

**ASD Traits, Social Competence, and Co-Occurring Psychopathology: The  
Moderating Role of Gender**

Nicole L. Kreiser

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Susan W. White, Chair  
George A. Clum  
Kirby D. Deater-Deckard  
Thomas H. Ollendick

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# **ASD Traits, Social Competence, and Co-Occurring Psychopathology: The Moderating Role of Gender**

Nicole L. Kreiser

## **Abstract**

The higher occurrence of autism spectrum disorder (ASD) and sub-threshold autistic traits in males, relative to females, has been consistently documented in the literature (e.g., Fombonne 2003, 2005). In addition to potential biogenetic mechanisms, there is some evidence suggesting that differences in the behavioral manifestation of ASD symptoms and co-occurring psychopathology may play a role in the differential prevalence of ASD in males and females (e.g., Holtmann, Bolte, & Poustka, 2007; Lai et al., 2011; Solomon, Miller, Taylor, Hinshaw, & Carter, 2012). In this two-phase study, we sought to examine potential gender differences in the relationship between behaviorally defined ASD traits and observable social impairment and co-occurring psychopathology, in a non-clinical sample of young adults. It was hypothesized that gender would moderate the relationship between ASD traits and observed social impairment and co-occurring psychopathology, such that ASD traits would be related to greater levels of observed social impairment for males, and that ASD traits would be related to greater levels of co-occurring psychopathology for females. In Phase I, 1039 undergraduate students participated in an online survey on general psychopathology and ASD traits. From this sample, a subgroup ( $n = 79$ ) completed Phase II, an in-lab study that included a clinical interview and behavioral observation. ASD traits were not predictive of observed social impairment over and above the effects of social anxiety in this sample, regardless of gender. Although males and females in the sample did not differ on severity of ASD traits, when controlling for the effect of social anxiety, females were rated as more socially competent than males. ASD traits more strongly predicted screening positive for mood disorders in females than in males. Implications regarding ASD traits, as related to social impairment and co-occurring psychopathology in females are discussed.

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## Chapter 1 – Introduction

Since the initial writings about autism spectrum disorder (ASD), researchers have suggested that ASD is a predominantly male disorder (Kanner, 1943; Asperger, 1944), perhaps reflecting an “extreme variant of the male intelligence” (Asperger, 1944). Indeed, estimates suggest that ASD occurs far more commonly in males than in females, with a male to female diagnosis ratio of 4.3:1 (Fombonne, 2003, 2005). Further, in the general population, higher levels of ASD traits (in non-diagnosed adults) are found in males as compared to females (e.g., Austin, 2005; Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001; Constantino, 2011; Ingersoll, Hopwood, Wainer, & Donnellan, 2011). The reason for the higher prevalence of ASD and ASD traits in males has long been assumed to reflect a greater biogenetic vulnerability in males to develop the disorder (e.g., Baron-Cohen, Knickmeyer, & Belmonte, 2005; Ingudomnukul, Baron-Cohen, Wheelwright, & Knickmeyer, 2007; Tsai, Stewart, & August, 1981; Wing, 1981), or biogenetic influences which are protective against females developing ASD traits (Ingudomnukul et al. 2007; Skuse, 2000, 2009). The majority of ASD research has included predominantly, sometimes exclusively, male samples (Thompson, Caruso, & Ellerbeck, 2003), and there have been few studies comparing females with ASD to males with the disorder or to typically functioning females. There is a very limited understanding of the clinical expression of ASD in females; however, emerging research suggests that there may be subtle gender differences in manifestation of core ASD deficits and co-occurring psychopathology (e.g., Holtmann et al., 2007; Solomon et al., 2012).

### 1.1 - ASD Traits

ASD is a neurodevelopmental disorder currently defined at the behavioral or symptom constellation level (e.g., Rutter, 2011). ASD has been increasingly conceptualized as a dimensional spectrum of impairment in the domains of social, communication, and restricted and repetitive behaviors (Volkmar, Lord, Bailey, Schultz, & Klin, 2004), as reflected in the dimensional structure of ASD defined in DSM-5 (APA, 2013). In addition to those who meet diagnostic criteria for ASD, a growing body of research suggests that the ASD and related impairments extend beyond the clinical threshold, and are quantitatively distributed in the general population (e.g., Baron-Cohen et al., 2001, Constantino, 2011; Constantino & Todd, 2003; Frazier et al., 2013; Ingersoll et al., 2011). The *Broader Autism Phenotype* (BAP) is a term

that refers to milder levels of ASD traits among individuals outside of the clinical threshold for ASD (e.g., Bolton et al., 1994; Piven & Palmer, 1999). Initial research on the BAP focused on genetic liability for ASD among first- and second-degree relatives of ASD probands (as reviewed in Bailey et al., 1998); however, BAP has also been used to refer to behavioral (as self-reported) characteristics of ASD quantitatively distributed in the general population (e.g., Baron-Cohen et al., 2001; Ingersoll et al., 2011). The term “ASD traits” is utilized in the present study to refer to quantitatively distributed ASD characteristics in the general population.

Despite the growing body of research examining ASD traits in the general population, only one study to date has examined the relationship between ASD traits and behavioral observation of social ability in a non-clinical sample utilizing a behaviorally based observational measure in addition to self-report measures. Sasson, Nollin, and Pinkham (2012), in a study with 74 undergraduate students, found a significant relationship between self-reported ASD traits and reduced social skill, as behaviorally measured during a social interaction task. Social cognition partially mediated the relationship between ASD traits and reduced social skill, suggesting that social impairment was at least in part explained by impaired social understanding. A larger body of research has illustrated the relationship between ASD traits and related difficulties frequently observed in individuals with ASD, including peer problems and co-occurring depression and anxiety (e.g., Bejerot, Nylander, & Linstrom, 2001; Kanne, Christ, & Reiersen, 2009; Rosbrook & Whittingam, 2010; Towbin, Pradella, Gorrindo, Pine, & Leibenluft, 2005; van Steensel, Bogels, & Wood, 2013; White, Bray, & Ollendick, 2011a; White, Ollendick, & Bray, 2011b).

## **1.2 - ASD and Gender**

### **1.2.1 - Prevalence.**

Gender ratio estimates consistently reflect a male predominance of ASD. The ratio of males to females is much lower for individuals with co-occurring intellectual disability (ID) (1.9:1) as compared to individuals without co-occurring ID (5.75:1 to 16:1) (Baird et al., 2006; Fombonne, 2003, 2005). Additionally, in the majority of studies investigating ASD traits in the general population, males have exhibited higher levels of ASD traits than females (e.g., Austin, 2005; Baron-Cohen et al., 2001; Ingersoll et al., 2011). Notably, as the definition of ASD has expanded over time and rates of identification have risen, there has been a decrease in the gender ratio in diagnosis, (from 8:1 in 1989 to between 3.5:1 to 5:1 in 1997 through 2012 (Baker, 2002, US CDC, 2012; Fombonne, 2009).

### **1.2.2 - Biogenetic Theories of Existing Gender Ratio Estimates.**

Several biogenetic theories have been explored in an attempt to understand the differential occurrence of ASD in males and females. The extreme male brain hypothesis (EMB; Baron-Cohen et al., 2001) proposes that ASD may represent an extreme version of the male pattern of neurodevelopment (Baron-Cohen, 2002; Baron-Cohen & Hammer, 1997; Baron-Cohen et al., 2005). Support for this hypothesis stems from the observance of relative strengths in systemizing and relative weaknesses in empathizing in males in the general population, a cognitive pattern also observed in individuals with ASD (e.g., Baron-Cohen et al., 2001). The potential role of prenatal exposure to high levels of androgens has been examined as it relates to the development of ASD traits (e.g., “masculinization” of the brain) (Ingudomnukul, Baron-Cohen, Wheelwright, & Knickmeyer, 2007). In support of this theory, significant correlations have been found between ASD traits and fetal testosterone and other indirect measures of testosterone (e.g., digit ratio, head circumference) (Auyeung et al., 2009; Ingudomnukul et al. 2007; Knickmeyer et al. 2006).

The greater variability model (GVM; Wing, 1981) and liability threshold model (LTM; Tsai et al., 1981) have proposed that males may exhibit ASD traits due to greater genetic variability, and that females have compensatory mechanisms that decrease their likelihood of actually manifesting ASD traits, respectively. Such theories have been based upon findings of greater levels of co-occurring ID and organic conditions (e.g., major birth defects) among females diagnosed with ASD, and patterns of more affected relatives among females diagnosed with ASD (e.g., Loat et al., 2004, 2008; Skuse, 2009; Tsai & Beisler, 1983). Additionally, epigenetic mechanisms (i.e., processes that can influence X-linked gene expression without changing the gene sequence), explored by investigating patterns of heritability in males and females, have provided some support for the GVM and LTM (e.g., Auyeung et al., 2009; Skuse, 2000, 2006, 2009).

### **1.2.3 - Gender Differences in Core ASD Deficits.**

In addition to gender differences in vulnerability to develop ASD in males, research has begun to investigate the possibility of differences in manifestation of core ASD characteristics in males and females with ASD. Gender differences in the severity of restricted and repetitive behavior have been most consistently noted in the literature. Across several studies with individuals with ASD of varying ages and levels of functioning, females have been found to

exhibit less repetitive behavior, and qualitatively less unusual forms of restricted interests (e.g., Bolte, Duketis, Poustka, & Holtmann, 2011; Hartley & Sikora, 2009; Mandy et al., 2011). A recent meta-analytic review of studies that have investigated gender and age effects in ASD found that males with ASD begin to exhibit more severe restricted and repetitive behavior during childhood (van Wijngaarden-Cremers et al., 2013).

In the domains of social and communication impairment, there have been inconsistent findings in regard to gender differences in symptom presentation. Several studies have reported no gender differences (e.g., Hartley & Sikora, 2009; Mandy et al., 2011; Mayes & Calhoun, 2011). Indeed, van Wijngaarden-Cremers and colleagues' (2013) meta-analysis of the extant literature found no gender differences in the domains of social behavior and communication across age categories. However, given the underrepresentation of females without co-occurring ID in this review, the possibility that important, yet subtle gender differences in this domain exist remains. Examination of studies exclusively including individuals with ASD without co-occurring ID yields some findings suggesting that females with ASD may exhibit equivalent or lower levels of specific types of social and communication impairment as compared to males at earlier stages of development, but increased peer related problems in adolescence and adulthood. In one clinical sample of children and adolescents, although no gender differences in overall levels of social and communication impairment were found, males had more inappropriate facial expressions, and less showing, and directing attention, whereas females exhibited greater problems with group play with peers, social immaturity, and social dependency (Holtmann et al., 2007). The oldest females in the sample had the highest levels of peer problems and social immaturity. In another sample of children and adolescents with ASD, although males had more severe social and communication impairments prior to age five according to parent report (e.g., greater impairments in comfort seeking and offering and social initiative play), females were more severely impaired in their 'current' ratings, and none of the females in the sample had a reciprocal friendship after the age of 10 (McLennan et al., 1993). Parallel to findings from clinical samples, in a recent study of school age typically developing children, ASD traits were more strongly related to school social problems and negative peer relationships in males; however, ASD traits were more strongly related to problems in with peers (e.g., bullying, rejection, preference for hanging out with older or younger children) in older females in the sample (Hsiao, Tseng, Huang, & Shur-Fen Gaua, 2013).

Further, in the only study that has investigated differences between adult males and females with ASD, a similar history of social impairments (as reported by parents) and similar cognitive difficulties (e.g., theory of mind difficulties, relative weakness in empathizing) were observed in both males and females; however, females were found to have less observable social and communication impairments during a gold-standard observational interview (Autism Diagnostic Observation Schedule: ADOS; Lord et al., 2000). In fact, only 20.7% were classified as having ASD through the use of the ADOS at the time of study (Lai et al., 2011). Interestingly, despite the females' superior social ability based upon clinician observation, females in this sample self-reported greater levels of ASD traits, potentially reflecting increased insight into social difficulties or greater difficulties with peers and in fulfilling social expectations.

#### **1.2.4 - Sociocultural Processes and ASD Symptom Manifestation.**

The extant research on gender differences in ASD does not lead to a clear conclusion as to why the gender difference exists in diagnosis of ASD. Differences in the severity of core deficits in males and females at particular stages of development may, at least in part, be driven by differential social and cultural influences experienced by males and females. For instance, how members of the community and culture (e.g., religious leaders, teachers) perceive and interact with an individual, family expectations and beliefs, and intrapersonal processes (e.g., one's own efforts to compensate for deficits due to negative reactions from others and consequent distress) may differ across gender (e.g., Bussey & Bandura, 1999). These processes, in addition to biological and genetic processes, may differentially influence the phenotypic presentation of ASD in males and females (Goldman, 2013; Kreiser & White, 2013).

Parental expectations and peer group modeling play an important role in shaping gendered behavior (e.g., Bussey & Bandura, 1999). Parents tend to encourage different types of behavior in their sons and daughters: females may be encouraged to be nurturing and polite and boys to be adventuresome (Huston, 1983; Zahn-Waxier, Cole, & Barrett, 1991). Mothers talk more with their daughters and use more supportive language with emotional references (Flannagan & Perese, 1998), while encouraging more autonomy and independence in their sons (Pomerantz & Ruble, 1998). Within the context of peer groups, females tend to interact in smaller and more intimate peer groups (Maccoby, 1998) and face greater expectations for

affiliation and the interpersonally focused conversations (Larson & Richards, 1998; Raffaelli & Duckett 1989). For females with ASD, the relationship between mother and daughter and experiences with peer groups could serve to strengthen conversational or empathizing abilities.

Additionally, due to the divergence between heightened culturally based social expectations for females (e.g., interpersonal sensitivity, emotional attunement, empathy) (Crick & Zahn-Waxler, 2003) and core ASD deficits, one might expect females with ASD to experience more adverse consequences and disapproving social reactions from peers and adults for engaging in atypical social behavior, including acting aloof or asocial or being socially insensitive. Such evaluative reactions and social consequences (e.g., social rejection) may lead to increased motivation to attempt to emulate peers' behavior and adopt social scripts (e.g., memorized social responses) for common social situations (Attwood, 2006; Kreiser & White, 2013; Nichols, Moravick, & Tetenbaum, 2009). For instance, a female with ASD may attempt to closely mirror the behavior of a more popular girls in her class, mimicking their conversational style, intonation, movements, interests, and gestures (Attwood, 2006).

The aforementioned processes may ultimately lead to differential phenotypic presentation of core social and communication deficits, such that females with ASD may present as more socially typical than their male counterparts (Kreiser & White, 2013; Lai et al., 2011). However, as highlighted in several empirical studies (Holtmann et al., 2007; Lai et al., 2012; McLennan et al., 1993), females with ASD may still experience great impairment associated with the core deficits of the disorder, particularly in comparison to their same-gender peer group, as peer relationship demands increase and become more interpersonally focused for females in adolescence and adulthood (e.g., Larson & Richards, 1998; Raffaelli & Duckett 1989).

### **1.2.5 - Gender Differences in Co-occurring Psychopathology.**

In addition to understanding gender differences in core ASD symptoms, a clinically relevant question is whether females with ASD exhibit greater levels of co-occurring internalizing disorders than males with ASD. The stress of attempting to navigate a complex and confusing social world while relying upon explicit strategies (i.e., memorizing scripts, mimicking), coupled with heightened societal social expectations for females and the experience of adverse social reactions and repeated social failure, may lead females with ASD to experience reduced self-efficacy and high levels of anxiety and depression. Indeed, in the general population, social relational difficulties have been more closely related to comorbid internalizing

disorders among females as compared to males (Crick & Zahn-Waxler, 2003). Also, in the general population, females experience greater problems related to anxiety and depression than males beginning in adolescence (Nolen-Hoeksema & Girgus, 1994). Thus, females with ASD or sub-clinical ASD traits may experience greater levels of internalizing problems than both their male counterparts and same-gender peers.

Several studies examining psychiatric comorbidity children and adolescents with ASD have found that females with ASD have higher levels of internalizing problems (e.g., anxiety, depression, somatic symptoms), and lower levels of externalizing behaviors as compared to males with the disorder. Solomon and colleagues (2012), in a sample of children and adolescents with ASD, found that adolescent females had significantly more internalizing symptoms (e.g., a combination of anxiety, depression, and somatic symptoms) than age-matched males with ASD and age-matched typically functioning female peers. Further, females with ASD in the sample were the only study participants to fall within the clinical range on a self-report measure of depression (26% met the cut-point). A recent study with a school-age sample of children with ASD found relatively higher levels of social anxiety symptoms in females than males (May, Cornish, and Rinehart, 2013). Additionally, higher levels of eating disorder symptoms have been found among females with ASD, as compared to both males with ASD and same-gender typically functioning peers (Kalyva, 2009). In both clinical and population-derived samples of children with ASD, higher levels of externalizing behaviors and aggression have been found (via school documentation and teacher report) in males as compared to females (Giarelli et al., 2010; Mandy et al., 2011; May et al., 2013).

### **1.3 - Study Rationale**

Gender differences in the ASD phenotype, particularly among adults, remain poorly understood. Only one study to date (Lai et al., 2011) has examined gender differences in the core domains of ASD using an observational measure. No studies have directly examined differences in rates of specific co-occurring psychiatric disorders among adult males and females with ASD; however, given that certain types of anxiety disorders (e.g., panic disorder, social anxiety disorder) and depression tend to emerge later in adolescence or early adulthood in typically developing populations (as reviewed in Kessler et al., 2007), gender differences in psychiatric comorbidity of adults with ASD is of particular interest. The small number of females with confirmed ASD diagnoses, relative to diagnosed males, poses sample ascertainment challenges.

The extant research in this area has been hampered by inadequate power to detect small to medium size gender effects, and the utilization of samples of a wide range of ages and intellectual ability has limited the ability to examine gender differences at particular stages of development. The majority of existing studies have utilized parent-report measures, which may evoke bias if parents expect more socially desirable behaviors in their daughters, and thus perceive and rate daughters more harshly due to the discrepancy between their deficits and expectations (Holtmann et al., 2007). Additionally, few studies have utilized observational measures or diagnostic interviews, which are relevant for the direct observation of core-deficits and assessment of whether co-occurring symptoms or disorders exceed diagnostic threshold.

The goal of the present study was to better understand the relationship between ASD traits and psychiatric symptoms and social impairment in young women, utilizing an observational interaction task and a brief clinician-administered screening diagnostic interview. An analogue approach was selected to maximize statistical power to detect gender differences, in order to inform subsequent research with clinical samples. Of particular relevance to these issues, two aspects of social competence were explored: competence during a “normative” social interaction, and adaptation during a condition in which the conversation partner exemplifies boredom. Based upon a sociocultural framework (e.g., Bussey & Bandura, 1999) for understanding gender differences in ASD and previous findings with an adult ASD sample (Lai et al., 2011), it was expected that self-reported ASD traits would be less related to social competence for females during a normative social context. However, when the social demands become more complex, and the individual is required to read nonverbal cues and adapt behavior to a changing social context, it was expected that ASD traits would be equally related to social competence for males and females. That is, when the social demands are simple, females may rely upon compensatory strategies (e.g., use of social scripts) which allow them to more successfully interact; however, during more complicated social interactions, females’ social impairment may become more obvious. To our knowledge, this is the first study to attempt to examine differences in male and female phenotypic expression of core ASD traits in a non-clinical adult sample.

#### **1.4 - Study Aims and Hypotheses**

The primary aim of the present study was to investigate the potential moderating role of gender in the relationship between self-reported ASD traits and observed social competence.

Based upon findings from Sasson and colleagues (2012), it was hypothesized that ASD traits would be negatively related to observed social competence during a normative social interaction (i.e., with a conversation partner who conveys interest) (hypothesis 1a). It was predicted that there would be a gender difference in the strength of the relationship between ASD traits and social competence, such that there would be less association between ASD traits and social competence in females, whereas, in males, ASD traits would more strongly predict less social competence (hypothesis 1b). It was also expected that ASD traits would be negatively related to social adaptation in a social interaction with a partner who conveys disinterest, as measured behaviorally, for both males and females (hypothesis 1c). Significant differences in adaptation when switching from interacting with an interested to a disinterested conversation partner have been found between adults with ASD and typical control participants (Ratto et al., 2011).

The secondary aim of the present study was to determine if gender moderates the relationship between self-reported ASD traits and the presence of psychiatric disorders (e.g., anxiety disorders, mood disorders, substance use disorders). Previous studies have established strong relationships between self-reported ASD traits and continuously measured symptoms of various psychiatric disorders; however, this was the first study to examine whether ASD traits are related to increased likelihood of exceeding clinical threshold for psychiatric disorders. Based upon the strong relationship found between ASD traits and symptoms of a variety of disorders, it was hypothesized that ASD traits would predict exceeding screening threshold for more psychiatric disorders (hypothesis 2a). It was hypothesized that gender would moderate the relationship between ASD traits and number of psychiatric disorders that exceed screening threshold (hypothesis 2b). Specifically, it was predicted that there would be a stronger relationship between ASD traits and number disorders exceeding screening threshold for females. Given the emerging body of literature suggesting increased internalizing symptoms in females with ASD as compared to males with ASD, it was also hypothesized that ASD traits would be associated with exceeding screening threshold for internalizing disorders for females to a greater extent than males (i.e., anxiety and mood disorders) (hypothesis 2c). Finally, an exploratory aim of the present study was to examine the relationship between ASD traits and academic functioning (i.e., GPA, taking time off of college) and satisfaction with life, and the potential moderating role of gender in these relationships.

## Chapter 2 - Method

### 2.1 - Design Overview

Study procedures were approved by the university's Institutional Review Board (IRB; Appendix). There were two phases of the study. Phase I involved the completion of an online survey consisting of questions related to demographics, ASD traits, social anxiety, and satisfaction with life. Phase II involved an in lab session, during which participants completed a social interaction task and a structured psychiatric interview. Participants were systematically invited into Phase II of the study based upon scores on a measure of ASD traits (referred to as "BAP score" herein for simplicity), obtained from Phase I as described below.

Data collection spanned an eight-month period, over the course of two 16-week semesters. Phase I data collection occurred for six weeks during the fall semester and four weeks during the spring semester, and Phase II data collection occurred for eight weeks in the fall semester and seven weeks in the spring semester. Participants provided separate consents for both phases of participation (See Appendix). Phase I, in each semester, began in the first week of classes. The online survey took about 60 minutes to complete. To avoid potential sampling and response bias, the survey was advertised and described as a questionnaire about personality and social concerns in college, rather than as an assessment of ASD characteristics. All survey participants received a list of local counseling resources at the end of the survey, with a statement encouraging participants to contact one of the agencies if they would like to talk to someone about personal problems or mental health services (see Appendix). Before beginning the online survey, participants were informed of the chance that they may be contacted about participating in Phase II of the study. Survey respondents provided their answers electronically via a secure server, and their e-mail addresses were used to link data for Phase II of the study. Phase II of the study was conducted in a clinical laboratory on campus. The single session lasted approximately 30 minutes.

In order to ensure that the Phase II sample contained a sufficient number of individuals with elevated ASD traits, participants were invited into Phase II systematically, rather than utilizing purely random sampling. Participants were enrolled into the study by groups to aid in recruiting individuals across the continuum of ASD traits, and to attempt to match males and females on major; however, the intent of the study was to utilize a continuous approach to

examining ASD traits, as this approach is more reflective of the dimensional versus categorical structure of ASD traits, and given statistical limitations with artificially dichotomizing continuous variables (i.e., restriction of range, loss of power) (MacCullum, Zhang, Preacher, & Rucker, 2002). Four groups of individuals were enrolled, with group status determined from Phase I data: Female students with high BAP scores, male students with high BAP scores, female students with low BAP scores, and male students with low BAP scores. For simplicity, the groups with high BAP scores will be referred to as the “high BAP” group, and the group with lower levels of BAP scores will be referred to as the “low BAP” group. The high BAP groups were attained by separately rank ordering males and females, based on their BAP score, and systematically inviting participants into the lab, working down the rank ordered list (highest to lowest BAP score). Within gender, the low BAP groups contained individuals with BAP scores at least one point lower than the high BAP groups. A random number generator was utilized to attempt to match low BAP individuals with high BAP individuals on gender and type of major (Science, Technology, Engineering, Math (STEM) versus non-STEM). This was done in order to prevent inequities across groups based on gender or field of study. Prior research suggests higher ASD traits tend to occur in males and in individuals in STEM majors (Austin, 2005; Baron-Cohen, 2001).

