.34	.32[a]	.40	-.32	.00[#]	.27	-.26	.00[#]		.22	-.05	.09[#b]	-.26[#]	EXT
12. Positive emotion	.25[a]	.16[#]	-.48	.23[*]	.49[*]	-.07[#b]	-.13[#b]	.01[#*]	-.39	-.05[#*]	.25		-.39[#a]	.50[#*]	-.29	EXT
13. Shy	-.09[#b]	.05[#*]	.16[#a]	-.16[#]	-.15[#b]	.12[#a]	.13[#]	-.09[#a]	.21[a]	-.16[#]	.01	-.10[#a]		-.65	.30	NEG
14. Sociability	.22	.24[*]	-.01[#*]	.22	.01[#*]	.06[#b]	-.13[#*]	.23[a]	-.14[#]	.36[b]	-.12[#b]	.01[#*]	-.52		-.04	EXT
15. Strong willed	-.19[b]	.10[#]	.55	-.34	-.24	.15[#*]	.14[#]	.12[b]	.54[b]	.19[#]	-.13[#]	-.36	.20	-.06		AGR
FFM Factor	CON	EXT	AGR	AGR	EXT	CON	NEG	OPN	NEG	OPN	EXT	EXT	NEG	EXT	AGR	

Note. Bolded items represent statistically significant correlations between two facets ($p < .05$); Underlined items indicate different directions of statistical significance in ASD and typical children ($p < .05$); Italicized items indicate different directions of correlations where the typical group is significant, but the ASD is not; [#] = significant correlation in the typical group ($p < .05$), but not in the ASD; ^ = significant correlation in the ASD group ($p < .05$), but not in the typical; AGR = Agreeableness; CON = Conscientiousness; EXT = Extraversion; NEG = Neuroticism; OPN = Openness; FFM = Five Factor Model; All p values in lower legend represent significant differences in correlations between ASD and Typical children. [*] $p < .001$. [a] $p < .01$. [b] p < .05. 20