During the fall semester, the 20 highest male and 20 highest female BAP scorers were emailed an invitation for Phase II of the study, moving systematically down the list of rank-ordered BAP scores. Participants who did not respond within 48 hours after the initial invitation were sent a reminder email. If participants did not respond to the invitation within 72 hours or declined participation, the researcher continued to move systematically down the list. This procedure was repeated during the fall semester until four weeks into Phase II data collection. Due to low recruitment (into Phase II) at that time, the decision was made to begin recruiting the low BAP group and to conduct additional recruitment for Phases I and II in the spring semester to strive to attain the desired sample size for the high BAP group. The low BAP group was then recruited using the aforementioned procedures. Beyond those matched with a high BAP individual, at this time the researcher also strove to recruit additional low BAP group participants to attain recruitment goals for the low groups. During the spring semester, the high BAP group was recruited for Phase II using the procedures described above. The lowest score of the high BAP group during the fall semester (separately for males and females) was utilized to demarcate

the lower bounds for the high BAP group during the spring semester. After high BAP sample sizes were attained (for the high BAP female group) or after all possible invitations were exhausted in an attempt to fill the high group (for the high BAP male group), efforts were made to recruit the remainder of the matched low BAP groups, utilizing the same random generation procedures.

## **2.2 - Participants**

All participants were undergraduate students at a public science and technology focused university in the southeast United States. Recruitment was across academic areas in order to enroll a sufficiently broad range of individuals with subclinical ASD traits. For Phase I of the study, students were recruited through flyers posted on campus, the psychology department's online experiment management database, email advertisements forwarded from non-psychology undergraduate advisors, and information slips attached to candy distributed outside of introductory psychology courses (during the spring semester only) (see Appendix for recruitment materials). All participating students eligible for extra credit through the psychology department's online experiment management database (72.5% of Phase I sample) received one credit for study participation. Survey respondents not eligible for extra credit (27.5% of Phase I sample) received entry into a raffle (conducted separately each semester) for a chance to win one of two \$25 cash prizes. Participants who completed the Phase I survey during the fall semester were not eligible to complete the survey again in the spring semester. During Phase II, participants eligible for class extra credit through the psychology department's online experiment management database via study participation received one credit (60% of the sample). Participants not eligible for extra credit were entered into a raffle for a chance to win one of six \$20 cash prizes during the fall semester (23.5% of the sample). During the spring semester, in an effort to increase recruitment, the raffle was replaced with a small cash prize; participants not eligible for extra credit were offered \$5 cash and a candy bar for their participation (16.5% of the sample).

Figure 1 illustrates the number of participants recruited into Phases I and II of the study. One thousand and ninety two unique participants (i.e., not including multiple surveys completed by same participant) started the Phase I survey. For participants who attempted to complete the survey multiple times ( $n = 83$ ), data from their first attempt to complete the survey was used, unless the second attempt provided more complete data, in which case the participant's second

survey was used. Fifty-three respondents did not complete the primary measure of ASD traits, which was required for in-lab invitation for Phase II. Data from these participants were excluded from any analyses (see missing data analyses below). Data from 1,039 participants were retained. Demographic information for the Phase I participants is provided in Table 1. The Phase II sample included a total of 85 participants (21 high BAP females, 24 low BAP females, 22 high BAP males, 18 low BAP males), as defined below. Each high BAP female was STEM major matched to a low BAP female ( $n = 21$ ) and all but four high BAP males ( $n = 18$ ) were STEM major matched to a low BAP male. Three additional low BAP females beyond the 21 matched low BAP female participants were recruited. Demographic data for the Phase II sample ( $n = 85$ ) are provided in Table 2. Of these participants, 79 had full data for Phase II measures (two high BAP females, two high BAP males, one low BAP female, and one low BAP male had incomplete data due to video recording difficulties or technical failure).

A priori power analyses were conducted in order to determine the needed sample size for Aims 1 and 2 of the study. Prior to beginning the study, no studies examining the relationship between ASD traits and social impairment, as assessed by an observational measure, were found. The only available study that compared social behavior of adult males and females with ASD was Lai and colleague's (2011) study in which the social interaction and communication algorithm scores of the ADOS for males and females with diagnosed ASD were compared using a Mann Whitney test. Significant group differences were found with a sample of 62 (33 males, 29 females). Effect sizes were medium for social interaction (Pearson  $r = 0.31$ ) and large for communication (Pearson  $r = 0.48$ ). Aim 1 of the study assumed a medium effect size of .15 for the main effect (i.e., ASD traits). A power analysis using G\*Power software (Faul, Erdfelder, Lang, & Buchner, 2007) for a linear multiple regression ( $R^2$  deviation from 0) with four predictors was conducted, using a medium effect size of  $f = 0.15$  and  $alpha$  of .05. The power analysis indicated that a sample size of 70 to 85 would provide adequate power (i.e., power of 0.70 or 0.80) to detect a medium effect. The average effect size in tests of moderation is 0.009 (Aguinis, Boik, & Pierce, 2001), and Kenny (2011) has suggested realistic effect sizes for small, medium, and large moderation effects to be 0.005, 0.01, and 0.025, respectively. Thus, the expected effect sizes for Aim 1 analyses ranged from 0.01 (for medium effect moderation) to 0.15 (for medium main effect of ASD traits). Given the generally small effect sizes obtained when examining moderation (Frazier, Tix, & Barron, 2004), and the preliminary nature of this

study, an *alpha* of 0.1 was utilized for the interaction effect. Following the start of data collection for the present study, Sasson and colleagues (2012) published the first study to examine the relationship between BAP and social impairment. With a sample size of 78, the authors found that BAP was significantly negatively related to social skills. The effect size was small (adjusted  $R^2 = .072$ ).

With respect to Aim 2, no previous studies have investigated the relationship between ASD traits and co-occurring psychiatric diagnoses, nor have any clinical studies compared the rate of psychiatric disorders among males and females with diagnosed ASD. Therefore, a medium effect size for the main effect of ASD traits was estimated. For hypotheses 2a and 2b, a power analysis using G\*Power software (Faul et al., 2007) for a linear multiple regression ( $R^2$  deviation from 0) with three predictors was conducted, using a medium effect size of  $f = 0.15$  and *alpha* of .05. This power analysis is the closest approximation to generalized linear model. The power analysis indicated that a sample size of 63 to 77 would achieve adequate power (power of 0.70 or 0.80) to detect a medium effect. Previously described effects sizes for moderation were assumed (i.e.,  $\alpha < .1$ ). For hypothesis 2c, given the lack of research in this area, an odds ratio estimate was unavailable, thus a power analysis was not able to be conducted. Again, an *alpha* of 0.1 was utilized for interaction effects. In summary, an ideal sample size for our aims would range from 63 to 80. A target sample of 80 participants (40 high BAP, 40 low BAP) was determined to be reasonable and feasible to ascertain, with an upper limit of 90 participants.

## 2.3 - Measures

**Demographics.** The Demographic Information Questionnaire was used to collect self-reported information about all participants' gender, age, race/ethnicity, declared or expected academic major, class year, taking time off of college (yes/no), and grade point average (GPA). Participants were also asked to report whether they struggle with or have formally received any psychological diagnoses (e.g., through an evaluation with a written report) by endorsing a checklist of various disorders (i.e., anxiety disorder, attention-deficit/hyperactivity disorder, ASD, depression, eating disorder, learning disorder).

### 2.3.1 - Primary Measures.

**ASD traits.** *Broad Autism Phenotype Questionnaire* (BAPQ: Hurley et al., 2007). The BAPQ is a 36-item self-report questionnaire designed to assess ASD traits in individuals not

exceeding the clinical threshold for ASD. It was designed to correspond to a conceptualization of the ASD traits as a set of personality and pragmatic language characteristics. The BAPQ is comprised of three theoretically-based subscales thought to represent key components of ASD traits including: Aloof, Rigidity and Pragmatic Language. These subscales are derived from the contents of direct assessment interviews for the BAP and parallel the defining behavioral domains of ASD (social deficits, restricted and repetitive behavior, and communication abnormalities). Aloof personality is defined as a lack of interest or enjoyment in social interaction, rigid personality is defined as little interest in change or adjusting to change, and pragmatic language refers to deficits in effectively communicating. Each item is rated on a 6-point scale from 1 (very rarely) to 6 (very often). Several items are reverse scored to limit the potential for response-set bias. Responses are averaged across all 36 items to create a total score ranging from 1 to 6.

Although the BAPQ is a relatively new measure and has only been utilized in a handful of studies, in comparison to other more commonly utilized measures of ASD traits (e.g., Social Responsiveness Scale – Adult Version (SRS-A: Constantino & Todd, 2005); Autism Spectrum Quotient (AQ: Baron-Cohen et al., 2001)), the BAPQ has been demonstrated to be superior in terms of internal consistency and replication of factor structure in a population-derived study (Ingersoll et al., 2011). The internal consistency for the three subscales and total score is quite good (aloof subscale  $\alpha = .94$ , rigid subscale  $\alpha = .91$ , pragmatic language subscale  $\alpha = .85$ , total  $\alpha = .95$ ) (Hurley et al., 2007). Total scores for the BAPQ have been found to be normally distributed in a college sample, and the proposed three-factor structure has been replicated via exploratory factor analyses (Ingersoll et al., 2011; Wainer et al., 2011). Although there are 3 empirically supported subscales, most research with the BAPQ has used the total score as a unidimensional severity index.

Convergent validity for the BAPQ has been established with direct clinical assessment of ASD traits, using interview, direct clinical assessment, and consensus ratings by trained raters, in which the presence or absence of BAP (i.e., high levels of sub-threshold ASD traits) was confirmed by the presence of at least two of three directly observed ASD characteristics (e.g., clinician ratings of aloof or rigid personality traits based upon a self-report interview or observation of pragmatic language deficits) among first-degree relatives of individuals with ASD (Hurley et al., 2007). Further, the BAPQ is convergent with other measures of ASD traits such as

the SRS and AQ ( $r$ 's = .66 and .65 respectively) (Ingersoll et al., 2011). Also, the BAPQ is strongly correlated in the predicted direction with a number of theoretically related constructs including mood and anxiety symptoms, personality disorders and problems, and personality traits (Ingersoll et al., 2011).

ROC analyses determined an average total score of 3.15 as a clinical cut-point for the presence of BAP, with 81.8% sensitivity and 78.1% specificity (Hurley et al., 2007). Although the BAPQ is designed to be scored by averaging across items, in order to maximize the distribution of scores and to assist in ranking participants by BAPQ for Phase II, sum scores were utilized in the present study to yield a score ranging from 36 to 216.

***Social competence.*** *Contextual Assessment of Social Skills* (CASS: Ratto et al., 2010). The CASS is a brief observational measure designed to assess conversational skills of adolescents and adults with ASD. This measure is unique from other measures, as it attempts to assess participants' ability to perceive and accommodate (i.e., behave in accordance with) a conversational partner's nonverbal cues. This fairly complex social skill is an essential skill for successful peer interactions, and individuals with ASD often struggle with this skill, exhibiting difficulty utilizing nonverbal cues to perceive more complex emotions such as boredom (Golan, Baron-Cohen, & Hill, 2006).

During this task, participants are observed during two 3-minute semi-structured role-plays, during which they interact with two different confederates. Participants speak only to confederates of the opposite gender, as opposite-gender interaction is one of the primary tasks which must be mastered during adolescence/young adulthood (Ratto et al., 2010). The social context is manipulated by the confederate, who modifies his/her expressed level of interest in the conversation: During the first conversation the confederate demonstrates social interest and engagement, and during the second conversation the confederate demonstrates boredom and disengagement. Confederates are trained to manipulate their behavior to portray either boredom or interest. Also, confederates are given specific instruction regarding their participation in the conversation.

All conversations are videotaped and participants' verbal and non-verbal behavior during each conversation is coded on nine dimensions: Asking Questions, Topic Changes, Vocal Expressiveness, Gestures, Positive Affect, Kinesic Arousal, Social Anxiety, Overall Involvement in the Conversation, and Overall Quality of Rapport. Two trained raters code each set of

videotaped role-plays. The items Asking Questions and Topic Changes are scored as behavioral counts and the remaining items are rated on a scale from 1 to 7 (1 = low, 7 = high). In previous research, four dimensions: Asking Questions, Topic Changes, Overall Involvement, and Overall Quality of Rapport were examined as primary measures of social competence (Ratto et al., 2010), as these items are indicative of conversation engagement, and are prone to change in response to conversational boredom (Burgoon, Stern, & Dillman, 1995). Adaptation across these dimensions is examined, by comparing scores on the Interested and Bored context: Normal social adaptation in the Bored context involves an increase in Asking Questions, Topic Changes, and Overall Involvement, and a decrease in Overall Quality of Rapport. Change across these variables from the Interested and Bored contexts is thought to reflect normative ability to respond to nonverbal cues from a conversation partner (e.g., perceive boredom), and adapt one's conversation style in an attempt to engage his or her conversation partner by asking more questions and changing conversation topics (Burgoon et al. 1995; Kearsley 1976; McLaughlin and Cody 1982; Ratto et al., 2010), leading to increased overall involvement, and ultimately reduced rapport when a conversation partner continues to exhibit boredom. A CASS total change score (CASS TC) is calculated by standardizing and summing the scores on the previously mentioned four items for both the Interested and Bored contexts (Overall Quality of Rapport is reverse scored) and subtracting the Interested total score from the Bored total score. Higher scores are indicative of more normative adaptation between contexts.

In a pilot study of the CASS, internal consistency across all items was quite high (e.g., .83), and inter-rater reliability was acceptable (range of .50 to .70;  $M = .68$ ) (Ratto et al., 2010). Further, the measure was generally sensitive in evaluating differences between typically developing adults and adults with ASD. Across contexts, the typically developing group asked more Questions, made more Topic Changes, had greater Overall Involvement, had better quality Rapport, greater Vocal Expressiveness, and exhibited more Positive Affect. However, no significant differences in Gestures or Kinesic Arousal were noted across groups. In examining behavioral change across conversation context, quality of rapport was the only item in which the control group demonstrated significantly higher levels of change across context; however, for asking questions and topic changes, the difference across groups approached significance. It is of note that Ratto and colleagues' study (2010) lacked sufficient power to detect interaction effects. In support of convergent validity, CASS TC was significantly correlated with both verbal IQ ( $r =$

.32,  $p < .04$ ) and theory of mind ( $r = .47, p < .002$ ). In support of construct validity, CASS TC was found to significantly predict the probability of an autism diagnosis (*odds ratio* = .62). Further, the mean CASS total change score was significantly greater for the control group than the ASD group ( $t = 2.80, p < .008$ ).

Although the psychometric properties of the CASS have not yet been subject to rigorous examination, the decision was made to utilize the CASS in this study as this is the first and only observational measure of conversational skills as a social behavior that has been developed for use with adults with ASD without co-occurring ID, and there is some preliminary support for acceptable reliability and convergent validity of the measure. Further, given the aims of the present study, the CASS provides advantages over observational measures which have been designed for typically functioning populations, as the CASS may be used to evaluate participants' social behavior in a normal interaction and also assess participants' ability to perceive nonverbal cues of their conversation partner and successfully adapt their behavior. The CASS is of interest in the present study if ASD traits are predictive of less social competence and less adaptation during the Bored context.

In the present study, performance during the 'Interested' conversation on items: Asking Questions, Topic Changes, Vocal Expressiveness, Gestures, Positive Affect, Overall Involvement and Overall Quality of Rapport were examined as indices of social competence.<sup>1</sup> A social competence score (e.g., CASS SC score), calculated by standardizing and summing scores for each of the seven aforementioned CASS items, was utilized as an overall measure of social competence in the present study. Also, a CASS TC score was examined utilizing Ratto and colleagues (2010) established scoring approach.

***DSM-IV disorders.*** *Mini International Neuropsychiatric Interview* (MINI: Sheehan & Lecrubier, 2006). The MINI is a brief, structured diagnostic screening interview developed for the major disorders in the DSM-IV (APA, 2000). The MINI was designed to be an efficient diagnostic screener for current psychiatric problems for use in research and clinical practice, but is not intended to be used for diagnostic purposes. No specific training is required for the administration of the MINI; however, it is recommended that before the MINI is utilized in research or practice, it should be reviewed and interpreted by a licensed clinician. The full MINI has a mean administration time of 18.7 minutes ( $SD = 11.6$  minutes) and covers 17 anxiety, mood, or substance abuse disorders, a suicidality module, and antisocial personality disorder

(Sheehan & Lecrubier, 2006). In the development of the measure, efforts were made to include questions that contribute to most of the weight in diagnostic decisions, and questions related to disability, illness, and drug rule-outs for meeting diagnostic criteria were eliminated. All questions require a “yes” or “no” answer, and at the end of each module, clinicians make a rating as to whether diagnostic criteria were met.

The MINI has good diagnostic concordance with the Structured Clinical Interview for DSM-IV (SCID) (Sheehan et al., 1998). The kappa values for most psychiatric diagnoses with SCID are 0.70 or above. Also, the MINI has good agreement between MINI diagnoses and expert diagnoses generated by general practitioners and expert psychiatrists (agreement in 85% of patients). The MINI has good inter-rater reliability, with all kappa values above 0.75 and majority of kappa values 0.90 or higher (70%), indicating excellent inter-rater reliability (Sheehan et al., 1998). Also, the MINI had good retest reliability over a one to two day period (61% above 0.75 and only one (mania) below 0.45) (Sheehan et al., 1998).

In the present study, 14 modules of the MINI were administered: major depressive disorder, dysthymia, (hypo)manic episode, panic disorder, agoraphobia, social phobia, obsessive-compulsive disorder (OCD), alcohol abuse and dependence, non-alcohol psychoactive substance use disorders, psychotic disorders and mood disorders without psychotic features, anorexia nervosa, bulimia nervosa, generalized anxiety disorder (GAD), and antisocial personality disorder. For these modules, in previous studies inter-rater reliability ranged from 0.88 to 1.00, kappa ranged from .51 to .90, and sensitivity ranged from .52 to .96 (Sheehan et al., 1998). Only questions related to current psychopathology were asked, with the exception of the (hypo)manic episode module, given the necessity of assessment of history of manic or hypomanic episode for diagnosis of a bipolar mood disorder. The suicide and post-traumatic stress disorder modules were not administered due to the sensitive nature of such questions, and the mood disorder with melancholic features module was not administered due the overlap with other mood disorder modules.

Based upon the suggested 10:1 minimum of ratio of valid cases to independent variables required to run analyses predicting exceeding diagnostic criteria, a minimum of 30 participants exceeding diagnostic criteria would be required in order to run separate analyses for each disorder (Peduzzi et al., 1996). Because none of the specific diagnostic categories included more than 30 cases exceeding diagnostic threshold in the current sample, the decision was made to

combine separate diagnoses into broader diagnostic categories, based on type of problem. Three dependent variables were created: exceeding diagnostic criteria (yes/no) for any DSM-IV anxiety disorder (i.e., panic disorder, agoraphobia, OCD, generalized anxiety disorder, social phobia;  $n = 35$ ), exceeding diagnostic criteria (yes/no) for any substance use disorder (i.e., alcohol use disorder, substance use disorder;  $n = 21$ ), and exceeding diagnostic criteria (yes/no) for any mood disorder (i.e., major depressive disorder, dysthymia, bipolar disorder;  $n = 30$ ). Analyses related to exceeding diagnostic criteria for anorexia nervosa, bulimia nervosa, psychotic disorder, and antisocial personality disorder were excluded due to the low number of participants exceeding diagnostic criteria for these disorders. Exceeding diagnostic criteria for a substance use disorder was included as a dependent variable in order to explore this relationship; however, it is notable that there were less than 30 cases in this category.

### **2.3.2 - Secondary Measures**

*ASD traits.* *Autism Spectrum Quotient* (AQ; Baron-Cohen et al., 2001). The AQ is a 50-item self-report measure of characteristics of ASD, originally designed to screen for ASD among adults with average to above average intelligence. The AQ is comprised of five domains: social skills, attention switching, attention to detail, communication, and imagination. All items are rated on a 4-point Likert scale from 1 (definitely agree) to 4 (definitely disagree). Approximately half of the items are worded to produce a “disagree” response and half an “agree” response in a high-scoring person with ASD. AQ items are typically scored in a binary manner (e.g., scored as a 1 if rated ‘agree’ or ‘strongly agree’; scored a 0 if rated ‘disagree’ or ‘strongly disagree’). Item scores are then summed for a total score that ranged from 0 to 50. Higher scores are indicative of more ASD traits. A clinical cut-off score of 32 has been determined to have acceptable sensitivity and specificity in identification of ASD diagnosis (Baron-Cohen et al., 2001). Although Baron-Cohen and colleagues (2001) suggest this method of scoring, it may also be scored continuously (e.g., summing Likert responses), which yields a score that ranges from 50 to 200. This method has been found to yield higher inter-item correlations (Austin, 2005).

The AQ has been utilized extensively with adults, yielding reliability across time and culture (Wheelwright, Auyeung, Allison, & Baron-Cohen, 2010). It has good internal consistency and test-retest reliability with college students; however, recent estimates of the internal consistency of the subscales have been less than acceptable (e.g., Austin, 2005; Hurst et al., 2007; Ingersoll et al., 2011). Also, in contrast to the five subscales proposed by Baron-Cohen

and colleagues (2001), several studies have suggested a four-factor (Stewart & Austin, 2009), three-factor (Austin, 2005; Hurst et al., 2007; Ingersoll et al., 2011, White et al., 2011a), or two-factor (Hoekstra, Bartels, Cath, & Boomsma, 2008) model of the AQ. In terms of convergent validity, the AQ has been found to be correlated in the predicted direction with a number of theoretically related constructs, but to a somewhat lesser degree than the BAPQ (Ingersoll et al., 2011).

Given that the BAPQ has generally demonstrated stronger psychometric properties relative to the AQ, the use of the BAPQ is recommended for studies of ASD traits in the general population (Ingersoll et al., 2011). Thus, in the present study, the AQ was not examined as a primary measure of ASD traits; however, the convergence between the AQ and BAPQ was examined for purposes of examining validity and generalizability, given that the AQ has been the predominant measure utilized to measure ASD traits to date.

*Symptoms of ASD. Early Development Questionnaire (EDQ:* White et al., 2011b). The EDQ is an unpublished self-report questionnaire which asks individuals to rate the degree to which they experienced specific symptoms of ASD, both currently and during early childhood (3-5 years). Questions were developed directly from DSM-IV-TR (APA, 2000) criteria for ASD and each item was rated on a 1 to 7 scale (1 = behavior/symptom not present, no impairment; 3 = likely present, mild impairment; 5 = present, moderate impairment; 7 = present, severe impairment). As many of the participants could not report on their early childhood behavior in White and colleague's (2011b) study, in the present study the questionnaire was modified such that participants were asked to report on behavior based upon their recollection of themselves in childhood in general. The convergence of scores on the EDQ with ASD trait measures was examined for generalizability purposes and to estimate the severity of impairment in individuals in the high BAP group.

*Social anxiety. Social Phobia and Anxiety Inventory-23 (SPAI-23;* Roberson-Nay, Strong, Nay, Beidel, & Turner, 2007). The SPAI-23, an abbreviated version of the SPAI (Turner, Beidel, Dancu, & Stanley, 1989), is a 23-item diagnostic screening instrument for social phobia in adults. Participants are asked to rate their social anxiety on 5-point scale from 0 (never) to 4 (always). The scale has excellent reliability (Roberson-Nay et al., 2007). Among college samples, the SPAI-23 has been found to have strong convergent validity with other measures of social anxiety and discriminant validity with measures of dissimilar constructs (Schry, Roberson-

Nay, & White, 2012). Also, SPAI-23 items have been demonstrated to have equivalent functioning across gender in college samples (Schry et al., 2012). The ‘difference’ score, which is the sum of the social phobia subscale items minus the sum of the agoraphobia subscale items, was utilized as a covariate in the present study because it has been found to have more discriminant validity than the total scale score in clinical samples (Roberson-Nay et al., 2007; Turner, Beidel, & Dancu, 1996). Social anxiety was selected to be utilized as a covariate due to the considerable construct overlap between social anxiety and ASD traits among college students (White et al., 2011a) and the potential unique influence of social anxiety on observed social competence (e.g., Beidel, Turner, & Dancu, 1985).

*Satisfaction with Life.* *Satisfaction with Life Scale* (SWLS: Diener, Emmons, Larson, & Griffin, 1985). The SWLS is a five-item self-report of an individual’s general sense of satisfaction with life as a whole. Participants rate each item on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The five ratings are added to arrive at a total score. The SWLS has demonstrated good psychometric properties (Pavot & Diener, 1993) and has been used extensively to examine the subjective quality of life of people experiencing serious mental and physical health concerns (> 100 studies). Internal consistency has been found to range from 0.79 to 0.89 (Pavot & Diener, 1993), and test-retest reliability is good (Pavot, Diener, Colvin, Sandvik, 1991). A single factor solution has been replicated across several studies (Pavot & Diener, 1993). Normative scores on the SWLS are well-established (Pavot & Diener, 2008); however, in the present study continuous scores were utilized. Higher scores reflect greater life satisfaction.

#### **2.4 - Training of Confederates and Raters**

A total of twelve different undergraduate research assistants (5 males, 7 females) were utilized to assist as confederates during the CASS task. Nine of the confederates for the CASS completed two hours of training prior to Phase II of the study. Training involved both a didactic (including presentation materials obtained from Ratto and colleagues (2010)) and live practice portion with observation and feedback. Confederates were trained to manipulate their eye contact, facial affect, posture, and gestures to create either the Interested or Bored context. Additionally, in both conditions, confederates were trained to not carry the conversation burden to allow for accurate assessment of social skill (i.e., not speak more than 50% of the time, wait 10 seconds after the examiner leaves the room to initiate conversation) (Ratto et al., 2010). The

amount of time the confederate waits before re-initiating conversation varies by context (Interested 5 seconds vs. Bored 7 seconds). During the practice portion of training, confederates practiced both Interested and Bored conditions at least two times, and received feedback from the investigator. Confederates were required to continue practicing until the previously specified standards for both Interested and Bored conditions were obtained. The investigator also watched the first three administrations for each trained confederate and provided systematic feedback regarding fidelity. Three of the confederates were only utilized as temporary fill-ins for the Interested context only, and received an abbreviated training in which they were individually trained on the Interested context only. These three confederates were provided with the printed training materials and a brief didactic training. The nine confederates with full training were assigned to the Interested and Bored contexts in a counterbalanced order.

CASS coding training was provided to eight undergraduate research assistants. Raters for the CASS were asked to review Ratto and colleague's (2010) article on the development of the CASS and the CASS manual prior to training. All raters attended a two-hour long didactic training session to review the codes and practice assigning domain codes. Also during training, raters were trained to rate videos of the CASS using a set of six training videos. Raters coded each video independently, and then codes were discussed in order to assist raters who assigned "outlier" ratings to better understand how ratings are assigned. In order to assist with coding for the study, raters needed to achieve 80% agreement with gold standard ratings for the training videos (e.g., at least one point within gold standard rating). Only three research assistants were able to successfully complete the training coding with greater than 80% agreement, and thus only these three coders were used to rate the CASS. The five research assistants below agreement threshold had agreement ranging from 72% to 78%. The three raters above the 80% agreement threshold had agreement ranging from 85% to 93% across the CASS domains. Rater A coded each CASS and either rater B or rater C double coded each CASS. Coding was completed independently, and research assistants were not permitted to discuss their codes. Two of the coders also acted as confederates during the CASS; however, none of the coders were assigned to code CASS interactions in which they acted as the confederate.

Both confederates and raters were kept 'blinded' (uninformed) to the study hypotheses and group membership. Names of Phase II participants were provided to research assistants prior to all appointments in order to prevent a confederate from interacting with an acquaintance or

classmate. Research assistants were asked to notify the investigator if they knew any of the participants so that a substitute research assistant could be utilized.

## **2.5 - Training of Interviewers**

MINI administration training was provided to five graduate level clinical psychology graduate research assistants during a two-hour long training session. Prior to the training session, graduate research assistants were asked to review the MINI and to read Sheehan & Lecrubier's (2006) study describing the development and psychometric validation of the MINI. During the training session, information regarding the structured format of the MINI and administration rules were reviewed, and each graduate research assistant was asked to practice the administration of two modules of the MINI with the principal investigator. Feedback was provided regarding administration, utilization of probing, and scoring. Training was also provided to graduate research assistants regarding risk assessment and procedures to be utilized in the case that risk of suicidality or other dangerous behavior arose during the interview.

## **2.6 - Phase II Procedures**

At the start of each Phase II session, after consent, participants were asked to sit in a waiting area with other students (the confederates). Confederates were instructed not to socialize with participants unless initiated spontaneously by the participant, in which case they could provide a brief response. It is notable that this scenario (i.e., sitting in a waiting area with confederates) was not possible in the first study location given space limitations; thus, in that location, confederates were brought into the same room with participants for the first time during the CASS. During consent, participants were told that they would interact with two other students and complete an interview during the session. No reference was made to the confederates in the waiting area.

Participants either completed the CASS interaction task or the MINI first, in a counterbalanced order. Procedures described by Ratto and colleagues (2010) were followed in the administration of the CASS. During the CASS, participants had two, three-minute conversations with opposite-gender confederates. Participants were seated in a room, across from a confederate approximately three feet away. Prior to each conversation, the examiner read the following prompt to the participant and confederate:

*“Thank you both so much for coming in. Right now we’d like each of you to act as if you had recently joined a new club or social group, and now you’re sitting next to each other, waiting for this new club or group to start. You will have 3 minutes to talk to each other, and then I will come back into the room”* (Ratto et al., 2010).

The second interaction was identical to the first; however, during the first interaction the confederate conveyed interest, and during the second interaction the confederate conveyed boredom. The order of Interested and Bored contexts were not counterbalanced in order to rate the participant’s social behavior in a normative interaction, and the participants adaptation to a different social context. Presenting the Bored context first may violate social expectations and lead the participant to expect similar behavior in the Interested context, which may lead to an inaccurate rating of the participant’s behavior in a normative interaction (Ratto et al., 2010).

A trained psychology graduate student administered the MINI. Prior to beginning the interview, participants were informed that they would be asked specific questions regarding psychological difficulties. Participants were reminded that they could discontinue the study or refuse to answer certain questions at any time if they became uncomfortable. Participants were asked to provide “yes” or “no” responses to all items. When necessary, the interviewer asked participants to clarify or provide examples to ensure accurate coding, and participants were encouraged to ask for clarification if any question was unclear. For each module, the interviewer provided a “yes” or “no” rating to indicate if the participant met diagnostic criteria. After the completion of the MINI, the interviewer reminded participants of the list of resources of local counseling centers and mental health programs provided during consent and encouraged participants to contact one of these services if they would like to further discuss any mental health or personal concerns.

Following the in-lab portion, a brief debriefing was conducted. During this time, a script was read to participants informing them that they interacted with a trained confederate during the interaction task. Participants were asked not to share this information with other students as to not compromise the study design.

## **2.7 - Primary Data Analyses**

Data were analyzed with IBM SPSS Statistics Version 20. All variables were assessed for normality and outliers. A manipulation check was completed to determine if the order of the in-lab tasks had an impact on CASS performance. Intraclass correlation coefficients (ICC’s) were

calculated between the two independent raters for the CASS to determine rater reliability. Interrater reliability was calculated utilizing ICC as opposed to *Kappa* as the ratings are ordinal (cf Shrout & Fleiss, 1979). Descriptive statistics were computed for all demographic variables to characterize Phase I and II samples. Phase I participants with missing data were compared to participants with full data. In order to investigate Aim 1, hierarchical multiple linear regression analyses were conducted. Gender, ASD traits and the interaction between these variables were entered simultaneously to predict the CASS score. All analyses were run with and without the inclusion of social anxiety as a covariate (included in the first step) and with and without the inclusion of the random effect of confederate. Additionally, analyses were run with both the full BAPQ score (i.e., BAPQ Total) and Aloof subscale of the BAPQ as indices of ASD traits. The Aloof subscale of the BAPQ was included to assist with comparison to Sasson and colleagues (2012) study, which utilized this subscale. In order to prevent possible problems with multicollinearity, ASD traits and social anxiety were centered at their means (cf Robinson & Schumaker, 2009). Separate regressions were conducted to predict CASS SC and CASS TC.

In order to investigate Aim 2, a generalized linear model (hypotheses 2a and 2b) and a series of logistic regressions (hypothesis 2c) were conducted. The generalized linear model was selected because the dependent variable for hypothesis 2a and 2b is count data (i.e., number of diagnoses); ASD traits, gender, and the interaction between these variables were entered into the model as to predict number of diagnoses exceeding diagnostic threshold. Again, ASD traits were mean centered. A poisson distribution and log lin link function were specified, given the ordinal nature of the dependent variable. For hypothesis 2c, a series of logistic regressions with ASD traits, gender, and the interaction between these variables predicting exceeding diagnostic threshold for each disorder group on the MINI (yes/no).

## **2.8 - Exploratory Analyses**

In order to investigate exploratory aims, a series of hierarchical multiple linear regressions were conducted. Gender, ASD traits, and the interaction between gender and ASD traits were used as predictors. Separate analyses were run for each dependent variable (i.e., GPA, satisfaction with life). Significant interactions were probed by plotting the simple slopes for males and females (Holmbeck 2002).

## Chapter 3 - Results

### 3.1 - Missing Data Analyses

Twenty-five students (2.29% of full sample) who began the online survey only entered their e-mail address, so they were not included in the following comparisons. The remaining twenty-eight students (2.62%) with missing survey data (i.e., those that did not complete the BAPQ) completed the demographics questionnaire, so they were compared to the 1,039 Phase I participants with complete BAPQ data. Completion of BAPQ was a requisite for invitation into Phase II of the study. The two groups (i.e., those who did and those who did not complete the BAPQ) did not differ on age,  $t(1065) = -0.102, p = 0.919$ , or year in college,  $t(1065) = 0.884, p = 0.377$ . Additionally, the groups did not differ on race/ethnicity (African American: Fisher's exact test  $p$  (2-sided) = 1.000; Asian/Asian American: Fisher's exact test  $p$  (2-sided) = 0.147; Caucasian/European American: Fisher's exact test  $p$  (2-sided) = 0.113; Latino, Hispanic, or Chicano: Fisher's exact test  $p$  (2-sided) = 0.293; Native American: Fisher's exact test  $p$  (2-sided) = 1.000; Pacific Islander: Fisher's exact test  $p$  (2-sided) = 1.00; Other: Fisher's exact test  $p$  (2-sided) = 1.00) or gender;  $\chi^2(1) = 2.613, p = 0.106$ . For the 42 students who did not complete the survey, but completed the BAPQ items, group comparisons with the survey-completers on the continuous total BAPQ score were conducted. The groups did not differ on continuous BAPQ score,  $t(1037) = -.0328, p = 0.743$ . All Phase I data analyses were conducted with those with complete BAPQ utilizing listwise deletion. All Phase II analyses were conducted utilizing listwise deletion in cases in which participants did not complete all Phase I or II measures included in analyses. Participants who were invited into Phase II but did not accept the invitation ( $n = 495$ ; 85%) did not significantly differ on social anxiety ( $t(551) = -1.26, p = .21$ ) or ASD traits ( $t(575) = -1.46, p = .144$ ), as compared to participants who accepted the invitation for Phase II.

### 3.2 - Descriptive Statistics

Descriptive statistics were computed for all demographic variables (i.e., gender, age, race/ethnicity, class year, mental health struggles and diagnoses) to characterize both the Phase I and Phase II samples (Tables 1 and 2, respectively). Descriptive statistics were also computed for the BAPQ, AQ, SPAI-23 difference score, and SWLS in both the Phase I and Phase II samples (Tables 3 and 4, respectively). Also, descriptive statistics were calculated for the CASS and EDQ

in Phase II (Table 4). Table 5 shows the percentage of participants exceeding screening threshold on Phase I and II measures of ASD traits and social anxiety. Of participants exceeding the AQ threshold during Phase I, 96% (all but one) also exceeded the BAPQ threshold. Of participants exceeding the SPAI-23 threshold during Phase I, 52.44% also exceeded the BAPQ threshold. In Phase II, most participants in the high BAP group exceeded threshold on the BAPQ (93%), one participant was diagnosed with ASD, 16.3% of participants exceeded the AQ threshold, and 65.1% of participants exceeded the SPAI-23 threshold. Mean scores on BAPQ, AQ, SPAI-23 were compared for males and females in Phases I and II (Table 6). Overall males had higher scores on measures of ASD traits than females during Phase I; however, males and females did not significantly differ on measures of ASD traits during Phase II. Males and females did not differ in social anxiety during Phases I or II. Phase II males had significantly higher scores on EDQ total, childhood communication, childhood repetitive behavior, current repetitive behavior (Table 6). In examining the high BAP group in Phase II, males and females did not significantly differ on ASD traits (BAPQ  $t(42) = 0.26, p = .61$ ); AQ ( $t(42) = 0.58, p = .80$ ), or EDQ subscales ( $p$ 's range from .05 to .88); however, females in the high BAP group ( $M = 33.30, SD = 10.94$ ) had significantly more social anxiety (SPAI-23) compared to males in the high BAP group ( $M = 25.43, SD = 10.42$ ) ( $t(40) = 5.57, p = .02$ ).

Participants in Phase II exceeded screening threshold for a mean number of 1.31 disorders on the MINI ( $SD = 1.57$ ;  $range = 0 - 6$ ). Most (66%) participants exceeded diagnostic threshold for at least one disorder (22.4% one diagnosis, 10.6% two diagnoses, 8.2% three diagnoses, 10.6% four diagnoses, 2.4% five diagnoses, 1.2% six diagnoses). Table 7 shows the percentage of males and females exceeding diagnostic threshold for each disorder.

All primary variables were determined to have acceptable normality (Tables 3 and 4). Skewness and kurtosis for all primary variables were within acceptable ranges (Kim, 2013), and visual inspection of the distribution of all variables indicated no concerns with non-normality. The distributions and normality of individual CASS items were also examined. The majority of participants received average scores in the range of 5 to 7 across items (on 0 to 7 point scales). No participants received scores of 0 or 1 on Kinesic Arousal and Overall Involvement. CASS total scores (i.e., CASS SC and TC) had acceptable normality. The kurtosis (leptokurtic) and skewness (negative skew) of Vocal Expressiveness was non-normal, and the kurtosis (leptokurtic) of Positive Affect, Overall Involvement, and Rapport was also non-normal. Because

CASS total scores were of primary interest in the present study, transformations on non-normal CASS items were not undertaken. Though Pearson's correlations were examined with the aforementioned CASS items, there is not a normality assumption required for the interpretation of Pearson's correlation strength (Nefzger & Drasgow, 1957; Rodgers & Nicewander, 1988).

Cronbach's alpha was utilized to examine internal consistency for all measures (Table 4). When discussing Cronbach's alpha, the commonly used rules-of-thumb to describe internal consistency are utilized (George & Mallory, 2003;  $\alpha \geq .9$  excellent,  $.9 > \alpha \geq .8$  good,  $.8 > \alpha \geq .7$  acceptable,  $.7 > \alpha \geq .6$  questionable,  $.6 > \alpha \geq .5$  poor,  $.5 > \alpha$  unacceptable). Internal consistency across all 9 items on the CASS was good ( $\alpha = .83$ ). Cronbach's alpha for self-report measures ranged from acceptable to excellent.

Intraclass correlation coefficients (ICC) were calculated for each of the nine CASS items to examine rater agreement. A two-way mixed random effects model was used (Shrout & Fleiss, 1979). When discussing rater agreement, Landis and Koch's (1977) qualitative descriptors are used ( $ICC > .80$  outstanding,  $.79 \geq ICC \geq .60$  substantial,  $.59 \geq ICC \geq .40$  moderate,  $ICC < .40$  poor). Rater agreement for all CASS items was outstanding (.82 to .96), aside from Positive Affect, which had moderate agreement (.59) (Table 4). The mean ICC across items was .85. ICC's obtained from the present study were largely within the range of agreement obtained from Ratto and colleagues (2011) initial study (.62 to .96; mean ICC = .81). ICC values were considered acceptable for further analyses. As was done in Ratto and colleagues' (2011) study, each rater's scores were averaged to calculate a final score for each participant on each item, which were used for all subsequent analyses.

Pearson's correlations were computed to examine relationships among Phase I measures of social anxiety and ASD traits (AQ and BAPQ) (Table 8). In describing the magnitude of relationships, Cohen's (1988) guidelines for the social sciences are utilized ( $r \geq .5$  large,  $.5 > r \geq .30$  medium,  $r < .30$  small). As expected, there was a large positive relationship between measures of ASD traits ( $r = .74$ ). There were also medium to large relationships between ASD traits and social anxiety (AQ  $r = .49$ ; BAPQ  $r = .56$ ).

Pearson's correlations were also computed to examine relationships among the two measures of ASD characteristics, social anxiety, and self-reported symptoms of ASD in childhood and at present (as measured by EDQ from Phase II) (Table 9). There were large positive relationships between measures of ASD traits and social anxiety and large relationships

between the measures of ASD traits and current symptoms of socialization difficulties. There were medium strength relationships between both measures of ASD traits and current repetitive behavior severity, current and childhood symptoms of socialization difficulties, and childhood and current symptoms of communication difficulties. There were small but significant relationships between measures of ASD traits and childhood repetitive behavior severity. There was a medium strength correlation between social anxiety and current socialization and communication symptoms, and a small, but significant, correlation with childhood socialization symptoms. Social anxiety was not significantly related to the presence of current or childhood repetitive behavior ( $r$ 's = .04 and .01 respectively) or childhood communication difficulties ( $r = .21$ ). Given the large correlations between ASD traits and social anxiety, Aim 1 analyses were run with and without social anxiety included as a covariate.

Pearson's correlations were also computed to examine relationships among CASS SC, CASS TC and individual CASS items (standardized) and ASD traits (AQ, BAPQ (total score and Aloof subscale)), self-reported symptoms of autism in childhood and at present, and social anxiety (Table 10). There were small and non-significant correlations between the BAPQ Total and CASS SC and TC. There was a medium relationship in the hypothesized direction between BAPQ Aloof and CASS SC; however there was a small and non-significant relationship between Aloof and CASS TC. In examining CASS items, there were small correlations between BAPQ Total, Vocal Expressiveness, Positive Affect, and Overall Involvement, and medium strength relationships between BAPQ Total and Rapport and Social Anxiety. The Aloof subscale of the BAPQ had a large negative relationship with CASS Social Anxiety, medium negative relationships with Vocal Expressiveness, Positive Affect, Overall Involvement, Rapport, and CASS SC, and a small significant relationship with Gestures. The SPAI-23 was moderately, negatively correlated with Social Anxiety on the CASS; however, it had small and insignificant correlations with all other CASS items. When controlling for the effect of social anxiety, the partial correlations between CASS items and total scores (i.e., CASS SC, CASS TC) and the BAPQ Total were small and non-significant; however, there were small to medium significant correlations between several CASS items (Vocal Expressiveness, Gestures, Positive Affect, Social Anxiety, Overall Involvement) and CASS SC and the Aloof subscale of the BAPQ. Since the Aloof subscale of the BAPQ was related to CASS items, and given the utilization of this

subscale in another recent study examining ASD traits in college students (Sasson et al., 2012), all Aim 1 analyses were run with both the Aloof subscale of the BAPQ and Total BAPQ score as the dependent variable to aid in generalization and comparison with other findings.

Possible effects of CASS confederate, order of administration (e.g., CASS versus MINI administered first), and STEM versus non-STEM major on CASS SC were explored. Overall, there was no effect of confederate in the Interested context ( $F(11, 67) = 1.94, p = .05$ ); however, there was a significant effect of confederate in the Bored context ( $F(8, 70) = 4.07, p = .001$ ). Because confederate was related to participant gender (i.e., only males interacted with female confederates and vice versa), and both confederate and gender might impact CASS SC, the effect of confederate was also examined separately for males and females. For female participants, there was not an effect of confederate during the Interested context ( $F(4, 36) = 0.90, p = .47$ ), but there was a main effect of confederate for the Bored context ( $F(3, 37) = 2.99, p = .04$ ). For male participants, the main effect of confederate during the Interested context was not significant ( $F(6, 31) = 2.03, p = .09$ ), but there was a main effect of confederate for the Bored context ( $F(4, 33) = 4.68, p = .004$ ). Therefore, Aim 1 analyses were run with and without the inclusion of the random effect of confederate in order to determine if confederate effects influenced our findings. There was not a statistically significant main effect of order of administration in predicting CASS SC ( $\beta = .21, t = 1.87, p = .07$ ). There was not a significant effect of STEM major status on CASS SC ( $\beta = .01, t = .11, p = .92$ ).

### 3.3 - Aim 1

**Hypothesis 1a** was that ASD traits would be negatively related to observed social competence during a normative social interaction. There was not a main effect of ASD traits in predicting CASS SC, as measured by BAPQ Total score, across models (Tables 11 through 14). There was a significant main effect of the BAPQ Aloof subscale in predicting CASS SC, in models not controlling for the effect of social anxiety (Tables 15 and 16). There was not a significant main effect of BAPQ Aloof subscale in models including social anxiety as a covariate (Tables 17 and 18).

**Hypothesis 1b** was that ASD traits would be more strongly negatively related to social competence during a normative social interaction for males than for females. There were no significant gender by ASD traits interaction effects across models (Tables 11 through 18). In models not controlling for the random effect of confederate, there was a significant main effect

of gender on CASS SC regardless of whether social anxiety was included as a covariate (Tables 11, 12, 15, 17), with females ( $M = 1.34, SD = 5.07$ ) scoring significantly higher than males ( $M = -1.45, SD = 5.09$ ) on CASS SC. In models including the random effect of confederate, without the inclusion of social anxiety as a covariate, gender was not a significant predictor of CASS SC ( $p$ 's = .09) (Tables 13 and 16). In the model including the random effect of confederate and controlling for the effect of social anxiety with BAPQ Total as a predictor, there was a significant main effect of gender (Table 14). In the model including the random effect of confederate and controlling for the effect of social anxiety with BAPQ Aloof as a predictor, there was not a significant main effect of gender ( $p = .053$ ) (Table 18).

Post-hoc analyses were conducted in order to examine potential gender differences in the relationship between ASD traits and specific CASS items during the Interested context. Bivariate and partial (controlling for social anxiety) correlations between ASD traits and all CASS items are presented in Table 19. Without controlling for social anxiety, both measures of ASD traits were significantly related to decreased Vocal Expressiveness, Positive Affect, Overall Involvement, and Rapport and increased Social Anxiety for females only. When social anxiety was controlled for, BAPQ Total was not significantly related to any of the CASS items for either males or females; however, the Aloof subscale of BAPQ was related to decreased Gestures for males.

**Hypothesis 1c** was that ASD traits would be related to decreased behavioral adaptation when transitioning from a conversation with a conversation partner portraying interest to a conversation partner portraying boredom for both males and females. There were no main effects of ASD traits or gender, or significant interaction effects in predicting CASS TC across models (Tables 20 through 27).

### **3.4 - Aim 2**

**Hypothesis 2a** was that ASD traits would predict exceeding screening threshold for more psychiatric disorders. There was a significant main effect of ASD traits, such that more ASD traits predicted exceeding diagnostic threshold for more disorders on the MINI, with and without controlling for social anxiety (Tables 28 and 29). With a one unit increase in ASD traits, the predicted number of diagnoses exceeding diagnostic criteria was about 1.04 times greater ( $\exp(B) = 1.036$ ).

**Hypothesis 2b.** ASD traits will be more strongly related to number of psychiatric disorders exceeding screening threshold for females as compared to males. The interaction between ASD traits and gender in predicting number of disorders exceeding diagnostic criteria was not significant at  $\alpha$  of .1, with models with or without social anxiety controlled ( $p$ 's = .104 and .106) (Tables 28 and 29). Given the preliminary nature of this study, though the interaction between gender and ASD traits was not significant, we explored the relationship between ASD traits and number of diagnoses for males and females by plotting separate logarithmic curves for males and females (Figure 2). For females, at increased levels of ASD traits, there appeared to be a trend towards a stronger relationship between ASD traits and number of diagnoses. Post-hoc exploratory analyses examined the strength of the Pearson bivariate correlations between ASD traits and number of diagnoses by gender. There was a significant medium correlation between ASD traits and number of diagnoses for females ( $r = .46, p = .002$ ), and there was a small non-significant correlation between ASD traits and number of diagnoses for males ( $r = .23, p = .16$ ); however, a Fisher's  $r$ -to- $z$  transformation revealed that the strength of these relationships did not significantly differ ( $z = 1.16, p = .25$ )

**Hypothesis 2c** was that ASD traits would be more strongly related to exceeding screening threshold for internalizing disorders (i.e., anxiety and mood disorders) for females as compared to males. There were not significant main effects of ASD traits or gender; nor was the interaction between ASD traits and gender significant in predicting exceeding diagnostic criteria for anxiety disorders and substance use disorders, with or without the inclusion of social anxiety as a covariate (Tables 30 through 33). There was a significant main effect of gender on exceeding diagnostic criteria for substance abuse (Tables 32 and 33). The odds ratio for exceeding diagnostic criteria for substance abuse disorders was about 3 times larger for males compared to females ( $\exp(B) = 3.069$ ). There was a significant main effect of ASD traits and a significant gender by ASD traits interaction effect in predicting exceeding diagnostic criteria for mood disorders (at our a priori  $\alpha < .10$ ), without controlling for the effect of social anxiety (Table 34). When controlling for social anxiety, there was not a significant main effect of ASD traits ( $p = .059$ ); however, there was still a significant gender by ASD traits interaction in predicting exceeding diagnostic criteria for mood disorders (Table 35). In order to explore the significant gender by ASD traits interaction effect in predicting exceeding diagnostic criteria for a mood disorder, separate logistic curves were plotted for males and females (Figure 3). For

females, at increased levels of ASD traits, there was a stronger relationship between ASD traits and exceeding diagnostic criteria for mood disorders. Females exceeding the threshold for a mood disorder ( $n = 14$ ) had a mean BAPQ Total score above the screening threshold ( $> 3.15$ ) ( $M = 3.47$ ,  $SD = 0.57$ ); whereas, males exceeding the screening threshold for a mood disorder ( $n = 16$ ) had a mean BAPQ Total score below the screening threshold ( $M = 3.08$ ,  $SD = 0.81$ ).

### **3.5 - Exploratory Analyses.**

Neither gender nor ASD traits significantly predicted GPA (Table 36). Only one participant took time off of college, thus proposed analyses could not be run with this dependent variable. Without controlling for the effect of social anxiety, gender and ASD traits significantly predicted satisfaction with life; however, the interaction between gender and ASD traits was not significant at our predetermined *alpha* of .10 ( $p = .10$ ) (Table 37). Females ( $M = 25.67$ ,  $SD = 6.17$ ) had significantly higher levels of satisfaction with life as compared to males ( $M = 23.83$ ,  $SD = 7.02$ ). When social anxiety was included as a covariate, there were significant main effects of social anxiety, gender, and ASD traits, and the interaction between gender and ASD traits was significant at our a priori *alpha* for interactions (Table 38). Post-hoc regressions with ASD traits predicting satisfaction with life, while controlling for effects of social anxiety, were conducted separately for males and females utilizing procedures for probing continuous by dichotomous interactions described by Holmbeck (2002). ASD traits was significantly related to reduced satisfaction with life for both females ( $B = -0.11$ ,  $t = -10.23$ ,  $p < .001$ ) and males ( $B = -0.14$ ,  $t = -7.42$ ,  $p < .001$ ). The simple slopes were plotted for males and females at one standard deviation below and above the mean of ASD traits (centered) (Figure 4). ASD traits were related to reduced satisfaction with life to a greater degree for males as compared to females.

## Chapter 4 - Discussion

The purpose of this study was to investigate the role of gender in the relationship between ASD traits and observed social competence and psychiatric comorbidity in a non-clinical adult sample. There was limited evidence for a moderating effect of gender on the relationship between ASD traits and social competence; however, there was some evidence of a moderating effect of gender on the relationship between ASD traits and psychiatric comorbidity. In particular, gender significantly (at our a priori  $\alpha = .10$ ) moderated the relationship between ASD traits and probability of exceeding diagnostic criteria for a mood disorder, such that ASD traits were more strongly predictive of exceeding diagnostic criteria for a mood disorder for females as compared to males.

Results did not fully support our hypothesis that ASD traits would predict reduced social competence or impaired adaptation to a change in social context, particularly when controlling for the impact of social anxiety on social competence. When controlling for the effect of social anxiety, neither total ASD traits nor the social interaction component of ASD traits (i.e., Aloof subscale of BAPQ) significantly predicted social competence or adaptation to a change in social context, as gauged by transitioning from a conversation with a partner who conveys interest to a conversation with a partner who conveys boredom. However, without controlling for the effect of social anxiety, the Aloof subscale (a facet of ASD traits) significantly predicted social competence. The effect sizes for both measures of ASD traits (with and without controlling for effect of social anxiety) were small (*Cohen's F<sup>2</sup>* ranged from .01 to .09). This was the first study to consider the large degree of overlap between social anxiety and ASD traits, in examining the relationship between ASD traits and observed social competence in a college sample. Without controlling for social anxiety, the small to moderate correlations between ASD traits and observed social competence in the present study ( $r^2$ 's = -.20 and -.30) are quite similar to correlations obtained from the only other study that has examined the relationship between ASD traits and observed social ability ( $r^2$ 's = -.24 and -.29) (Sasson et al., 2012).

The lack of significant relationship between ASD traits and social competence when controlling for social anxiety suggests that, in non-clinical samples, ASD traits may not equate to behaviorally observable social and communication difficulties, especially when social anxiety is present. Although the BAPQ is arguably a psychometrically strong measure of ASD traits and

was designed in order to measure sub-threshold levels of ASD related difficulties (Hurley et al., 2007; Ingersoll et al., 2011; Wainer et al., 2011), in general, research examining measures of continuous ASD traits has yielded inconsistencies in replication of factor structure (White et al 2011a), and a recent study found measurement non-equivalence when comparing a clinical versus non-clinical sample using a popular measure of ASD traits (Frazier et al., 2013). Increased levels of ASD traits in a non-clinical college sample, particularly when accounting for construct overlap (Tyson & Cruess, 2011) and large degree of shared variance (White et al., 2011a) between ASD traits and social anxiety, may reflect difficulties or individual differences that are outside the scope of social interaction and communication difficulties, such as cognitive style (i.e., attention to details), theory of mind deficits, or preference for routine, which may not be expected to be as closely related to observable social difficulty. However, in support of the uniqueness of ASD traits and social anxiety in our sample, ASD traits were significantly related to current and childhood difficulties across ASD domains (with exception of childhood restricted and repetitive behavior), whereas social anxiety was not significantly related to childhood communication difficulties or present or childhood restricted and repetitive behavior.

Another possibility is that the strong overlap between ASD traits and social anxiety, and the important role that social anxiety may play in expression of ASD related social difficulties, may be reflective of similar etiological processes occurring in both high-functioning clinical and non-clinical populations (i.e., shared genetic vulnerability (Kerns & Kendall, 2013; Wood & Gadow, 2010) and bi-directional processes between social difficulty and anxiety in social situations (e.g., Bellini, 2004; White & Schry, 2011)). Indeed, social anxiety and ASD traits have also been found to be moderately correlated in clinical ASD samples (i.e.,  $r$ 's range from .31 to .43 in child and adolescent ASD samples; Bellini, 2004; Renno & Wood, 2013), and correlations between social anxiety and ASD traits in the present study were found to be moderate to large ( $r$ 's = .46 and .62).

Though gender was not found to moderate the relationship between ASD traits and social competence, due to the preliminary nature of the present study, this finding should be interpreted with caution. Not unlike many studies that have examined gender differences in social and communication domains in the ASD literature with null findings (as reviewed in Kreiser & White, 2013), the present study lacked sufficient power to detect significant interaction effects. Aim 1 moderation effect sizes ranged from small to medium ( $F^2$  ranged from .004 to .02), based

upon Kenny's (2011) realistic guidelines for detection of moderation effects. Post hoc power analyses with G\*Power (Faul et al., 2009) with *alpha* at .10 revealed that we were underpowered to detect small to medium moderation effects (power ranged from .12 to .25). Additionally, it is possible, that our measures lacked sensitivity to detect subtle gender differences in social difficulties in a high functioning college sample. It is plausible that gender-based social differences in the manifestation of ASD-related social difficulties in high functioning adult samples may be most observable in more complex peer interactions within dynamic social contexts, and such difficulties may not be obvious during brief introductory interactions with an opposite gender student in a laboratory setting. Indeed, of the limited number of studies that have found significant gender differences between males and females with diagnosed ASD, most differences in social ability have related to peer difficulties and friendships (e.g., Holtmann et al., 2007; McLennan et al., 1993).

Despite the lack of moderating role of gender found in the present study, it is notable that when controlling for the effects of social anxiety, females in our sample had significantly higher levels of observed social competence as compared to males. This finding is consistent with Sasson and colleagues' (2012) findings of higher levels of social ability among females as compared to males in their college sample, and Lai and colleagues' (2011) findings of females with ASD exhibiting less observable impairment during an observational interaction task than their male counterparts. The greater observed social competence among females in our sample is particularly interesting given the lack of gender difference in severity of self-reported ASD traits in our sample. In exploring the high BAP group participants, though no gender differences in ASD traits were found, females in this group had significantly higher levels of social anxiety as compared to males in this group. Further, exploratory findings revealed that ASD traits were significantly related to certain types of social difficulties for females (e.g., reduced Vocal Expressiveness, Positive Affect, Overall Involvement, and Rapport and increased Social Anxiety) but not males; however, these significant relationships for females washed away when controlling for the effect of social anxiety. Such results introduce the potential important role that social anxiety may play when understanding gender differences in ASD related social difficulties.

This is the first study to demonstrate that ASD traits are related to increased likelihood of exceeding diagnostic threshold for more psychiatric disorders and increased likelihood of exceeding diagnostic threshold for a mood disorder. The effects of ASD traits on number of psychiatric disorders and exceeding diagnostic threshold for a mood disorder were small (odds ratios < 1.50) based upon Cohen's (1988) rule-of-thumb for effect sizes of odds ratios (as reviewed in Haddock, Rindskopf, & Shadish, 1998). Our findings are in line with previous studies documenting the strong correlation between ASD traits and symptoms of depression (e.g., Cath, Ran, Smit, van Balkom, & Comijs, 2008; Kanne et al., 2009; Rosbrook & Whittingham, 2010), and with research that has documented increased prevalence of major depressive disorder among relatives of probands with ASD (e.g., Bolton et al., 1998; Piven & Palmer, 1999). It was surprising that ASD traits were not predictive of increased likelihood of exceeding diagnostic threshold for an anxiety disorder; however, it is notable that participants in the high BAP group were the only in our sample to exceed diagnostic threshold for Panic Disorder ( $n = 1$ ) and OCD ( $n = 5$ ), and all but one of the 13 participants exceeding diagnostic criteria for social phobia were in the high BAP group.

Though gender did not significantly moderate the relationship between BAP and number of diagnoses exceeding threshold for diagnostic criteria, post hoc analyses conducted with G\*Power revealed that we were underpowered to detect our small moderation effect (*odds ratio* = 1.01) (power = .12). The results do suggest a trend towards a stronger relationship between ASD traits and number of diagnoses exceeding threshold for diagnostic criteria for females as compared to males. ASD traits more strongly related to exceeding diagnostic criteria for a mood disorder for females as compared to males (at  $\alpha = .10$ ; small effect based upon Cohen's guidelines (1988)). This is consistent with prior findings of higher levels of affective problems among females with ASD (e.g., Solomon et al., 2012), the higher rate of depression found in female as compared to male relatives of ASD probands (Bolton et al., 1998), and findings of relatively higher rates of depression among females as compared to males in the typically developing literature (Kessler et al., 2003). Collectively, our findings and those from prior analogue and clinical research indicating a stronger relationship between ASD traits and likelihood of exceeding criteria for a mood disorder and higher levels of depression among females with ASD may be reflective of shared vulnerability of ASD traits and affective problems, particularly in females (e.g., Bolton et al., 1998), or of unique gender based

sociocultural processes (i.e., differential culturally based social demands, including differential peer expectations) that may lead to increased isolation and stress experienced by females with core social deficits.

Finally, exploratory analyses revealed that ASD traits were not related to academic variables (e.g., GPA); however, ASD traits were predictive of reduced satisfaction with life. When controlling for the effect of social anxiety, ASD traits were more strongly related to reduced satisfaction with life for males as compared to females ( $F^2 = .003$ ; small effect).

There are several notable strengths of the present study that distinguish it from both the extant literature examining gender differences in individuals with ASD and research examining ASD traits in the general population. First, direct assessment (as opposed to the sole use of self- or parent-report) was utilized in order to determine the presence of social difficulties and psychiatric disorders. This was the first study to examine the relationship between ASD traits and social difficulties utilizing blind raters and an observational measure specifically developed to assess core difficulties experienced by individuals with ASD. Additionally, this was the first study to utilize a psychiatric screening tool to examine the relationship between ASD traits and exceeding screening threshold for particular DSM-IV disorders. Also, this was the first study to examine the potentially moderating role of gender in relation to ASD traits in a non-clinical adult sample.

Additionally, in the present study we took into account the potential impact of several methodological and theoretically related constructs on observed social ability that were not considered in the only other study that has examined the relationship between ASD traits and social ability in a non-clinical sample (i.e., Sasson et al., 2012). In particular, we considered the effects of counterbalanced order, confederate, and – arguably most important - symptom overlap between ASD traits and social anxiety. As reflected in the significant main effects of confederate and in differences in primary findings obtained when controlling for social anxiety, our data could have been interpreted quite differently without consideration for these variables.

Also, this study treated ASD traits as a continuous variable in primary data analyses, with no artificial cut-offs or dichotomization of high and low BAP groups. This approach seems to more accurately reflect the continuum of ASD characteristics in the general population and allowed for practical advantages, including our ability to recruit a larger sample size of female participants than has typically be attained in research examining gender differences in ASD.

Further, careful ascertainment procedures were utilized in order to recruit participants. Particular effort was made to recruit individuals with the highest level of ASD traits into Phase II, and a considerable portion of our sample included individuals exceeding diagnostic threshold on our measure of ASD traits (48.2%). We also matched participants on both gender and type of major (STEM versus non-STEM) in order to compare across gender and to ensure that individuals with lower levels of ASD traits did not also differ on type of major.

There are also a number of important limitations of the present study. Given the unique characteristics of our sample (i.e., college students at a science and technology focused university), we are limited in our ability to generalize our findings to other population samples or clinical populations. Indeed, only one participant in the present study had a formal diagnosis of ASD. As has been noted in previous research at this university (White et al., 2011b), in comparison to other non-clinical studies examining ASD traits (e.g., Baron-Cohen et al., 2001), there was a higher number of females in this sample exceeding clinical threshold for ASD and BAP on screening measures. It is possible that the females in this study's sample represent a unique phenotype, different from females with high levels of ASD traits in the general population. Recent concerns of measurement non-equivalence of ASD traits when comparing non-clinical and clinical samples (Frazier et al., 2013), the lack of direct support for the relationship between ASD traits and social ability in our study given prior research supporting a relationship between social ability and ASD severity in clinical samples (Ratto et al., 2010), and questions regarding the uniqueness of ASD traits from social anxiety in predicting social competence all suggest caution in the generalization of these findings to males and females diagnosed with ASD.

The strong correlation between social anxiety and ASD traits in the present study poses some methodological and data analytic challenges. When statistically controlling for social anxiety to evaluate the relationship between ASD traits and social competence, as was done in this study, the leftover variance of ASD traits in predicting social competence may not have been meaningful. That is, due to the potential important role of social anxiety and its bidirectional influence with ASD traits on social competence and the meaningful shared variance between the constructs of ASD traits and social anxiety, it may not be methodologically pragmatic or theoretically sound to account for the overlap between social anxiety and ASD traits. Future research is needed to explore the shared and unique facets of social anxiety and ASD traits.

Additionally, the utilization of ASD domains (e.g., subscales of the BAPQ, such as Rigidity and Pragmatic Language that are less correlated with social anxiety) in predicting social competence may be an alternative method for examining the unique relationship between ASD traits and social competence.

Though we made a concerted effort to purposefully recruit and match participants based upon ASD traits, gender, and type of major, there are also concerns regarding sampling biases. Fewer males than females volunteered for Phase I of the study, and there was considerable difficulty in recruiting a sufficient sample of both high and low BAP males for Phase II of the study. Thus, in order to obtain a sufficient sample size, through our specified recruitment procedures, it was necessary to invite a large proportion of the males from Phase I into Phase II. There may have been systematic differences between both males and females in enrolling, and between those males who were invited (but did not participate) and those actually completed Phase II of the study; however, there were no significant differences in those groups on primary variables of interest (i.e., ASD traits, social anxiety). Though we made a concerted effort to match males and females by STEM major in the Phase II sample, due to particular difficulty recruiting the low BAP male group, we were unable to match four of the high BAP males with low BAP males.

There are also important limitations in our primary measures utilized during Phase II. Notably, the CASS has not yet been subject to rigorous psychometric testing, and research utilizing this measure remains exploratory. It is noteworthy that there was considerable difficulty in training undergraduate research assistants in the CASS coding scheme (less than half were able to be reliably trained for coding), the sensitivity and validity of the CASS requires further evaluation, particularly in non-clinical samples, there were significant confederate effects on CASS performance in the present study, and there are concerns about the ecological validity of the CASS, particularly in the Bored context (several participants made comments to the regard of suspicion of confederates). There are also cautions in the interpretation of the relationship between ASD traits and psychiatric comorbidity in this sample, given our use of an interview that, although well-validated, is meant to be used for screening purposes. It is unclear how many of the participants exceeding screening threshold would meet diagnostic criteria through a more in-depth interview. It is important to note that in our present study there was a higher than expected rate of participants exceeding diagnostic threshold for bipolar mood disorder (22.6%).

Anecdotally, it was noted that participants seemed to have some confusion in understanding the meaning of particular screening items. Though questions were clarified and the interviewers asked for examples of specific symptoms to be provided, it is questionable whether many of those participants would actually meet diagnostic criteria with further semi-structured or unstructured interviewing. It is possible that for some participants, elevated bipolar scores were more indicative of more global emotion regulation difficulties (e.g., periods of irritability and anger, hyperactivity) and social difficulties and misunderstanding (e.g., ideas that others do not understand or agree with), perhaps experienced to a higher degree by participants with elevated ASD traits.

Finally, given the preliminary nature of our study, there is some concern of both Type I and Type II error rates. Given the predominantly small moderation effects found in the psychological literature (Aguinis et al., 2001; Kenny, 2011), despite our use of an elevated alpha to detect moderation effects, we were largely underpowered to detect significant gender moderation in this sample. Conversely, due the number of exploratory analyses we conducted, it is possible that there may be an elevated Type I error rate (rejecting the null when no difference exists).

#### **4.1 - Future Directions**

Future research should examine the relationship between ASD traits and social competence in more naturalistic settings. Observations within peer group interactions (e.g., clubs, group projects) may be conducive to detecting the types of subtle social deficits that we might expect among young adults with high levels of ASD traits, and that we might expect to differ across gender. Additionally, peer (i.e., classmates, roommates) or other (i.e., parent) ratings of social ability of individuals' with high levels of ASD traits may reveal whether ASD traits translate into observable social difficulties within more naturalistic and dynamic settings. In light of Sasson and colleagues' (2012) findings of the mediating role of cognitive aspects related to ASD traits (i.e., social cognition), future research is also warranted in examining endophenotypic differences among individuals with high ASD traits in regard to social insight and understanding (i.e., theory of mind, insight into relationships including own role), as such difficulties may more directly impact social functioning and co-occurring psychopathology. Researchers examining social difficulties among individuals with sub-clinical ASD traits and those with clinically diagnosed ASD should consider factors that may influence social ability

during brief in lab interactions, especially the effect of co-occurring social anxiety, as ignoring such influences may lead to spurious findings. There were few individuals exceeding diagnostic criteria for specific disorders in the present study; it would be of clinical interest to examine the relationship between ASD traits and exceeding diagnostic threshold for specific psychiatric disorders (and perhaps confirming diagnosis with a clinical interview) in a larger sample.

#### **4.2 - Conclusions and Clinical Implications**

Gender was not found to significantly moderate the relationship between ASD traits and social competence in the present study; however, present findings highlight the potential importance of considering the impact of social anxiety when examining the relationship between ASD traits and social ability, particularly for females. We found clear support for the relationship between ASD traits and exceeding criteria for a mood disorder in our sample; however, it is unclear whether exceeding criteria for a mood disorder is reflective of broader emotion regulation difficulties versus meeting diagnostic criteria for a mood disorder.

Though our study does not provide direct support for the relationship between ASD traits and social competence in a college population, our present findings do highlight the clinical need of those with high levels of ASD traits in a college population. In a college sample purposefully recruited based upon ASD traits, there were elevated risks for increased rates of exceeding diagnostic criteria for mental health diagnoses associated with increased ASD traits, particularly mood related concerns. Also, ASD traits were associated with reduced satisfaction with life. These findings underscore the importance of services and support for college students with self-perceived social difficulty, as such difficulties may place individuals at risk for elevated co-occurring mental health concerns. If a young adult presents for treatment related to psychiatric and social difficulties, it may be clinically useful to assess for the presence of ASD traits. Social and peer related difficulties may be an important target of intervention, given the possible mutually exacerbating relationship between social isolation and difficulties and anxiety (e.g., Bellini, 2004) and mood related problems (e.g., Ghaziuddin, Ghaziuddin, & Greden, 2002).

Further research is sorely needed to understand gender differences in the relationship between ASD traits and social competence and co-occurring psychopathology. Results from this study, though preliminarily, suggest that females with ASD may be at heightened risk for psychiatric comorbidity, and that social anxiety may be particularly important to consider in the manifestation of social difficulties among college females with high levels of ASD traits. When

assessing and planning appropriate treatment for females with elevated levels of ASD traits, consideration of social anxiety, as it may impact social, communication, and interpersonal difficulties may be particularly important. Also, the present findings build upon clinical research illustrating increased affective problems among females with ASD (e.g., Solomon et al., 2010), and suggest that consideration of co-occurring mood related concerns may be particularly important when treating female populations with elevated levels of ASD traits. Our exploratory finding that ASD traits were more related to reduced satisfaction with life for males as compared to females deserves further exploration, but may suggest the importance of consideration of overall life satisfaction, in addition to co-occurring psychopathology, in the assessment and treatment of adult males with high levels of ASD traits.

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Table 1

*Demographic Information – Phase I (n = 1039)*

|                                   | <i>M</i> | <i>SD</i> | Minimum  | Maximum     |
|-----------------------------------|----------|-----------|----------|-------------|
| Age (in years)                    | 19.65    | 1.339     | 18       | 24          |
|                                   |          |           | <i>n</i> | % of sample |
| Gender                            |          |           |          |             |
| Male                              |          |           | 267      | 25.7        |
| Female                            |          |           | 772      | 74.3        |
| Race/Ethnicity <sup>a</sup>       |          |           |          |             |
| African American                  |          |           | 48       | 4.6         |
| Asian/Asian American              |          |           | 150      | 14.4        |
| Caucasian/European American       |          |           | 854      | 82.2        |
| Latino, Hispanic, or Chicano      |          |           | 41       | 3.9         |
| Native American                   |          |           | 24       | 2.3         |
| Other                             |          |           | 12       | 1.2         |
| Year in College                   |          |           |          |             |
| First year                        |          |           | 325      | 34.5        |
| Second year                       |          |           | 261      | 25.1        |
| Third year                        |          |           | 227      | 21.8        |
| Fourth year                       |          |           | 189      | 18.2        |
| Fifth year                        |          |           | 33       | 3.2         |
| Sixth year                        |          |           | 2        | 0.2         |
| Seventh year or beyond            |          |           | 2        | 0.2         |
| Major Field of Study              |          |           |          |             |
| Agriculture and Life Sciences     |          |           | 180      | 17.3        |
| Architecture and Urban Studies    |          |           | 18       | 1.7         |
| Biological Sciences               |          |           | 224      | 21.6        |
| Business                          |          |           | 117      | 11.3        |
| Computer Science                  |          |           | 10       | 1.0         |
| Engineering                       |          |           | 72       | 6.9         |
| Liberal Arts and Human Sciences   |          |           | 210      | 20.2        |
| Mathematics                       |          |           | 24       | 2.3         |
| Natural Resources and Environment |          |           | 0        | 0           |
| Physical Sciences                 |          |           | 24       | 2.3         |
| Psychology                        |          |           | 140      | 13.5        |
| Other                             |          |           | 20       | 1.9         |

Table 1 continued

*Demographic Information – Phase I (n = 1039)*

|   | <i>n</i> | % of sample |
|---|----------|-------------|
| Science Technology Engineering Math (STEM) Status |          |             |
| STEM  | 484      | 46.6        |
| Non-STEM  | 542      | 52.2        |
| Other   | 13       | 1.3         |
| Participant Diagnoses <sup>a, b</sup>             |          |             |
| Depression  | 115      | 11.1        |
| Anxiety   | 100      | 9.6         |
| Attention-Deficit/Hyperactivity Disorder          | 54       | 5.2         |
| Autism Spectrum Disorder                          | 1        | 0.1         |
| Learning Disorder                                 | 17       | 1.6         |
| Eating Disorder                                   | 20       | 1.9         |
| Participant Reported Struggles <sup>a</sup>       |          |             |
| Depression  | 309      | 29.7        |
| Anxiety   | 273      | 26.3        |
| Attention-Deficit/Hyperactivity Disorder          | 81       | 7.8         |
| Autism Spectrum Disorder                          | 7        | 0.7         |
| Learning Disorder                                 | 30       | 2.9         |
| Eating Disorder                                   | 114      | 11.0        |

<sup>a</sup>Participants could choose more than one answer for these questions.

<sup>b</sup>Diagnoses that have been given as a formal diagnosis (e.g., through an evaluation with a written report).

Table 2

*Demographic Information – Phase II (n = 85)*

|                                   | <i>M</i> | <i>SD</i> | Minimum  | Maximum     |
|-----------------------------------|----------|-----------|----------|-------------|
| Age (in years)                    | 19.95    | 1.495     | 18       | 24          |
|                                   |          |           | <i>n</i> | % of sample |
| Gender                            |          |           |          |             |
| Male                              |          |           | 40       | 47.1        |
| Female                            |          |           | 45       | 52.9        |
| Race/Ethnicity <sup>a</sup>       |          |           |          |             |
| African American                  |          |           | 7        | 8.2         |
| Asian/Asian American              |          |           | 16       | 18.8        |
| Caucasian/European American       |          |           | 66       | 77.6        |
| Latino, Hispanic, or Chicano      |          |           | 2        | 2.4         |
| Native American                   |          |           | 1        | 1.2         |
| Other                             |          |           | 0        | 0           |
| Year in College                   |          |           |          |             |
| First year                        |          |           | 28       | 32.9        |
| Second year                       |          |           | 25       | 29.4        |
| Third year                        |          |           | 18       | 21.2        |
| Fourth year                       |          |           | 8        | 9.4         |
| Fifth year                        |          |           | 4        | 4.7         |
| Sixth year                        |          |           | 1        | 1.2         |
| Seventh year or beyond            |          |           | 1        | 1.2         |
| Major Field of Study              |          |           |          |             |
| Agriculture and Life Sciences     |          |           | 180      | 17.3        |
| Architecture and Urban Studies    |          |           | 18       | 1.7         |
| Biological Sciences               |          |           | 224      | 21.6        |
| Business                          |          |           | 117      | 11.3        |
| Computer Science                  |          |           | 10       | 1.0         |
| Engineering                       |          |           | 72       | 6.9         |
| Liberal Arts and Human Sciences   |          |           | 210      | 20.2        |
| Mathematics                       |          |           | 24       | 2.3         |
| Natural Resources and Environment |          |           | 0        | 0           |
| Physical Sciences                 |          |           | 24       | 2.3         |
| Psychology                        |          |           | 140      | 13.5        |
| Other                             |          |           | 20       | 1.9         |

Table 2 continued

*Demographic Information – Phase II (n = 85)*

|   | <i>n</i> | % of sample |
|---|----------|-------------|
| Science Technology Engineering Math (STEM) Status |          |             |
| STEM  | 54       | 63.5        |
| Non-STEM  | 31       | 36.5        |
| Participant Diagnoses <sup>a, b</sup>             |          |             |
| Depression  | 13       | 15.3        |
| Anxiety   | 8        | 9.4         |
| Attention-Deficit/Hyperactivity Disorder          | 2        | 2.4         |
| Autism Spectrum Disorder                          | 1        | 1           |
| Learning Disorder                                 | 1        | 1.2         |
| Eating Disorder                                   | 0        | 0           |
| No diagnoses reported                             | 69       | 81.2        |
| Participant Reported Struggles <sup>a</sup>       |          |             |
| Depression  | 33       | 33.8        |
| Anxiety   | 20       | 23.5        |
| Attention-Deficit/Hyperactivity Disorder          | 8        | 9.4         |
| Autism Spectrum Disorder                          | 1        | 0.1         |
| Learning Disorder                                 | 3        | 3.5         |
| Eating Disorder                                   | 5        | 5.9         |
| No struggles reported                             | 46       | 54.1        |

<sup>a</sup>Participants could choose more than one answer for these questions.

<sup>b</sup>Diagnoses that have been given as a formal diagnosis (e.g., through an evaluation with a written report).

Table 3

*Descriptive Data for BAPQ (n = 1039), AQ (n = 1020), SPAI-23 (n = 999), and SWLS (n = 997)*

*– Phase I*

|                          | <i>M (SD)</i>  | <i>Range</i> | <i>Skewness</i> | <i>Kurtosis</i> | <i>α</i> |
|--------------------------|----------------|--------------|-----------------|-----------------|----------|
| BAPQ total score         | 2.75 (0.56)    | 1.17 - 4.72  | 0.31            | -0.03           | .86      |
| BAPQ continuous score    | 99.0 (20.21)   | 42 – 170     | 0.31            | -0.03           | .86      |
| AQ binary score          | 17.00 (6.32)   | 2 – 39       | 0.50            | 0.03            | .78      |
| AQ continuous score      | 106.54 (13.46) | 69 – 153     | 0.09            | 0.04            | .82      |
| SPAI-23 difference score | 20.32 (14.30)  | -8 – 55      | 0.25            | 0.21            | .94      |
| SWLS total score         | 25.21 (6.44)   | 5-35         | -0.65           | -0.07           | .88      |

Table 4

*Descriptive Data for BAPQ (n = 85), AQ (n = 74), SPAI-23 (n = 83), SWLS (n = 82), EDQ (n = 85), and CASS<sup>1</sup> (n = 79) – Phase II*

|                             | <i>M (SD)</i>  | <i>Range</i> | <i>Skewness</i> | <i>Kurtosis</i> | <i>α/ICC</i>      |
|-----------------------------|----------------|--------------|-----------------|-----------------|-------------------|
| BAPQ Total score            | 2.99 (0.70)    | 1.69 – 4.72  | 0.04            | -0.40           | 0.90              |
| BAPQ Aloof Continuous score | 36.04 (12.49)  | 14 – 65      | 0.15            | -0.73           | 0.91              |
| BAPQ Continuous score       | 107.93 (25.35) | 61 – 170     | 0.04            | -0.40           | 0.90              |
| AQ Binary score             | 19.71 (7.56)   | 5 – 38       | 0.19            | -0.35           | 0.78              |
| AQ Continuous score         | 109.97 (15.95) | 75-153       | -0.02           | -0.01           | 0.86              |
| SPAI-23 Difference Score    | 23.31 (11.36)  | -1 - 55      | 0.55            | 0.09            | 0.94              |
| SWLS Total score            | 23.49 (7.06)   | 5 - 35       | -0.26           | -0.58           | 0.85              |
| EDQ Present Total score     | 16.18 (5.79)   | 10 – 33      | 1.05            | 0.52            | 0.80              |
| EDQ Childhood Total score   | 21.25 (8.12)   | 12 – 53      | 1.20            | 1.78            | 0.81              |
| CASS Topic Changes          | 3.33 (2.25)    | 0 - 10       | 0.72            | 0.35            | 0.82 <sup>c</sup> |
| CASS Asks Questions         | 8.33 (3.95)    | 1 - 22.5     | 1.07            | 1.78            | 0.96              |
| CASS Vocal Expressiveness   | 5.67 (0.87)    | 1 - 7        | -2.43           | 12.11           | 0.93              |
| CASS Gestures               | 4.07 (1.72)    | 1 - 7        | -0.68           | -0.68           | 0.87              |
| CASS Positive Affect        | 5.06 (1.12)    | 1.5 - 7      | -1.35           | 2.83            | 0.59              |
| CASS Kinesic Arousal        | 5.24 (0.94)    | 2.5 - 7      | -0.48           | 0.70            | 0.84              |
| CASS Social Anxiety         | 5.43 (1.16)    | 2 - 7        | -1.33           | 1.63            | 0.90              |
| CASS Overall Involvement    | 5.75 (0.83)    | 2.5 - 7      | -1.92           | 4.95            | 0.86              |
| CASS Rapport                | 5.57 (0.95)    | 3 - 7        | -1.41           | 2.50            | 0.85              |
| CASS SC                     | 37.08 (7.14)   | 14 – 58      | -0.45           | 1.47            | -                 |
| CASS TC                     | 5.23 (5.15)    | -10.5 – 19.5 | -0.17           | 0.77            | -                 |

*Note:* CASS SC = CASS Social Competence. CASS TC = CASS Total Change.

<sup>1</sup>Mean, standardize deviations, and ranges are based upon non-standardized average ratings across coders. Reliability statistics reflect ICC's computed across two raters.

Table 5

*Percentage of Participants Exceeding Screening Threshold on the AQ, BAPQ, and SPAI-23, and Self-Reporting Struggle with or Diagnosis of ASD during Phases I and II*

|                                   | Phase I                     |                      | Phase II                    |                      |
|-----------------------------------|-----------------------------|----------------------|-----------------------------|----------------------|
|                                   | <i>n</i><br>(males/females) | % of Total<br>Sample | <i>n</i><br>(males/females) | % of Total<br>Sample |
| AQ                                | 25 (10/15)                  | 2.4                  | 7 (4/3)                     | 8.2                  |
| BAPQ                              | 238 (80/158)                | 22.9                 | 41 (18/23)                  | 48.2                 |
| SPAI-23                           | 225 (56/169)                | 21.79                | 29 (11/18)                  | 34.1                 |
| Struggle with<br>ASD <sup>1</sup> | 7 (2/5)                     | < 0.001              | 0                           | 0.0                  |
| Diagnosed ASD <sup>1</sup>        | 1 (0/1)                     | <0.001               | 1 (0/1)                     | 0.01                 |

<sup>1</sup>As self-reported on demographic questionnaire.

Table 6

*Independent Samples t-tests Comparing Scores on AQ, BAPQ, SPAI-23, and EDQ in Phases I and II across Gender*

| Phase I                 |                |                |          |           |
|-------------------------|----------------|----------------|----------|-----------|
|                         | Males          | Females        |          |           |
|                         | <i>M (SD)</i>  | <i>M (SD)</i>  | <i>t</i> | <i>df</i> |
| AQ                      | 109.91(12.87)  | 105.39 (13.47) | -4.60**  | 976       |
| BAPQ                    | 102.44 (20.73) | 97.81 (19.90)  | -3.20**  | 1037      |
| SPAI-23                 | 20.26 (9.75)   | 20.34 (10.48)  | 0.10     | 997       |
| Phase II                |                |                |          |           |
|                         | Males          | Females        |          |           |
|                         | <i>M (SD)</i>  | <i>M (SD)</i>  | <i>t</i> | <i>df</i> |
| AQ                      | 112.51 (14.50) | 107.69 (17.02) | -1.30    | 72        |
| BAPQ                    | 107.03 (26.06) | 108.73 (24.96) | 0.31     | 83        |
| SPAI-23                 | 21.23 (10.27)  | 25.16 (12.06)  | 1.59     | 81        |
| EDQ childhood total     | 23.65 (8.83)   | 19.11 (6.85)   | -2.66*   | 83        |
| EDQ childhood com.      | 7.37 (3.61)    | 6.00 (2.19)    | -2.15*   | 83        |
| EDQ childhood social    | 8.55 (4.25)    | 6.98 (3.4)     | -1.89    | 83        |
| EDQ childhood rep. beh. | 7.73 (3.19)    | 6.13 (2.54)    | -2.60*   | 83        |
| EDQ current total       | 17.40 (5.49)   | 15.09 (5.89)   | -1.87    | 83        |
| EDQ current com.        | 3.70 (1.77)    | 3.29 (1.58)    | -1.13    | 83        |
| EDQ current social      | 7.13 (2.91)    | 6.98 (3.40)    | -1.53    | 83        |
| EDQ current rep. beh.   | 6.58 (2.07)    | 5.64 (2.19)    | -2.01*   | 83        |

*Note.* EDQ childhood com. = EDQ childhood communication. EDQ current com. = EDQ current communication. EDQ childhood rep. beh. = EDQ childhood repetitive behavior. EDQ current rep. beh. = EDQ current repetitive behavior.

\* $p < .05$ ; \*\* $p < .01$

Table 7

*Number of participants exceeding diagnostic threshold for disorders on the MINI by gender*

*(female n = 45; male n = 39)*

|  | <i>n</i>  | % of sample |
|--|-----------|-------------|
| <b>Major depressive disorder</b>         | <b>11</b> | <b>31</b>   |
| Females                                  | 6         | 13.3        |
| Males                                    | 4         | 10          |
| <b>Dysthymia</b>                         | <b>2</b>  | <b>2.4</b>  |
| Females                                  | 0         | 0           |
| Males                                    | 2         | 5           |
| <b>Panic Disorder</b>                    | <b>1</b>  | <b>1.2</b>  |
| Females                                  | 1         | 2.2         |
| Males                                    | 0         | 0           |
| <b>Agoraphobia</b>                       | <b>9</b>  | <b>10.7</b> |
| Females                                  | 5         | 11.1        |
| Males                                    | 4         | 10          |
| <b>OCD</b>                               | <b>5</b>  | <b>6.5</b>  |
| Females                                  | 4         | 8.9         |
| Males                                    | 1         | 2.5         |
| <b>Alcohol Use Disorder</b>              | <b>15</b> | <b>17.9</b> |
| Females                                  | 4         | 8.9         |
| Males                                    | 11        | 27.5        |
| <b>Substance Use Disorder</b>            | <b>11</b> | <b>13.1</b> |
| Females                                  | 4         | 8.9         |
| Males                                    | 7         | 17.5        |
| <b>Psychotic Disorder</b>                | <b>0</b>  | <b>0</b>    |
| Females                                  | -         | -           |
| Males                                    | -         | -           |
| <b>Anorexia nervosa</b>                  | <b>0</b>  | <b>0</b>    |
| Females                                  | -         | -           |
| Males                                    | -         | -           |
| <b>Bulimia nervosa</b>                   | <b>3</b>  | <b>3.6</b>  |
| Females                                  | 3         | 6.7         |
| Males                                    | 0         | 0           |
| <b>Generalized anxiety disorder</b>      | <b>20</b> | <b>23.8</b> |
| Females                                  | 12        | 26.7        |
| Males                                    | 8         | 20          |
| <b>Bipolar mood disorder<sup>1</sup></b> | <b>19</b> | <b>22.6</b> |
| Females                                  | 8         | 17.8        |
| Males                                    | 11        | 27.5        |
| <b>Social Phobia</b>                     | <b>13</b> | <b>15.5</b> |
| Females                                  | 7         | 15.6        |
| Males                                    | 6         | 15          |
| <b>Antisocial personality disorder</b>   | <b>1</b>  | <b>1.2</b>  |
| Females                                  | 0         | 0           |
| Males                                    | 1         | 2.5         |

<sup>1</sup>Includes exceeding threshold for hypomania or mania symptoms in the past or at present. The majority of symptoms were of hypomania ( $n = 13$ ; 68%), and all but one case was a past episode.

Table 8

*Pearson Correlation Matrix between Phase I BAPQ (n = 1039), AQ (n = 1020), and SPAI-23 (n = 999)*

|    | 1. BAPQ<br>Total | 2. BAPQ<br>Aloof | 3. BAPQ<br>Pragmatic | 4. BAPQ<br>Rigidity | 5. AQ | 6. SPAI-23 |
|----|------------------|------------------|----------------------|---------------------|-------|------------|
| 1. | -                | .84**            | .72**                | .75**               | .74** | .56**      |
| 2. |                  | -                | .47**                | .41**               | .65** | .55**      |
| 3. |                  |                  | -                    | .29**               | .51** | .34**      |
| 4. |                  |                  |                      | -                   | .53** | .38**      |
| 5. |                  |                  |                      |                     | -     | .49**      |
| 6. |                  |                  |                      |                     |       | -          |

\* $p < .05$ ; \*\* $p < .001$

Table 9

*Pearson Correlation Matrix among Phase II BAPQ (n = 85), AQ (n = 74), SPAI-23 (n = 83), and EDQ (n = 85)*

|     | 1. BAPQ<br>Total | 2. Aloof | 3. Prag. | 4. Rigid | 5. AQ | 6. SPAI-23 | 7. EDQ<br>Current<br>Soc. | 8. EDQ<br>Current<br>Com. | 9. EDQ<br>Current<br>Rep. Beh. | 10. EDQ<br>Child.<br>Soc. | 11. EDQ<br>Child.<br>Com. | 12. EDQ<br>Child.<br>Rep. Beh. |
|-----|------------------|----------|----------|----------|-------|------------|---------------------------|---------------------------|--------------------------------|---------------------------|---------------------------|--------------------------------|
| 1.  | -                | .87**    | .73**    | .81**    | .80** | .62**      | .59**                     | .46**                     | .31**                          | .40**                     | .44**                     | .26*                           |
| 2.  |                  | -        | .51**    | .52**    | .72** | .67**      | .60**                     | .52**                     | .24*                           | .37**                     | .42**                     | .18                            |
| 3.  |                  |          | -        | .41**    | .53** | .34**      | .35**                     | .29**                     | .26*                           | .32**                     | .33**                     | .33*                           |
| 4.  |                  |          |          | -        | .63** | .44**      | .44**                     | .29**                     | .25*                           | .31**                     | .31**                     | .17                            |
| 5.  |                  |          |          |          | -     | .46**      | .55**                     | .35**                     | .38**                          | .34**                     | .43**                     | .25*                           |
| 6.  |                  |          |          |          |       | -          | .35**                     | .37**                     | .04                            | .29**                     | .21                       | .01                            |
| 7.  |                  |          |          |          |       |            | -                         | .70**                     | .58**                          | .55**                     | .62**                     | .41**                          |
| 8.  |                  |          |          |          |       |            |                           | -                         | .27*                           | .45**                     | .60**                     | .27*                           |
| 9.  |                  |          |          |          |       |            |                           |                           | -                              | .35**                     | .43**                     | .67**                          |
| 10. |                  |          |          |          |       |            |                           |                           |                                | -                         | .66**                     | .42**                          |
| 11. |                  |          |          |          |       |            |                           |                           |                                |                           | -                         | .45**                          |
| 12. |                  |          |          |          |       |            |                           |                           |                                |                           |                           | -                              |

*Note:* Aloof = BAPQ Aloof. Prag. = BAPQ Pragmatic Language. Rigid = BAPQ Rigidity. EDQ Current Soc. = EDQ Current Socialization. EDQ Current Com. = EDQ Current Communication. EDQ Current Rep. Beh. = EDQ Current Repetitive Behavior. EDQ Child. Soc. = EDQ Childhood Socialization. EDQ Child. Com. = EDQ Childhood Communication. EDQ Child. Rep. Beh. = EDQ Childhood Repetitive Behavior.

\* $p < .05$ ; \*\* $p < .001$

Table 10

*Pearson Bivariate Correlations between BAPQ, AQ, SPAI-23, and CASS Items and CASS Total Scores and Partial Correlations between BAPQ Total and Aloof and CASS Items and CASS Total Scores*

|                     | BAPQ<br>Total | BAPQ<br>Aloof | AQ            | SPAI-23      | BAPQ Total<br>controlling for<br>SPAI-23 | BAPQ<br>Aloof<br>controlling<br>for SPAI-23 |
|---------------------|---------------|---------------|---------------|--------------|--|---|
|                     | <i>r</i>      |               |               |              | <i>pr</i>                                |   |
| Asks Questions      | -.21          | -.21          | -.06          | -.19         | -.11                                     | -.14  |
| Topic Changes       | .07           | .04           | -.13          | .07          | .11                                      | .06   |
| Vocal Exp.          | <b>-.27*</b>  | <b>-.41**</b> | <b>-.29*</b>  | -.13         | -.14                                     | <b>-.30**</b>                               |
| Gestures            | -.20          | <b>-.26*</b>  | <b>-.32**</b> | -.09         | -.10                                     | <b>-.23*</b>                                |
| Positive Affect     | <b>-.23*</b>  | <b>-.34**</b> | <b>-.29*</b>  | -.06         | -.12                                     | <b>-.24*</b>                                |
| Kinesic Arousal     | -.10          | -.14          | -.07          | -.14         | -.001                                    | -.05  |
| Social Anxiety      | <b>-.41**</b> | <b>-.51**</b> | <b>-.39**</b> | <b>-.23*</b> | -.12                                     | <b>-.29*</b>                                |
| Overall Involvement | <b>-.27*</b>  | <b>-.38**</b> | <b>-.36**</b> | -.13         | -.11                                     | <b>-.24*</b>                                |
| Rapport             | <b>-.31**</b> | <b>-.41**</b> | <b>-.30**</b> | -.19         | -.07                                     | -.21  |
| CASS SC             | -.20          | <b>-.30**</b> | <b>-.31**</b> | -.17         | -.10                                     | <b>-.25*</b>                                |
| CASS TC             | -.07          | -.12          | -.10          | -.10         | -.03                                     | -.07  |

*Note:* BAPQ Tot. = BAPQ Total. Vocal Exp. = Vocal Expressiveness. CASS SC = CASS Social Competence. CASS TC = CASS Total Change.  
\* $p < .05$ ; \*\* $p < .001$

Table 11

*Hierarchical Regression Analysis using BAPQ Total score, Gender, and Interaction  
Between BAPQ Total and Gender Predicting CASS SC (n = 79)*

| Variable           | <i>B</i> | <i>SE B</i> | $\beta$ |
|--------------------|----------|-------------|---------|
| BAPQ Total         | -0.13    | 0.07        | -.62    |
| Gender             | -2.93    | 1.12        | -.28**  |
| BAPQ x gender      | 0.05     | 0.04        | .42     |
| $R^2$              |          | .14         |         |
| <i>F</i> for $R^2$ |          | 3.98*       |         |

*Note:* CASS SC = CASS Social Competence. BAPQ Total score was centered at its mean.

\* $p < .05$ ; \*\* $p < .01$

Table 12

*Hierarchical Regression Analysis using Social Anxiety, BAPQ Total, Gender, and Interaction Between BAPQ Total and Gender Predicting CASS SC (n = 77)*

| Variable                                     | Model 1  |             |         | Model 2  |             |         |
|--|----------|-------------|---------|----------|-------------|---------|
|  | <i>B</i> | <i>SE B</i> | $\beta$ | <i>B</i> | <i>SE B</i> | $\beta$ |
| Social Anxiety                               | -0.08    | 0.05        | -.18    | -0.08    | 0.63        | -.18    |
| BAPQ Total                                   |          |             |         | 0.78     | 0.08        | -.39    |
| Gender                                       |          |             |         | -3.61    | 1.11        | -.36**  |
| BAPQ x gender                                |          |             |         | 0.04     | 0.04        | .31     |
| <i>R</i> <sup>2</sup>                        |          | .03         |         |          | .18         |         |
| <i>F</i> for change in <i>R</i> <sup>2</sup> |          | 2.43        |         |          | 4.20**      |         |

*Note:* CASS SC = CASS Social Competence. Social anxiety and BAPQ Total were centered at their means.

\**p* < .05; \*\**p* < .01

Table 13

*Mixed Model including Random Effect of Confederate and Fixed Effects of BAPQ Total, Gender, and Interaction between BAPQ Total and Gender Predicting CASS SC (n = 79)*

| Variable      | <i>Estimate</i>           | <i>Std. Error</i> | <i>t Ratio</i>       |
|---------------|---------------------------|-------------------|----------------------|
| BAPQ Total    | -0.04                     | 0.02              | -1.69                |
| Gender        | 1.52                      | 0.77              | 1.99                 |
| BAPQ x gender | -0.03                     | 0.02              | -1.46                |
|               | <i>Variance Component</i> | <i>Std. Error</i> | <i>Pct. of Total</i> |
| Confederate   | 1.94                      | 2.74              | 7.72                 |
| $R^2$         |                           | .22               |                      |

*Note:* CASS SC = CASS Social Competence. BAPQ Total was centered at its mean.

Table 14

*Mixed Model including Random Effect of Confederate and Fixed Effects of Social Anxiety, BAPQ Total, Gender, and Interaction between BAPQ Total and Gender Predicting CASS SC (n = 77)*

| Variable             | <i>Estimate</i>           | <i>Std. Error</i> | <i>t Ratio</i>       |
|----------------------|---------------------------|-------------------|----------------------|
| Social Anxiety       | -0.08                     | 0.06              | -1.36                |
| BAPQ Total           | -0.01                     | 0.03              | -0.40                |
| Gender               | 1.96                      | 0.77              | 2.55*                |
| BAPQ x gender        | -0.03                     | 0.02              | -1.23                |
|                      | <i>Variance Component</i> | <i>Std. Error</i> | <i>Pct. of Total</i> |
| Confederate          | 2.09                      | 2.63              | 9.09                 |
| <i>R<sup>2</sup></i> | <i>.27</i>                |                   |                      |

*Note:* CASS SC = CASS Social Competence. BAPQ Total and social anxiety were mean centered.

\**p* < .05; \*\**p* < .01

Table 15

*Hierarchical Regression Analysis using BAPQ Aloof, Gender, and Interaction*

*Between BAPQ Aloof and Gender Predicting CASS SC (n = 79)*

| Variable           | Model 1  |             |         |
|--------------------|----------|-------------|---------|
|                    | <i>B</i> | <i>SE B</i> | $\beta$ |
| BAPQ Aloof         | -0.16    | 0.06        | -.38*   |
| Gender             | -2.60    | 1.10        | -.25*   |
| Aloof x gender     | -0.07    | 0.09        | -.13    |
| $R^2$              | .16      |             |         |
| <i>F</i> for $R^2$ | 4.78**   |             |         |

*Note:* CASS SC = CASS Social Competence. BAPQ Aloof was centered at its mean.

\* $p < .05$ ; \*\* $p < .01$

Table 16

*Mixed Model including Random Effect of Confederate and Fixed Effects of BAPQ Aloof, Gender, and Interaction between BAPQ Aloof and Gender Predicting CASS SC (n = 79)*

| Variable       | <i>Estimate</i>           | <i>Std. Error</i> | <i>t Ratio</i>       |
|----------------|---------------------------|-------------------|----------------------|
| BAPQ Aloof     | -0.11                     | 0.05              | -2.32*               |
| Gender         | 1.37                      | 0.72              | 2.39                 |
| Aloof x gender | -0.05                     | 0.04              | -1.01                |
|                | <i>Variance Component</i> | <i>Std. Error</i> | <i>Pct. of Total</i> |
| Confederate    | 1.13                      | 2.49              | 4.67                 |
| $R^2$          |                           | .21               |                      |

*Note:* CASS SC = CASS Social Competence. BAPQ Aloof was centered at its mean.

\* $p < .05$ ; \*\* $p < .01$

Table 17

*Hierarchical Regression Analysis using Social Anxiety, BAPQ Aloof, Gender, and Interaction Between BAPQ Aloof and Gender Predicting CASS SC (n = 77)*

| Variable                     | Model 1  |             |         | Model 2  |             |         |
|------------------------------|----------|-------------|---------|----------|-------------|---------|
|                              | <i>B</i> | <i>SE B</i> | $\beta$ | <i>B</i> | <i>SE B</i> | $\beta$ |
| Social Anxiety               | -0.08    | 0.05        | -.18    | -0.04    | 0.07        | -.09    |
| BAPQ Aloof                   |          |             |         | -0.12    | 0.08        | -.29    |
| Gender                       |          |             |         | -3.24    | 1.14        | -.32**  |
| Aloof x gender               |          |             |         | 0.05     | 0.08        | .09     |
| $R^2$                        |          | .03         |         |          | .19         |         |
| <i>F</i> for change in $R^2$ |          | 2.43        |         |          | 4.21**      |         |

*Note:* CASS SC = CASS Social Competence. Social anxiety and BAPQ Aloof were centered at their means.

\* $p < .05$ ; \*\* $p < .01$

Table 18

*Mixed Model including Random Effect of Confederate and Fixed Effects of Social Anxiety, BAPQ Aloof, Gender, and Interaction between BAPQ Aloof and Gender Predicting CASS SC (n = 77)*

| Variable             | <i>Estimate</i>           | <i>Std. Error</i> | <i>t Ratio</i>       |
|----------------------|---------------------------|-------------------|----------------------|
| Social Anxiety       | -0.05                     | 0.07              | -0.71                |
| BAPQ Aloof           | -0.07                     | -1.13             | -0.27                |
| Gender               | 1.96                      | 0.77              | 2.55                 |
| Aloof x gender       | -0.04                     | 0.04              | 0.37                 |
|                      | <i>Variance Component</i> | <i>Std. Error</i> | <i>Pct. of Total</i> |
| Confederate          | 1.43                      | 2.48              | 6.35                 |
| <i>R<sup>2</sup></i> | <i>.25</i>                |                   |                      |

*Note:* CASS SC = CASS Social Competence. BAPQ Aloof and Social anxiety were mean centered.

\**p* < .05; \*\**p* < .01

Table 19

*Correlations between BAPQ (both Total and Aloof Subscale) and CASS Items by Gender*

*(females n = 41; males n = 38) with and without (females n = 40; males n = 37) Controlling for Effect of Social Anxiety*

|                 | BAPQ Total    |       | BAPQ Aloof    |       | BAPQ Total Controlling for Social Anxiety <sup>1</sup> |       | BAPQ Aloof Controlling for Social anxiety <sup>1</sup> |              |
|-----------------|---------------|-------|---------------|-------|--|-------|--|--------------|
|                 | Females       | Males | Females       | Males | Females  | Males | Females  | Males        |
| Asks Questions  | -.27          | -.13  | -.29          | -.11  | -.13   | -.07  | -.15   | -.06         |
| Topic Changes   | -.09          | .06   | .11           | .03   | .25  | -.01  | .30  | -.08         |
| Vocal Exp.      | <b>-.40**</b> | -.04  | <b>-.43**</b> | -.17  | -.22   | -.08  | .04  | -.26         |
| Gestures        | -.28          | -.10  | -.28          | -.27  | .002   | -.18  | -.13   | <b>-.43*</b> |
| Positive Affect | <b>-.36*</b>  | -.05  | <b>-.40*</b>  | -.12  | -.08   | -.12  | -.04   | -.22         |
| Kinesic Arousal | -.20          | -.10  | -.22          | -.16  | .05  | .09   | -.08   | .07          |
| Social Anxiety  | <b>-.40**</b> | -.25  | <b>-.46**</b> | -.36  | -.01   | -.15  | .03  | -.29         |
| Overall Involv. | <b>-.32*</b>  | -.11  | <b>-.33*</b>  | -.21  | .03  | -.16  | .06  | -.21         |
| Rapport         | <b>-.40**</b> | -.10  | <b>-.42*</b>  | -.23  | -.04   | -.04  | -.12   | -.03         |

*Note.* Overall Involv. = Overall Involvement.

<sup>1</sup>Partial correlations.

\* $p < .05$ ; \*\* $p < .01$

Table 20

*Hierarchical Regression Analysis using BAPQ Total, Gender, and Interaction*

*Between BAPQ Total and Gender Predicting CASS TC (n = 79)*

| Variable           | <i>B</i> | <i>SE B</i> | $\beta$ |
|--------------------|----------|-------------|---------|
| BAPQ total         | 0.00     | 0.30        | .01     |
| Gender             | -0.23    | 0.02        | -.06    |
| BAP x gender       | 0.00     | 0.02        | -.09    |
| $R^2$              |          | .01         |         |
| <i>F</i> for $R^2$ |          | 0.24        |         |

*Note:* CASS TC = CASS Total Change. BAPQ Total was centered at its mean.

Table 21

*Hierarchical Regression Analysis using Social Anxiety, BAPQ Total, Gender, and Interaction*

*Between BAPQ Total and Gender Predicting CASS TC (n = 77)*

| Variable                     | Model 1  |             |         | Model 2  |             |         |
|------------------------------|----------|-------------|---------|----------|-------------|---------|
|                              | <i>B</i> | <i>SE B</i> | $\beta$ | <i>B</i> | <i>SE B</i> | $\beta$ |
| Social Anxiety               | -0.02    | 0.02        | -.10    | -0.01    | 0.02        | -.08    |
| BAPQ Total                   |          |             |         | 0.00     | 0.03        | .03     |
| Gender                       |          |             |         | -0.07    | 0.43        | -.02    |
| BAPQ x gender                |          |             |         | -0.07    | 0.43        | -0.02   |
| $R^2$                        |          | .01         |         |          | .01         |         |
| <i>F</i> for change in $R^2$ |          | 0.69        |         |          | 0.19        |         |

*Note:* CASS TC = CASS Total Change. Social anxiety and BAPQ Total were centered at their means.

Table 22

*Hierarchical Regression Analysis using BAPQ Aloof, Gender, and Interaction*

*Between BAPQ and Gender Predicting CASS TC (n = 79)*

| Variable           | <i>B</i> | <i>SE B</i> | $\beta$ |
|--------------------|----------|-------------|---------|
| BAPQ Aloof         | 0.09     | 0.30        | -.03    |
| Gender             | -.019    | 0.43        | -.05    |
| Aloof x gender     | 0.03     | 0.04        | -.13    |
| $R^2$              |          | .03         |         |
| <i>F</i> for $R^2$ |          | 0.65        |         |

*Note:* CASS TC = CASS Total Change. BAPQ Aloof was centered at its mean.

Table 23

*Hierarchical Regression Analysis using Social Anxiety, BAPQ Aloof, Gender, and Interaction Between BAPQ Aloof and Gender Predicting CASS TC (n = 77)*

| Variable                     | Model 1  |             |         | Model 2  |             |         |
|------------------------------|----------|-------------|---------|----------|-------------|---------|
|                              | <i>B</i> | <i>SE B</i> | $\beta$ | <i>B</i> | <i>SE B</i> | $\beta$ |
| Social Anxiety               | -0.02    | 0.02        | -.10    | -0.01    | 0.03        | -.05    |
| BAPQ Aloof                   |          |             |         | 0.00     | 0.03        | -.03    |
| Gender                       |          |             |         | -0.02    | 0.44        | -.11    |
| Aloof x gender               |          |             |         | -0.02    | 0.43        | -0.01   |
| $R^2$                        |          | .01         |         |          | .02         |         |
| <i>F</i> for change in $R^2$ |          | 0.69        |         |          | 0.37        |         |

*Note:* CASS TC = CASS Total Change. Social anxiety and BAPQ Aloof were centered at their means.

Table 24

*Mixed Model including Random Effect of Interested and Bored Confederates and Fixed Effects of BAPQ Total, Gender, and Interaction between BAPQ Total and Gender Predicting CASS TC (n = 79)*

| Variable         | <i>Estimate</i>           | <i>Std. Error</i> | <i>t Ratio</i>       |
|------------------|---------------------------|-------------------|----------------------|
| BAPQ Total       | <-0.001                   | 0.55              | 0.58                 |
| Gender           | -0.03                     | -0.07             | 0.94                 |
| BAPQ x gender    | <-0.001                   | 0.05              | 0.96                 |
|                  | <i>Variance Component</i> | <i>Std. Error</i> | <i>Pct. of Total</i> |
| Confederate Int. | 0.58                      | 0.56              | 15.20                |
| Confederate Bor. | 0.45                      | 0.53              | 11.80                |
| $R^2$            |                           | .33               |                      |

*Note: CASS TC = CASS Total Change. BAPQ Total was centered at its mean.*

Table 25

*Mixed Model including Random Effect of Interested and Bored Confederates and Fixed Effects of Social Anxiety, BAPQ Total, Gender, and Interaction between BAPQ Total and Gender Predicting CASS TC (n = 77)*

| Variable         | <i>Estimate</i>           | <i>Std. Error</i> | <i>t Ratio</i>       |
|------------------|---------------------------|-------------------|----------------------|
| Social Anxiety   | 0.003                     | 0.02              | 0.12                 |
| BAPQ Total       | <0.001                    | 0.01              | -0.54                |
| Gender           | -0.08                     | 0.40              | -0.20                |
| BAPQ x gender    | <0.001                    | 0.01              | -0.02                |
|                  | <i>Variance Component</i> | <i>Std. Error</i> | <i>Pct. of Total</i> |
| Confederate Int. | 0.38                      | 0.50              | 11.08                |
| Confederate Bor. | 0.41                      | 0.56              | 11.94                |
| $R^2$            | .28                       |                   |                      |

*Note:* CASS TC = CASS Total Change. BAPQ Total and social anxiety were mean centered.

Table 26

*Mixed Model including Random Effects of Interested and Bored Confederates and Fixed Effects of BAPQ Aloof, Gender, and Interaction between BAPQ Aloof and Gender Predicting CASS TC (n = 79)*

| Variable         | <i>Estimate</i>           | <i>Std. Error</i> | <i>t Ratio</i>       |
|------------------|---------------------------|-------------------|----------------------|
| Aloof            | -0.02                     | 0.02              | -1.18                |
| Gender           | -0.06                     | 0.44              | -0.14                |
| Aloof x gender   | 0.01                      | 0.02              | 0.83                 |
|                  | <i>Variance Component</i> | <i>Std. Error</i> | <i>Pct. of Total</i> |
| Confederate Int. | 0.61                      | 0.58              | 15.89                |
| Confederate Bor. | 0.51                      | 0.55              | 13.28                |
| $R^2$            | .36                       |                   |                      |

*Note:* CASS TC = CASS Total Change. BAPQ Aloof was centered at its mean.

Table 27

*Mixed Model including Random Effects of Interested and Bored Confederates and Fixed Effects of Social Anxiety, BAPQ Aloof, Gender, and Interaction between BAPQ Aloof and Gender Predicting CASS TC (n = 77)*

| Variable         | <i>Estimate</i>           | <i>Std. Error</i> | <i>t Ratio</i>       |
|------------------|---------------------------|-------------------|----------------------|
| Social Anxiety   | 0.02                      | 0.03              | 0.34                 |
| Aloof            | -0.03                     | -0.02             | -1.33                |
| Gender           | -0.18                     | 0.43              | -0.41                |
| Aloof x gender   | 0.01                      | 0.02              | 0.66                 |
|                  | <i>Variance Component</i> | <i>Std. Error</i> | <i>Pct. of Total</i> |
| Confederate Int. | 0.47                      | 0.52              | 13.3                 |
| Confederate Bor. | 0.52                      | 0.63              | 14.88                |
| $R^2$            | .33                       |                   |                      |

*Note:* CASS TC = CASS Total Change. BAPQ Aloof and social anxiety were mean centered.

Table 28

*Generalized Linear Model with BAPQ Total, Gender, and Interaction between BAPQ Total and Gender Predicting Number of Diagnoses Exceeding Diagnostic Criteria on MINI (n = 84)*

| Variable      | <i>B</i> | <i>Std. Error</i> | <i>Wald Chi-square</i> |
|---------------|----------|-------------------|------------------------|
| BAPQ Total    | 0.04     | 0.01              | 8.03**                 |
| Gender        | -0.29    | 0.14              | 1.91                   |
| BAPQ x gender | -0.01    | 0.01              | 2.63 <sup>a</sup>      |

*Note:* BAPQ Total was mean centered.

\* $p < .05$ ; \*\* $p < .01$

<sup>a</sup> $p = .104$

Table 29

*Generalized Linear Model with Social Anxiety, BAPQ Total, Gender, and Interaction between BAPQ Total and Gender Predicting Number of Diagnoses Exceeding Diagnostic Criteria on MINI (n = 82)*

| Variable       | <i>B</i> | <i>Std. Error</i> | <i>Wald Chi-square</i> |
|----------------|----------|-------------------|------------------------|
| Social anxiety | 0.01     | 0.01              | 0.29                   |
| BAPQ Total     | 0.03     | 0.01              | 6.88**                 |
| Gender         | -0.33    | 0.21              | 2.37                   |
| BAPQ x gender  | -0.01    | 0.01              | 2.62 <sup>a</sup>      |

*Note:* BAPQ Total was mean centered.

\* $p < .05$ ; \*\* $p < .01$

<sup>a</sup> $p = .106$

Table 30

*Logistic Regression with BAPQ Total, Gender, and Interaction between BAPQ Total and Gender*

*Predicting Exceeding Criteria for an Anxiety Disorder (n = 84)*

| Variable      | <i>B</i> | <i>Std. Error</i> | <i>Wald Chi-square</i> |
|---------------|----------|-------------------|------------------------|
| BAPQ Total    | 0.02     | 0.03              | 0.25                   |
| Gender        | -0.02    | 0.48              | 0.002                  |
| BAPQ x gender | 0.01     | 0.02              | 0.21                   |

*Note:* BAPQ Total was mean centered.

Table 31

*Logistic Regression with Social Anxiety, BAPQ Total, Gender, and Interaction between BAPQ Total and Gender Predicting Exceeding Criteria for an Anxiety Disorder (n = 82)*

| Variable       | <i>B</i> | <i>Std. Error</i> | <i>Wald Chi-square</i> |
|----------------|----------|-------------------|------------------------|
| Social anxiety | -0.001   | 0.03              | 0.002                  |
| BAPQ Total     | 0.01     | 0.03              | 0.16                   |
| Gender         | 0.08     | 0.49              | 0.02                   |
| BAPQ x gender  | 0.01     | 0.02              | 0.27                   |

*Note:* BAPQ Total was mean centered.

Table 32

*Logistic Regression with BAPQ Total, Gender, and Interaction between BAPQ Total and Gender*

*Predicting Exceeding Criteria for a Substance Use Disorder (n = 84)*

| Variable      | <i>B</i> | <i>Std. Error</i> | <i>Wald Chi-square</i> |
|---------------|----------|-------------------|------------------------|
| BAPQ Total    | -0.02    | 0.04              | 0.24                   |
| Gender        | 1.12     | 0.54              | 4.40*                  |
| BAPQ x gender | 0.01     | 0.02              | 0.13                   |

*Note:* BAPQ Total was mean centered.

\* $p < .05$ ; \*\* $p < .01$

Table 33

*Logistic Regression with Social Anxiety, BAPQ Total, Gender, and Interaction between BAPQ Total and Gender Predicting Exceeding Criteria for a Substance Use Disorder (n = 82)*

| Variable       | <i>B</i> | <i>Std. Error</i> | <i>Wald Chi-square</i> |
|----------------|----------|-------------------|------------------------|
| Social anxiety | -0.02    | 0.03              | 0.24                   |
| BAPQ Total     | -0.01    | 0.04              | 0.07                   |
| Gender         | 1.09     | 0.55              | 3.97*                  |
| BAPQ x gender  | 0.006    | 0.02              | 0.07                   |

*Note:* BAPQ Total was mean centered.

\* $p < .05$ ; \*\* $p < .01$

Table 34

*Logistic Regression with BAPQ Total, Gender, and Interaction between BAPQ Total and Gender  
Predicting Exceeding Criteria for a Mood Disorder (n = 84)*

| Variable      | <i>B</i> | <i>Std. Error</i> | <i>Wald Chi-square</i> |
|---------------|----------|-------------------|------------------------|
| BAPQ Total    | 0.09     | 0.04              | 4.85*                  |
| Gender        | 0.73     | 0.52              | 1.98                   |
| BAPQ x gender | -0.04    | 0.02              | 3.07 <sup>a</sup>      |

*Note:* BAPQ Total was mean centered.

\* $p < .05$ ; \*\* $p < .01$

<sup>a</sup> $p = .08$

Table 35

*Logistic Regression with Social Anxiety, BAPQ Total, Gender, and Interaction between BAPQ Total and Gender Predicting Exceeding Criteria for a Mood Disorder (n = 82)*

| Variable       | <i>B</i> | <i>Std. Error</i> | <i>Wald Chi-square</i> |
|----------------|----------|-------------------|------------------------|
| Social anxiety | 0.03     | 0.03              | 1.14                   |
| BAPQ Total     | 0.08     | 0.04              | 3.57 <sup>a</sup>      |
| Gender         | 0.85     | 0.54              | 2.45                   |
| BAPQ x gender  | -0.04    | 0.02              | 2.73 <sup>b</sup>      |

*Note:* BAPQ Total was mean centered.

<sup>a</sup>  $p = .059$

<sup>b</sup>  $p = .098$

Table 36

*Hierarchical Regression Analysis using BAPQ Total, Gender, and Interaction*

*Between BAPQ Total and Gender Predicting GPA (n = 1008)*

| Variable           | <i>B</i> | <i>SE B</i> | $\beta$ |
|--------------------|----------|-------------|---------|
| BAPQ Total         | -0.001   | 0.001       | -.03    |
| Gender             | -.07     | 0.38        | -.06    |
| BAPQ x gender      | 0.001    | 0.002       | .02     |
| $R^2$              |          | .06         |         |
| <i>F</i> for $R^2$ |          | 1.40        |         |

*Note:* BAPQ Total was centered at its mean.

Table 37

*Hierarchical Regression Analysis using BAPQ Total, Gender, and Interaction*

*Between BAPQ Total and Gender Predicting Satisfaction with Life (n = 996)*

| Variable           | <i>B</i> | <i>SE B</i> | $\beta$           |
|--------------------|----------|-------------|-------------------|
| BAPQ Total         | -0.11    | 0.01        | -.34**            |
| Gender             | -1.19    | 0.48        | -.08**            |
| BAPQ x gender      | -0.04    | 0.02        | -.06 <sup>a</sup> |
| $R^2$              | .16      |             |                   |
| <i>F</i> for $R^2$ | 60.55**  |             |                   |

*Note:* BAPQ Total was centered at its mean.

\* $p < .05$ ; \*\* $p < .01$

<sup>a</sup> $p = .10$

Table 38

*Hierarchical Regression Analysis using Social Anxiety, BAPQ Total, Gender, and Interaction*

*Between BAPQ Total and Gender Predicting Satisfaction with Life (n =996)*

| Variable                     | Model 1  |             |         | Model 2  |             |                    |
|------------------------------|----------|-------------|---------|----------|-------------|--------------------|
|                              | <i>B</i> | <i>SE B</i> | $\beta$ | <i>B</i> | <i>SE B</i> | $\beta$            |
| Social Anxiety               | -0.20    | 0.02        | -.32**  | -0.11    | 0.02        | -.17**             |
| BAPQ Total                   |          |             |         | -0.08    | 0.01        | -.24**             |
| Gender                       |          |             |         | -1.34    | 0.43        | -.09**             |
| BAPQ x gender                |          |             |         | -0.04    | 0.02        | -0.07 <sup>a</sup> |
| $R^2$                        | .10      |             |         | .18      |             |                    |
| <i>F</i> for change in $R^2$ | 115.45** |             |         | 52.52**  |             |                    |

*Note:* Social anxiety and BAPQ Total were centered at their means.

\* $p < .05$ ; \*\* $p < .001$

<sup>a</sup> $p = .057$

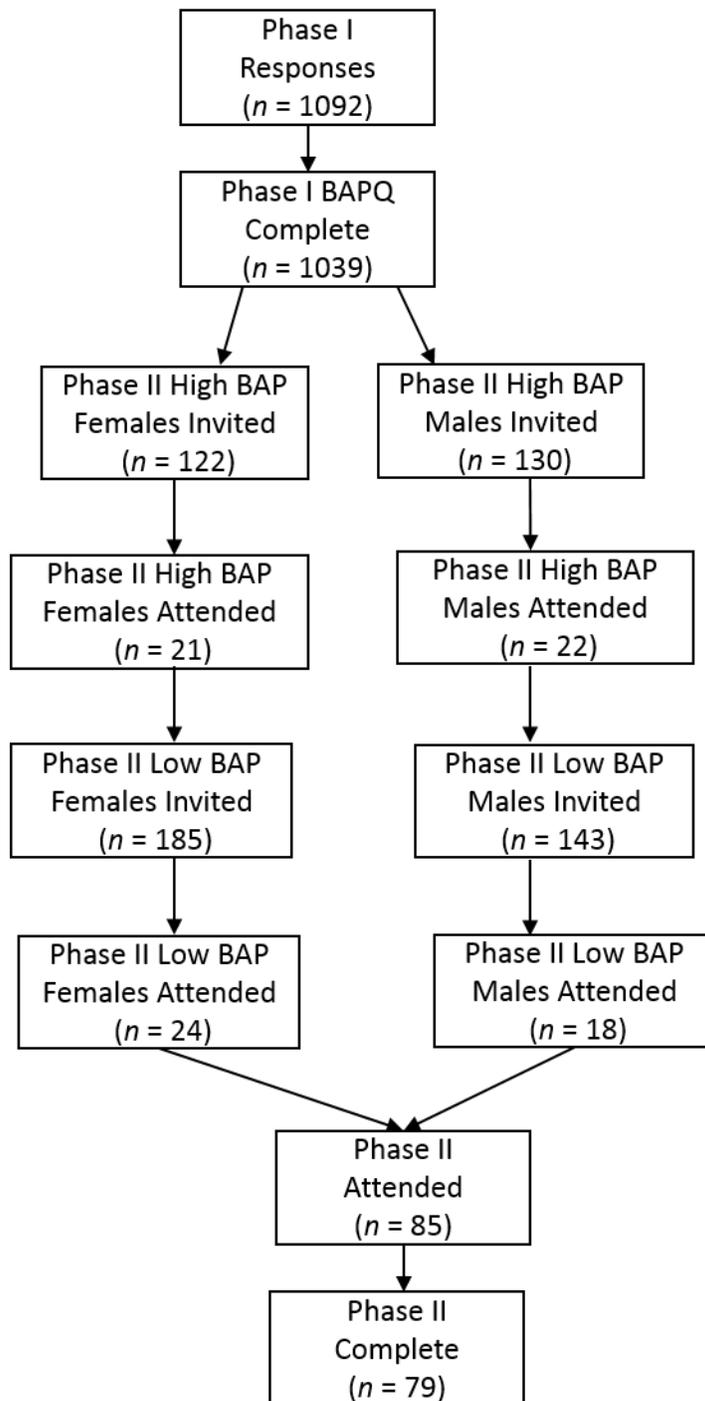


Figure 1. Recruitment flowchart for Phases I and II of the study.

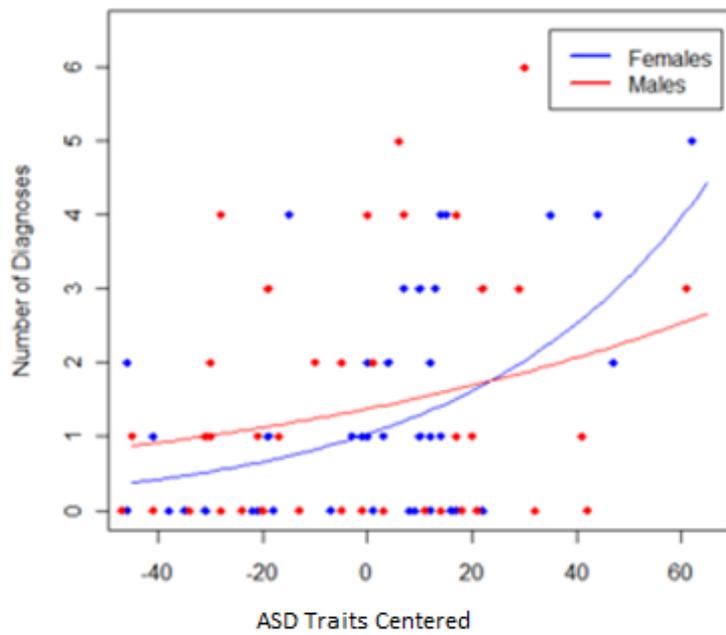


Figure 2. Logarithmic curves plotted separately by gender for the relationship between BAPQ Total (mean centered) and number of diagnoses exceeding diagnostic criteria on the MINI.

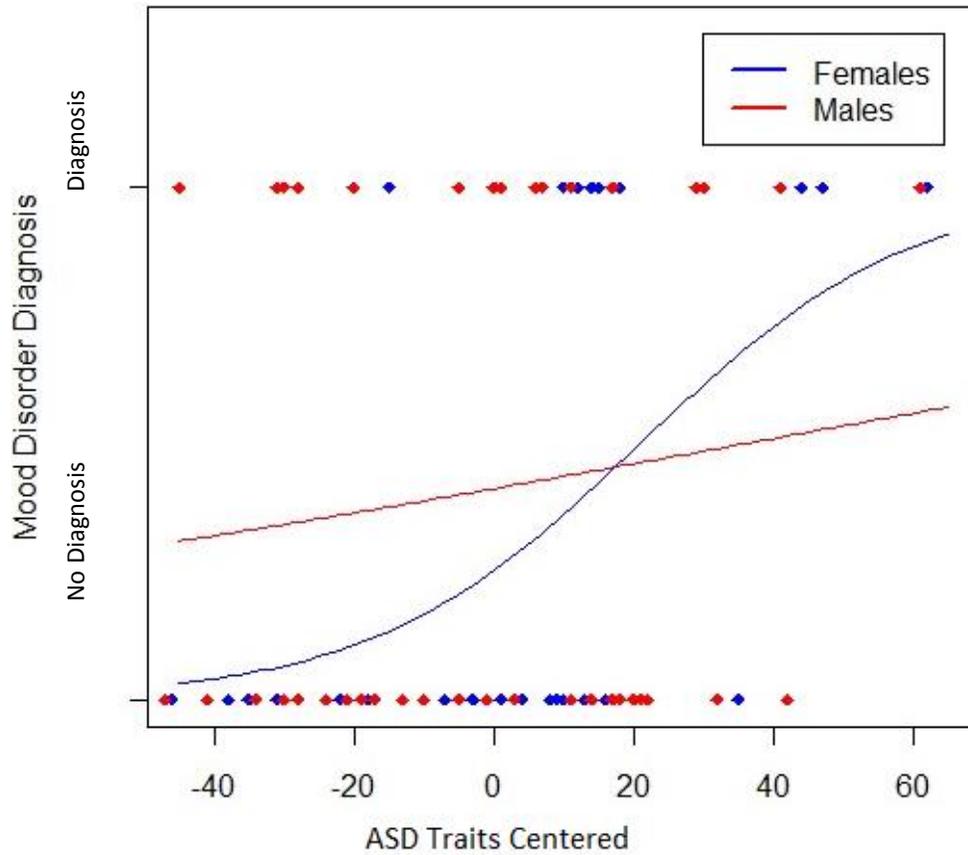


Figure 3. Logistic curves plotted separately by gender for the relationship between BAPQ Total (mean centered) and mood disorder diagnosis status on MINI (exceeding versus not exceeding diagnostic threshold for a mood disorder).

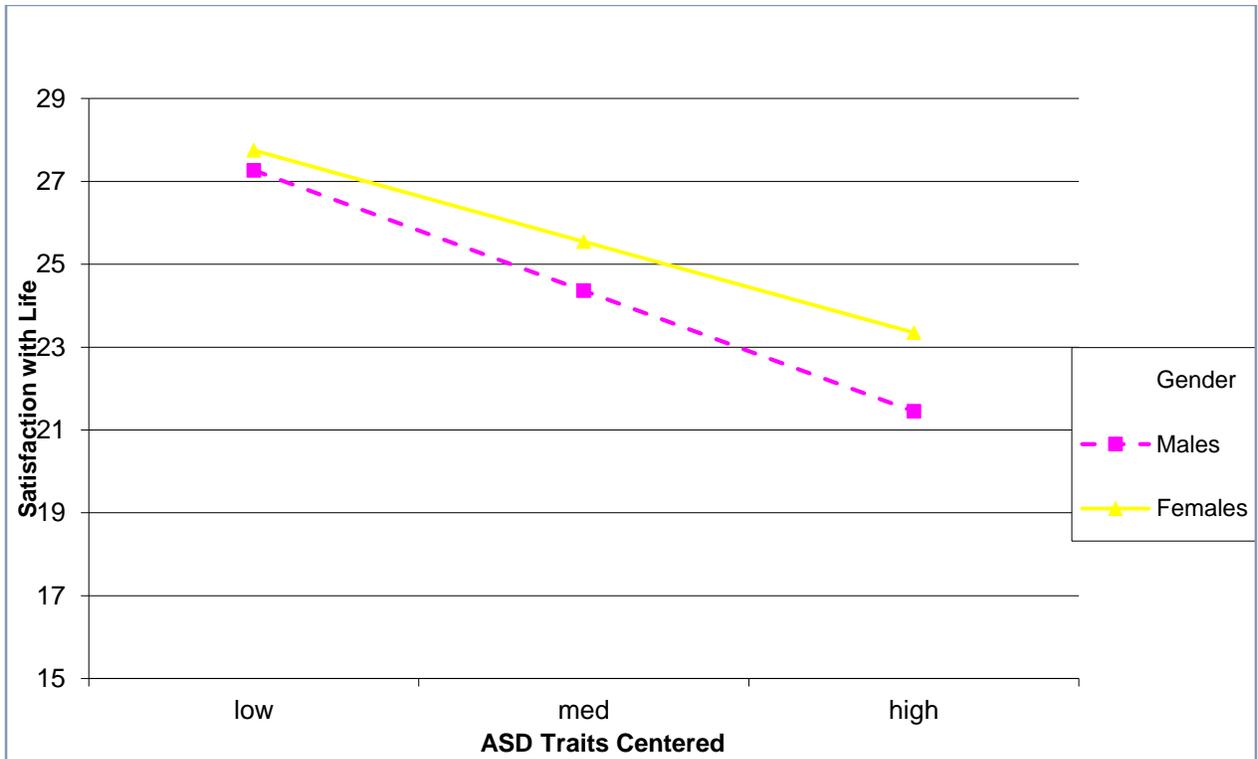


Figure 4. Simple slopes plotted for the relationship between BAPQ Total (mean centered) and satisfaction with life as moderated by gender. Low and high levels of BAP are at one standard deviation below and above the mean (centered).

# Appendix A

## IRB Approval Letter



Office of Research Compliance  
Institutional Review Board  
2000 Kraft Drive, Suite 2000 (D497)  
Blacksburg, VA 24060  
540/231-4606 Fax 540/231-0969  
email [irb@vt.edu](mailto:irb@vt.edu)  
website <http://www.irb.vt.edu>

### MEMORANDUM

**DATE:** August 15, 2012  
**TO:** Susan Williams White, Nicole L Kreiser, Brenna Burns Maddox, Caitlin Mary Conner, Katharine A Donlon, Haley Melissa Gordon  
**FROM:** Virginia Tech Institutional Review Board (FWA00000572, expires May 31, 2014)  
**PROTOCOL TITLE:** Personality and Social Concerns in College Students  
**IRB NUMBER:** 12-543

Effective August 15, 2012, the Virginia Tech Institutional Review Board (IRB) Administrator, Carmen T Green, approved the Amendment request for the above-mentioned research protocol.

This approval provides permission to begin the human subject activities outlined in the IRB-approved protocol and supporting documents.

Plans to deviate from the approved protocol and/or supporting documents must be submitted to the IRB as an amendment request and approved by the IRB prior to the implementation of any changes, regardless of how minor, except where necessary to eliminate apparent immediate hazards to the subjects. Report within 5 business days to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

All investigators (listed above) are required to comply with the researcher requirements outlined at:

<http://www.irb.vt.edu/pages/responsibilities.htm>

(Please review responsibilities before the commencement of your research.)

### PROTOCOL INFORMATION:

Approved As: **Full Review**  
Protocol Approval Date: **July 23, 2012**  
Protocol Expiration Date: **July 22, 2013**  
Continuing Review Due Date\*: **June 24, 2013**

\*Date a Continuing Review application is due to the IRB office if human subject activities covered under this protocol, including data analysis, are to continue beyond the Protocol Expiration Date.

### FEDERALLY FUNDED RESEARCH REQUIREMENTS:

Per federal regulations, 45 CFR 46.103(f), the IRB is required to compare all federally funded grant proposals/work statements to the IRB protocol(s) which cover the human research activities included in the proposal / work statement before funds are released. Note that this requirement does not apply to Exempt and Interim IRB protocols, or grants for which VT is not the primary awardee.

The table on the following page indicates whether grant proposals are related to this IRB protocol, and which of the listed proposals, if any, have been compared to this IRB protocol, if required.

*Invent the Future*

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY  
*An equal opportunity, affirmative action institution*

**PERSONALITY AND SOCIAL CONCERNS SURVEY**

Investigators

Principal Investigator: Susan W. White, PhD, Assistant Professor

Co-Investigators: Nicole Kreiser, M.S., Graduate Student

Psychology Department, Virginia Tech

Purpose and Procedure

The purpose of this study is to assess various personality traits and social behaviors in undergraduate college students. This is a two-phase study. It is estimated that about seven hundred college students from Virginia Tech will participate in this online study (Phase I). You may, based on your responses during Phase I, be invited to come in for Phase II later in the semester. Phase II participation is also completely voluntary and you can complete this online portion then decide you don't want to be in Phase II. If you are invited to Phase II, you will complete an interaction task and a brief interview, which will take about 30 minutes. We expect approximately 90 survey respondents to participate in Phase II of this study. Those individuals who participate in the second phase of the study will receive extra credit if they are enrolled in a course that uses the Sona system or will be entered into a raffle with a chance to win one of six \$20 cash prizes. The remainder of this information sheet concerns only Phase I, the online survey. For this survey, you will be asked to complete a series of questions about your behaviors, feelings, and experiences. Please read each question carefully and try to answer each question to the best of your ability. If you choose to participate in this study, you will be directed to a secure website to complete the survey.

Risks and Benefits

This survey takes only about 1 hour to complete, but it is time that you could spend doing other activities. A second risk concerns the social behavior and anxiety questions asked in the survey. These questions relate to problems in social situations (e.g., feeling tense when talking with another person), and could make you feel uncomfortable or possibly trigger negative memories. Please remember that, at the end of the survey, we provide a list of several services available to help you if you would like someone to talk to. While some of the agencies listed provide services free of charge, some do charge for services. If you choose to seek treatment from a provider who does charge for the services, it is your responsibility to pay for these services. Also, if the questions are too distressing for you, please remember that you can stop at any time.

There is no immediate and direct benefit to you for completing this survey. However, we hope that results of this project can help in designing future research and programs to benefit students. No promises or guarantees of benefits have been made to encourage you to participate.

Costs and Payment for Participation

There is no cost for participating in this survey, nor is any direct payment offered. If you are in a class that uses the Sona system, you will be offered one hour of Sona credit for participating in this online study. For information about how this extra credit will affect your grade and alternative ways to earn extra credit, please speak with your class instructor. Please refer to the Sona system to receive your extra credit: <https://vt-psyc.sona-systems.com/>. Even if you do not complete the whole survey, you will still be entered in the Sona system to receive the credit.

If you are not enrolled in a class that uses the Sona system, you have the opportunity to be entered into a raffle for a chance to one of two \$25 cash prizes. Even if you do not complete the survey, you will still be entered into the raffle.

### Confidentiality

Your name and e-mail address is collected at the bottom of this page and will be used solely for the purposes of assigning credit on the Sona system, entering participants into the gift card raffle, determining which participants have completed the survey, and inviting approximately 90 individuals to Phase II. In order to receive credit on Sona and/or be entered into the raffle, you MUST enter your name and e-mail address at the bottom of the page. Your name and e-mail address will be securely stored separately from your survey answers, and subject numbers will be assigned for data storage. As such, all of your answers will be kept *strictly confidential*. Sona administrators will be able to view who participated in the study for credit, but they will not have access to individuals' survey answers. Trained research assistants may also have access to a list of participant e-mail addresses not linked to participant data in order to assist with assigning credit on Sona.

It is possible that the Institutional Review Board (IRB) may view this study's collected data for auditing purposes. The IRB is responsible for the oversight of the protection of human subjects involved in research. If you would like to contact the graduate students conducting this study or their adviser, you are welcome to do so. Contact information is at the bottom of the following page.

You do not have to participate in this survey and, if you choose to participate, you can stop at any time. We do ask, however, that you try to answer every question completely to the best of your ability.

### Subject's Responsibilities

As a participant in this study, you voluntarily agree to participate in this study. You have the following responsibilities:

1. Complete the questions to the best of your ability.
2. Contact the researchers if you have any questions about the study.

### Questions/Contact Information

If you have any questions about the protection of human research participants regarding this study, you may contact Dr. David Moore, Chair Virginia Tech Institutional Review Board for the Protection of Human Subjects, telephone: (540) 231-4991; e-mail: [moored@vt.edu](mailto:moored@vt.edu); address: Office of Research Compliance, 2000 Kraft Drive, Suite 2000 (0497), Blacksburg, VA 24060 or

David W. Harrison, PhD, Chair Departmental Institutional Review Board, telephone: (540) 231-4422 ; e-mail: [dwh@vt.edu](mailto:dwh@vt.edu).

If you would like to speak with a member of this research team, please call Nicole Kreiser or Dr. Susan White at the Psychosocial Interventions Lab at (540) 231-6744 or e-mail: [vtpilab@gmail.com](mailto:vtpilab@gmail.com).

Before continuing on to the survey, we ask that you please print a copy of this form for your records.

**By entering your name and e-mail address below and continuing to the survey, you acknowledge that you have read this document and that you voluntarily consent to participate in this study.**

**We appreciate your input and thank you for your time and help in this study!**

First and last name: \_\_\_\_\_

E-mail address that is linked to your Sona account or that you provided when volunteering for the study: \_\_\_\_\_

Note: Your email address is required in order to receive credit on the Sona system and to be entered into the raffle. If you have multiple e-mail addresses, it is important that you provide the e-mail that is linked to your Sona account, as it is the only information that we will be able to use to assign credit on Sona. If you do not wish to receive Sona credit or are not enrolled in a course that uses the Sona system, we still need your e-mail address in order to mark off that you have completed the survey, enter you into the gift card raffle, and possibly contact you with an invitation to Phase II of the study.

Will you be receiving Sona credit through your participation in this study?

- Yes
- No

## PERSONALITY AND SOCIAL CONCERNS SURVEY

### Investigators

Principal Investigator: Susan W. White, PhD, Assistant Professor

Co-Investigators: Nicole Kreiser, M.S., Graduate Student

Psychology Department, Virginia Tech

### Purpose and Procedure

The purpose of this study is to assess various personality traits and social behaviors in undergraduate college students. This is a two-phase study. **Only participants who have not previously completed the Personality and Social Concerns survey in fall of 2012 are eligible to complete this survey. Participants who have already completed the survey and complete the survey again will not receive Sona credit or be entered into a raffle for their participation and their data will be deleted.**

It is estimated that about seven hundred college students from Virginia Tech will participate in this online study (Phase I). You may, based on your responses during Phase I, be invited to come in for Phase II later in the semester. Phase II participation is also completely voluntary and you can complete this online portion then decide you don't want to be in Phase II. If you are invited to Phase II, you will complete an interaction task and a brief interview, which will take about 30 minutes. We expect approximately 90 survey respondents total to participate in Phase II of this study. Those individuals who participate in the second phase of the study will receive extra credit if they are enrolled in a course that uses the Sona system or will receive \$5 and a candy bar for their participation in the study. The remainder of this information sheet concerns only Phase I, the online survey. For this survey, you will be asked to complete a series of questions about your behaviors, feelings, and experiences. Please read each question carefully and try to answer each question to the best of your ability. If you choose to participate in this study, you will be directed to a secure website to complete the survey.

### Risks and Benefits

This survey takes only about 1 hour to complete, but it is time that you could spend doing other activities. A second risk concerns the social behavior and anxiety questions asked in the survey. These questions relate to problems in social situations (e.g., feeling tense when talking with another person), and could make you feel uncomfortable or possibly trigger negative memories. Please remember that, at the end of the survey, we provide a list of several services available to help you if you would like someone to talk to. While some of the agencies listed provide services free of charge, some do charge for services. If you choose to seek treatment from a provider who does charge for the services, it is your responsibility to pay for these services. Also, if the questions are too distressing for you, please remember that you can stop at any time.

There is no immediate and direct benefit to you for completing this survey. However, we hope that results of this project can help in designing future research and programs to benefit students. No promises or guarantees of benefits have been made to encourage you to participate.

### Costs and Payment for Participation

There is no cost for participating in this survey, nor is any direct payment offered. If you are in a class that uses the Sona system, you will be offered one hour of Sona credit for participating in this online study. For information about how this extra credit will affect your grade and alternative ways to earn extra credit, please speak with your class instructor. Please refer to the Sona system to receive your extra credit: <https://vt-psyc.sona-systems.com/>. Even if you do not complete the whole survey, you will still be entered in the Sona system to receive the credit.

If you are not enrolled in a class that uses the Sona system, you have the opportunity to be entered into a raffle for a chance to one of two \$25 cash prizes. Even if you do not complete the survey, you will still be entered into the raffle.

### Confidentiality

Your name and e-mail address is collected at the bottom of this page and will be used solely for the purposes of assigning credit on the Sona system, entering participants into the gift card raffle, determining which participants have completed the survey, and inviting approximately 90 individuals to Phase II. In order to receive credit on Sona and/or be entered into the raffle, you MUST enter your name and e-mail address at the bottom of the page. Your name and e-mail address will be securely stored separately from your survey answers, and subject numbers will be assigned for data storage. As such, all of your answers will be kept *strictly confidential*. Sona administrators will be able to view who participated in the study for credit, but they will not have access to individuals' survey answers. Trained research assistants may also have access to a list of participant e-mail addresses not linked to participant data in order to assist with assigning credit on Sona.

It is possible that the Institutional Review Board (IRB) may view this study's collected data for auditing purposes. The IRB is responsible for the oversight of the protection of human subjects involved in research. If you would like to contact the graduate students conducting this study or their adviser, you are welcome to do so. Contact information is at the bottom of the following page.

You do not have to participate in this survey and, if you choose to participate, you can stop at any time. We do ask, however, that you try to answer every question completely to the best of your ability.

### Subject's Responsibilities

As a participant in this study, you voluntarily agree to participate in this study. You have the following responsibilities:

3. Complete the questions to the best of your ability.
4. Contact the researchers if you have any questions about the study.

### Questions/Contact Information

If you have any questions about the protection of human research participants regarding this study, you may contact Dr. David Moore, Chair Virginia Tech Institutional Review Board for the Protection of Human Subjects, telephone: (540) 231-4991; e-mail: [moored@vt.edu](mailto:moored@vt.edu); address: Office of Research Compliance, 2000 Kraft Drive, Suite 2000 (0497), Blacksburg, VA 24060 or David W. Harrison, PhD, Chair Departmental Institutional Review Board, telephone: (540) 231-4422 ; e-mail: [dwh@vt.edu](mailto:dwh@vt.edu).

If you would like to speak with a member of this research team, please call Nicole Kreiser or Dr. Susan White at the Psychosocial Interventions Lab at (540) 231-6744 or e-mail: [vtpilab@gmail.com](mailto:vtpilab@gmail.com).

Before continuing on to the survey, we ask that you please print a copy of this form for your records.

**By entering your name and e-mail address below and continuing to the survey, you acknowledge that you have read this document and that you voluntarily consent to participate in this study.**

**We appreciate your input and thank you for your time and help in this study!**

First and last name: \_\_\_\_\_

E-mail address that is linked to your Sona account or that you provided when volunteering for the study: \_\_\_\_\_

Note: Your email address is required in order to receive credit on the Sona system and to be entered into the raffle. If you have multiple e-mail addresses, it is important that you provide the e-mail that is linked to your Sona account, as it is the only information that we will be able to use to assign credit on Sona. If you do not wish to receive Sona credit or are not enrolled in a course that uses the Sona system, we still need your e-mail address in order to mark off that you have completed the survey, enter you into the gift card raffle, and possibly contact you with an invitation to Phase II of the study.

Will you be receiving Sona credit through your participation in this study?

- Yes
- No

**INFORMATION FORM FOR RESEARCH PROJECT**

Project Title: *Personality and Social Concerns in College Students*

Investigators

Principal Investigator: Susan W. White, PhD, Assistant Professor

Co-Investigators: Nicole Kreiser, M.S., Graduate Student

Psychology Department, Virginia Tech

Purpose of the Study

The purpose of this research study is to develop a better understanding of how college students with certain personality or behavioral traits think about different situations and interact with others. We hope to complete this phase of the study with 90 different Virginia Tech undergraduate students. In order to decide whether or not you wish to be a part of this research study, you should know enough about its risks and benefits to make an informed decision. This consent form gives you detailed information about the research study, which a study investigator will also discuss with you if you choose to come to the research session.

Procedures

If you choose to participate in this research study, you will be asked to come to 460 Turner Street for a 30 minute long appointment. At the appointment, you will first meet with a study investigator to further discuss this consent form and address any questions you may have. Once you have all your questions answered, you will sign the consent form if you wish to continue with the session. You will then be asked to complete a questionnaire related to social concerns. Also, you will complete an interaction task during which you will have two brief videotaped conversations with other students, and a brief interview, related to emotional or psychological concerns.

Risks and Benefits

One possible risk is experiencing anxiety during some of the tasks. You might experience anxiety or discomfort in interacting with another student while being videotaped or answering questions of a personal nature. A second risk is related to confidentiality. We have procedures to ensure confidentiality and protection of your personal information (see below), but the risk of compromised confidentiality is still somewhat present.

There is no immediate, direct, or indirect benefit to you for participating in this study. No promises of benefits have been made to encourage you to participate. However, we hope that results of this project can help in designing future research to benefit students.

### Costs and Payment for Participation

There is no cost for participating in this study. If you are in a class that uses the Sona system, you will be offered one hour of Sona credit for participating in this study. For information about how this extra credit will affect your grade and alternative ways to earn extra credit, please speak with your class instructor. Please refer to the Sona system to receive your extra credit: <https://vt-psyc.sona-systems.com/>. Even if you do not complete the whole session, you will still be entered in the Sona system to receive the credit.

If you are not enrolled in a class that uses the Sona system, you have the opportunity to be entered into a raffle for a chance to win one of six \$20 cash prizes. Even if you do not complete the whole appointment, you will still be entered in the raffle.

### Confidentiality

Any identifiable information that is obtained in connection with this study will remain confidential and will be disclosed only with your permission or as required by U.S. or State law. Examples of information that we are legally required to disclose include suspected abuse of a child or elderly person, suicidality, and intention to harm identifiable others. Each person who participates in this study will be assigned a unique, identifying number. This number will be used to identify all research data within our database. The master list, which will contain your name and the unique identifying number, will be kept separate from all other data. Only the investigators of the study will have access to this master list. All video recordings will be kept separately from identifying information, in a secure locked filing cabinet. Only the investigators and trained lab personnel will have access to these recordings.

When the results of the research are published or discussed in conferences, no information will be included that would reveal your identity. It is possible that the Institutional Review Board (IRB) may view this study's collected data for auditing purposes. The IRB is responsible for the oversight of the protection of human subjects involved in research. These individuals are required to keep all information confidential.

To further help us protect your privacy, we have obtained a Certificate of Confidentiality from the United States Department of Health and Human Services (DHHS). With this Certificate, we cannot be forced (for example by court order or subpoena) to disclose information that may identify you in any federal, state, local, civil, criminal, legislative, administrative, or other proceedings. The researchers will use the Certificate to resist any demands for information that would identify you, except to prevent serious harm to you or others. As previously stated, you should understand that we will in all cases, take the necessary action, including reporting to authorities, to prevent serious harm to yourself, children, or others (see information we are legally required to disclose above). You should understand that a Certificate of Confidentiality does not prevent you from voluntarily releasing information about yourself. A Certificate of Confidentiality does not represent an endorsement of the research study by the Department of Health and Human Services or the National Institutes of Health.

### Freedom to Withdraw

You do not have to participate in this study. If you do participate, you can stop at any time and without penalty, by telling the researchers that you want to stop the study. If you decide to not participate or to withdraw from the study, your involvement in any future study will not be jeopardized.

#### Questions

Please feel free to ask about anything you do not understand. In addition, consider this research and the consent form carefully – as long as you feel is necessary – before you make a decision. If you would like to speak with a member of the research team, please call Nicole Kreiser or Dr. Susan White at the Psychosocial Interventions Lab at (540) 231-6744 or e-mail: [vtpilab@gmail.com](mailto:vtpilab@gmail.com).

If you should have any questions about the protection of human research participants regarding this study, you may contact: Dr. David Harrison, Chair of Departmental Human Subjects Committee, (540) 231-4422, e-mail: [dwh@vt.edu](mailto:dwh@vt.edu), or Dr. David Moore, Chair Virginia Tech Institutional Review Board for the Protection of Human Subjects, telephone: (540) 231-4991; e-mail: [moored@vt.edu](mailto:moored@vt.edu); address: Office of Research Compliance, 2000 Kraft Drive, Suite 2000 (0497), Blacksburg, VA 24060.

The following are some local resources available to you, should you need someone to talk with about mental health services or personal problems following your participating in this experiment. There is no guarantee that the listed services will be available to see you and it is your responsibility to pay any fees associated with such services. Cook Counseling Center provides services free of charge to Virginia Tech students who have paid their student health fees. The Raft Crisis Hotline is free to call. All other services may charge fees for their services.

#### **ACCESS/Raft Crisis Hotline**

(Emergency services clinicians)

(540) 961-8400

<http://www.nrvcs.org/services.htm>

#### **Center for Family Services**

(703) 538-8470

<http://www.nvc.vt.edu/cfs>

#### **Cook Counseling Center**

(540) 231-6557

<http://www.ucc.vt.edu/>

#### **Mental Health Association of the New River Valley**

(540) 951-4990; (800) 559-2800



**INFORMATION FORM FOR RESEARCH PROJECT**

Project Title: *Personality and Social Concerns in College Students*

Investigators

Principal Investigator: Susan W. White, PhD, Assistant Professor

Co-Investigators: Nicole Kreiser, M.S., Graduate Student

Psychology Department, Virginia Tech

Purpose of the Study

The purpose of this research study is to develop a better understanding of how college students with certain personality or behavioral traits think about different situations and interact with others. We hope to complete this phase of the study with 90 different Virginia Tech undergraduate students. In order to decide whether or not you wish to be a part of this research study, you should know enough about its risks and benefits to make an informed decision. This consent form gives you detailed information about the research study, which a study investigator will also discuss with you if you choose to come to the research session.

Procedures

If you choose to participate in this research study, you will be given the option to either come to our lab at 252 Williams Hall or our lab at 460 Turner Street for a 30 minute long appointment. At the appointment, you will first meet with a study investigator to further discuss this consent form and address any questions you may have. Once you have all your questions answered, you will sign the consent form if you wish to continue with the session. You will then be asked to complete a questionnaire related to social concerns. Also, you will complete an interaction task during which you will have two brief videotaped conversations with other students, and a brief interview, related to emotional or psychological concerns.

Risks and Benefits

One possible risk is experiencing anxiety during some of the tasks. You might experience anxiety or discomfort in interacting with another student while being videotaped or answering questions of a personal nature. A second risk is related to confidentiality. We have procedures to ensure confidentiality and protection of your personal information (see below), but the risk of compromised confidentiality is still somewhat present.

There is no immediate, direct, or indirect benefit to you for participating in this study. No promises of benefits have been made to encourage you to participate. However, we hope that results of this project can help in designing future research to benefit students.

### Costs and Payment for Participation

There is no cost for participating in this study. If you are in a class that uses the Sona system, you will be offered one hour of Sona credit for participating in this study. For information about how this extra credit will affect your grade and alternative ways to earn extra credit, please speak with your class instructor. Please refer to the Sona system to receive your extra credit: <https://vt-psyc.sona-systems.com/>. Even if you do not complete the whole session, you will still be entered in the Sona system to receive the credit.

If you are not enrolled in a class that uses the Sona system, you will receive \$5 and a candy bar for your participation in the study. Even if you do not complete the whole appointment, you will still be entered in the raffle.

### Confidentiality

Any identifiable information that is obtained in connection with this study will remain confidential and will be disclosed only with your permission or as required by U.S. or State law. Examples of information that we are legally required to disclose include suspected abuse of a child or elderly person, suicidality, and intention to harm identifiable others. Each person who participates in this study will be assigned a unique, identifying number. This number will be used to identify all research data within our database. The master list, which will contain your name and the unique identifying number, will be kept separate from all other data. Only the investigators of the study will have access to this master list. After you accept an invitation into the in-lab phase of the study, the link between your identifying information and ID number will be deleted. Thus, after data collection no link will exist between your in-lab responses and identifying information. All video recordings will be kept separately from identifying information, in a secure locked filing cabinet. Only the investigators and trained lab personnel will have access to these recordings.

When the results of the research are published or discussed in conferences, no information will be included that would reveal your identity. It is possible that the Institutional Review Board (IRB) may view this study's collected data for auditing purposes. The IRB is responsible for the oversight of the protection of human subjects involved in research. These individuals are required to keep all information confidential.

### Freedom to Withdraw

You do not have to participate in this study. If you do participate, you can stop at any time and without penalty, by telling the researchers that you want to stop the study. If you decide to not participate or to withdraw from the study, your involvement in any future study will not be jeopardized.

### Questions

Please feel free to ask about anything you do not understand. In addition, consider this research and the consent form carefully – as long as you feel is necessary – before you make a decision. If you would like to speak with a member of the research team, please call Nicole Kreiser or Dr. Susan White at the Psychosocial Interventions Lab at (540) 231-6744 or e-mail: [vtpilab@gmail.com](mailto:vtpilab@gmail.com).

If you should have any questions about the protection of human research participants regarding this study, you may contact: Dr. David Harrison, Chair of Departmental Human Subjects Committee, (540) 231-4422, e-mail: [dwh@vt.edu](mailto:dwh@vt.edu), or Dr. David Moore, Chair Virginia Tech Institutional Review Board for the Protection of Human Subjects, telephone: (540) 231-4991; e-mail: [moored@vt.edu](mailto:moored@vt.edu); address: Office of Research Compliance, 2000 Kraft Drive, Suite 2000 (0497), Blacksburg, VA 24060.

The following are some local resources available to you, should you need someone to talk with about mental health services or personal problems following your participating in this experiment. There is no guarantee that the listed services will be available to see you and it is your responsibility to pay any fees associated with such services. Cook Counseling Center provides services free of charge to Virginia Tech students who have paid their student health fees. The Raft Crisis Hotline is free to call. All other services may charge fees for their services.

### **ACCESS/Raft Crisis Hotline**

(Emergency services clinicians)

(540) 961-8400

<http://www.nrvcs.org/services.htm>

### **Center for Family Services**

(703) 538-8470

<http://www.nvc.vt.edu/cfs>

### **Cook Counseling Center**

(540) 231-6557

<http://www.ucc.vt.edu/>

### **Mental Health Association of the New River Valley**

(540) 951-4990; (800) 559-2800

<http://www.mhanrv.org/>

### **New River Valley Community Services**

(540) 961-8400

<http://www.nrvcs.org/>

### **VT Psychological Services Center**

(540) 231-6914

<http://www.psyc.vt.edu/centers/psc/>



## Appendix F - List of Resources

Thank you for participating in this study.

Should you want to talk with someone about this research project, please feel free to call the Psychosocial Interventions Lab directly (540-231-6744) or e-mail Nicole Kreiser, the graduate student conducting this study at [nlk010@vt.edu](mailto:nlk010@vt.edu).

The following are some local resources available to you, should you need someone to talk with about mental health services or personal problems. There is no guarantee that the listed services will be available to see you and it is your responsibility to pay any fees associated with such services. Cook Counseling Center provides services free of charge to Virginia Tech students who have paid their student health fees. The Raft Crisis Hotline is free to call. All other services may charge fees for their services.

### **ACCESS/Raft Crisis Hotline**

(Emergency services clinicians)

(540) 961-8400

<http://www.nrvcs.org/services.htm>

### **Center for Family Services**

(703) 538-8470

<http://www.nvc.vt.edu/cfs>

### **Cook Counseling Center**

(540) 231-6557

<http://www.ucc.vt.edu/>

### **Mental Health Association of the New River Valley**

(540) 951-4990; (800) 559-2800

<http://www.mhanrv.org/>

### **New River Valley Community Services**

(540) 961-8400

<http://www.nrvcs.org/>

### **VT Psychological Services Center**

(540) 231-6914

<http://www.psyc.vt.edu/centers/psc/>

## Appendix G - Debriefing Script

Thank you for your participation in the study. At this time I would like to briefly provide you with information regarding mild deception that was involved in the study. When you interacted with two different students during the conversation tasks, those students were trained research assistants involved in this study and not other students participating in the study. It was necessary to avoid revealing this information prior to the conversation task as to not influence participants' performance on the task. Do you have any questions or concerns at this time?

We ask that you do not discuss this information with other students in order to prevent other potential participants from learning about the nature of the conversation task before participating in the study. At this time I also want to inform you that you may choose to have the data from your participation in this study destroyed if you so wish.



## Appendix I - Study Description on Sona Website

**Study Name:** Personality and Social Concerns Survey

**Abstract:** Online survey about personality and social concerns in college students.

**Description:** This study involves an online survey regarding your personality and social concerns in college. After signing up for this study, you will receive an e-mail with a website address for the survey. The survey will be open through Friday, October 5th. You will receive a reminder e-mail three, and five weeks after you sign-up for the survey until you complete the survey or remove yourself from the study.

**Web Study:** This is an online study. Participants are not given the study URL until after they sign up.

**Eligibility Requirements:** Virginia Tech undergraduate students only

**Duration:** Approximately 60 minutes

**Credits:** 1

**Researchers:** Nicole Kreiser E-mail: Nlk010@vt.edu

## Appendix J - E-mail to Undergraduate Advisors to Request Student Participation

Subject Line: Request for Student Participation in Research Project

Dear Virginia Tech Undergraduate Advisor,

I am a doctoral student in the VT's Clinical Psychology program, and I am seeking undergraduate students to participate in my dissertation research involving personality and social concerns in college. This project, supervised by Susan White, Ph.D., has been approved for data collection by Virginia Tech's Institutional Review Board.

**I am requesting your help in forwarding our survey to your undergraduate advisees.**

The hyperlink below takes students to an information sheet, which provides a more in-depth explanation of the study and the rights of a participant, and then continues on to the survey.

Briefly, the study calls for undergraduate students to complete an online survey, which should take approximately 60 minutes. All participating students eligible for Sona extra credit by participating in psychology research studies will receive one extra credit. Students not eligible for Sona extra credit will be entered into a raffle for a chance to win 1 of 2 \$25 cash prizes. In addition, approximately 90 survey respondents will be invited to participate in Phase II of this study, during which participants will be asked to complete an interaction task and a brief interview. This on-campus session would last approximately 30 minutes, and students eligible for Sona extra credit will receive one extra credit. Students not eligible for Sona will have a chance to win one of six \$20 cash prizes. All individuals can decline the invitation to participate in Phase II.

<insert link to survey>

I greatly appreciate your willingness to share information about this study with your advisees. Please feel free to contact me with any questions or concerns at [nlk010@vt.edu](mailto:nlk010@vt.edu). Thank you very much for your time and consideration.

Sincerely,

Nicole Kreiser

## Appendix K - E-mail to Invite Survey Respondents to In-Lab Session

Subject Line: Research Opportunity– Chance to Earn \$20 or Sona Credit!

Dear Virginia Tech Student,

Earlier this semester, you completed an online survey entitled “Personality and Social Concerns.” A total of <INSERT TOTAL NUMBER OF SURVEY COMPLETERS> undergraduate students have completed the same survey. You are now receiving a personal invitation to participate in the second part of this research project based on your survey responses.

You are invited to join us in our lab at 460 Turner street for a 30 minute session. Students eligible for Sona credit will receive one Sona extra credit. Students not eligible for Sona will be entered into a raffle for a chance to win one of six \$20 case prizes. The purpose of this research study is to assess various personality traits and social behaviors in undergraduate college students. During the session, you will be asked to complete a questionnaire related to social concerns. Also, you will complete an interaction task during which you will have two brief videotaped conversations with other students, and a brief interview, related to emotional or psychological concerns.

Please let us know if you are interested in participating by <INSERT DATE AND TIME 72 HOURS FROM E-MAIL DATE AND TIME>, or your invitation will be offered to another eligible student. If you let us know that you are interested, we will promptly e-mail you the consent form, with more in-depth information about the project, for your review, and we can schedule a 30-minute session at your convenience.

Sincerely,

Nicole Kreiser

Nlk010@vt.edu

(540) 231-6744

Appendix L - Two-Week Reminder E-mail to Undergraduate Advisors to Request Student  
Participation

Subject Line: Student Participation in Research Project Reminder

Dear Virginia Tech Undergraduate Advisor,

I am a doctoral student in the VT's Clinical Psychology program, and I am seeking undergraduate students to participate in my dissertation research involving personality and social concerns in college. This project, supervised by Susan White, Ph.D., has been approved for data collection by Virginia Tech's Institutional Review Board.

Two weeks ago I emailed you to request for you help in forwarding our survey to your undergraduate advisees. **I am requesting your help in forwarding this email to your undergraduate advisees as a reminder of this research participation opportunity.** The hyperlink below takes students to an information sheet, which provides a more in-depth explanation of the study and the rights of a participant, and then continues on to the survey.

Briefly, the study calls for undergraduate students to complete an online survey, which should take approximately 60 minutes. All participating students eligible for Sona extra credit by participating in psychology research studies will receive one extra credit. Students not eligible for Sona extra credit will be entered into a raffle for a chance to win 1 of 2 \$25 cash prizes. In addition, approximately 90 survey respondents will be invited to participate in Phase II of this study, during which participants will be asked to complete an interaction task and a brief interview. This on-campus session would last approximately 30 minutes, and students eligible for Sona extra credit will receive one extra credit. Students not eligible for Sona will have a chance to win one of six \$20 cash prizes. All individuals can decline the invitation to participate in Phase II.

<insert link to survey>

I greatly appreciate your willingness to share information about this study with your advisees. Please feel free to contact me with any questions or concerns at [nlk010@vt.edu](mailto:nlk010@vt.edu). Thank you very much for your time and consideration.

Sincerely,

Nicole Kreiser

Appendix M - Five-Week Reminder E-mail to Undergraduate Advisors to Request Student Participation

Subject Line: Student Participation in Research Project Reminder

Dear Virginia Tech Undergraduate Advisor,

I am a doctoral student in the VT's Clinical Psychology program, and I am seeking undergraduate students to participate in my dissertation research involving personality and social concerns in college. This project, supervised by Susan White, Ph.D., has been approved for data collection by Virginia Tech's Institutional Review Board.

Five weeks ago I emailed to request for you help in forwarding our survey to your undergraduate advisees. **I am requesting your help in forwarding this email to your undergraduate advisees as a reminder of this research participation opportunity.** This is the last reminder email that I will forward. The survey closes on 10/5/12 at midnight. The hyperlink below takes students to an information sheet, which provides a more in-depth explanation of the study and the rights of a participant, and then continues on to the survey.

Briefly, the study calls for undergraduate students to complete an online survey, which should take approximately 60 minutes. All participating students eligible for Sona extra credit by participating in psychology research studies will receive one extra credit. Students not eligible for Sona extra credit will be entered into a raffle for a chance to win 1 of 2 \$25 cash prizes. In addition, approximately 90 survey respondents will be invited to participate in Phase II of this study, during which participants will be asked to complete an interaction task and a brief interview. This on-campus session would last approximately 30 minutes, and students eligible for Sona extra credit will receive one extra credit. Students not eligible for Sona will have a chance to win one of six \$20 cash prizes. All individuals can decline the invitation to participate in Phase II.

<insert link to survey>

I greatly appreciate your willingness to share information about this study with your advisees. Please feel free to contact me with any questions or concerns at [nlk010@vt.edu](mailto:nlk010@vt.edu). Thank you very much for your time and consideration.

Sincerely,

Nicole Kreiser

## Appendix N - Two-Week Sona Participation Reminder Email

Subject Line: Sona Credit for Participation in Study

Dear student,

This email serves as a reminder that you signed-up on the Sona system for the Personality and Social Concerns in College Students but have not yet taken this survey. Below is the url for the survey:

<https://www.surveymonkey.com/s/HVJZH36>

Please note that you may receive one additional reminder email until you either complete the survey, remove yourself from the Sona sign-up, or contact the co-investigator ([nlk010@vt.edu](mailto:nlk010@vt.edu)) asking to be removed from the study sign-up.

Sincerely,

Nicole Kreiser

## Appendix O - Five-Week Sona Participation Reminder Email

Subject Line: Sona Credit for Participation in Study

Dear student,

This email serves as a reminder that you signed-up on the Sona system for the Personality and Social Concerns in College Students but have not yet taken this survey. Below is the url for the survey:

<https://www.surveymonkey.com/s/HVJZH36>

Please note that this is your final reminder email to either complete the survey, remove yourself from the Sona sign-up, or contact the co-investigator ([nlk010@vt.edu](mailto:nlk010@vt.edu)) asking to be removed from the study sign-up. The survey will be closing on Friday 10/5/12 at midnight.

Sincerely,

Nicole Kreiser

## Appendix P - Recruitment Slip

For a chance to win **1 of 2 \$25 cash prizes** or **Sona credit** complete the *Personality and Social Concerns Survey* at: <https://www.surveymonkey.com/s/HVJZH36>. Study closes on 10/5 at midnight.

## Appendix Q - Demographic Questionnaire

Please answer the following questions about yourself.

Gender

- Male
- Female

Age

\_\_\_\_\_ Years  
\_\_\_\_\_ Months

Race/ethnicity (Check all that apply)

- African American
- Asian
- Caucasian/European American
- Latino, Hispanic, or Chicano
- Native American
- Other

If you select Other, please specify: \_\_\_\_\_

Primary College Major (Declared or expected)

- Agriculture and life sciences
- Architecture and urban studies
- Biological sciences
- Business, economics, finance, marketing, or hospitality
- Computer science
- Engineering
- Liberal arts and human sciences
- Mathematics
- Natural resources
- Physical sciences (e.g., physics, chemistry, geology)
- Psychology
- Other

If you select Other, please specify: \_\_\_\_\_

Class Year in College

- First year
- Second year
- Third year
- Fourth year
- Fifth year

- Sixth year
- Seventh year
- Beyond seventh year

Expected Years to Completion of Degree

- Three years
- Four years
- Five Years
- Six years
- Seven years
- Beyond seven years

Have you ever taken time off of school for any reason other than financial?

- Yes
- No

Please enter an estimate of your current GPA.

\_\_\_\_\_

Please indicate if you struggle with any of the following problems or have been diagnosed with any of the following disorders via an official assessment from a psychologist or doctor.

**Anxiety disorder** – Worry that you can't control, intense fear

**Attention-Deficits/Hyperactivity Disorder (ADHD)** – Inattentiveness, restlessness, hyperactivity

**Autism Spectrum Disorder** – Social difficulties, intense or preoccupying interests

**Depression** – Feelings of sadness, loss of interest in pleasurable activities, changes in appetite or sleep

**Learning disorder** – Difficulty in acquisition and use of listening, speaking, reading, writing, or math abilities

**Eating disorder** – Preoccupation with weight, may include restrictive eating patterns and bingeing and purging

|                          | Struggle with problem | Received diagnosis |
|--------------------------|-----------------------|--------------------|
| Anxiety Disorder         |                       |                    |
| ADHD                     |                       |                    |
| Autism Spectrum Disorder |                       |                    |
| Depression               |                       |                    |
| Learning Disorder        |                       |                    |
| Eating Disorder          |                       |                    |

## Appendix R - Autism Quotient

Below is a list of statements. Please read each statement very carefully and rate how strongly you agree or disagree with it.

|   |                  |                |                   |                     |
|---|------------------|----------------|-------------------|---------------------|
| 1. I prefer to do things with others rather than on my own.   | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 2. I prefer to do things the same way over and over again.  | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 3. If I try to imagine something, I find it very easy to create a picture in my mind.                 | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 4. I frequently get so strongly absorbed in one thing that I lose sight of other things.              | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 5. I often notice small sounds when others do not.  | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 6. I usually notice car number plates or similar strings of information.                              | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 7. Other people frequently tell me that what I've said is impolite, even though I think it is polite. | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 8. When I'm reading a story, I can easily imagine what the characters might look like.                | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 9. I am fascinated by dates.  | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 10. In a social group, I can easily keep track of several different people's conversations.           | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 11. I find social situations easy.  | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 12. I tend to notice details that others do not.  | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 13. I would rather go to a library than a party.  | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 14. I find making up stories easy.  | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 15. I find myself drawn more strongly to people than to things.                                       | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 16. I tend to have very strong interests which I get upset about if I can't pursue.                   | definitely agree | slightly agree | slightly disagree | definitely disagree |

|   |                  |                |                   |                     |
|---|------------------|----------------|-------------------|---------------------|
| 17. I enjoy social chit-chat.   | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 18. When I talk, it isn't always easy for others to get a word in edgeways.               | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 19. I am fascinated by numbers.   | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 20. When I'm reading a story, I find it difficult to work out the characters' intentions. | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 21. I don't particularly enjoy reading fiction.   | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 22. I find it hard to make new friends.   | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 23. I notice patterns in things all the time.   | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 24. I would rather go to the theatre than a museum.                                       | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 25. It does not upset me if my daily routine is disturbed.                                | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 26. I frequently find that I don't know how to keep a conversation going.                 | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 27. I find it easy to "read between the lines" when someone is talking to me.             | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 28. I usually concentrate more on the whole picture, rather than the small details.       | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 29. I am not very good at remembering phone numbers.                                      | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 30. I don't usually notice small changes in a situation, or a person's appearance.        | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 31. I know how to tell if someone listening to me is getting bored.                       | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 32. I find it easy to do more than one thing at once.                                     | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 33. When I talk on the phone, I'm not sure when it's my turn to speak.                    | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 34. I enjoy doing things spontaneously.   | definitely agree | slightly agree | slightly disagree | definitely disagree |

|  |                  |                |                   |                     |
|--|------------------|----------------|-------------------|---------------------|
|  |                  |                |                   |                     |
| 35. I am often the last to understand the point of a joke.   | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 36. I find it easy to work out what someone is thinking or feeling just by looking at their face.                                      | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 37. If there is an interruption, I can switch back to what I was doing very quickly.   | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 38. I am good at social chit-chat.   | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 39. People often tell me that I keep going on and on about the same thing.   | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 40. When I was young, I used to enjoy playing games involving pretending with other children.  | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 41. I like to collect information about categories of things (e.g. types of car, types of bird, types of train, types of plant, etc.). | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 42. I find it difficult to imagine what it would be like to be someone else.   | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 43. I like to plan any activities I participate in carefully.  | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 44. I enjoy social occasions.  | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 45. I find it difficult to work out people's intentions.   | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 46. New situations make me anxious.  | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 47. I enjoy meeting new people.  | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 48. I am a good diplomat.  | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 49. I am not very good at remembering people's date of birth.  | definitely agree | slightly agree | slightly disagree | definitely disagree |
| 50. I find it very easy to play games with children that involve pretending.   | definitely agree | slightly agree | slightly disagree | definitely disagree |

## Appendix S - Broader Autism Phenotype Questionnaire

*Below is a list of statements. Please read each statement very carefully and rate how often it applies to you by circling the number corresponding to your answer. Think about the way you have behaved the majority of the time rather than during selected time periods or transitory phases of your life. Note the items with asterisks; there is guidance about how to consider those statements at the bottom of the page.*

**Please do not leave any statements out. If unsure about at item, give your best guess.**

- |               |                  |              |
|---------------|------------------|--------------|
| 1—Very rarely | 3—Occasionally   | 5—Often      |
| 2—Rarely      | 4—Somewhat often | 6—Very often |

**Questions:**

- |  |             |
|--|-------------|
| 1. I like being around other people  | 1 2 3 4 5 6 |
| 2. I find it hard to get my words out smoothly                             | 1 2 3 4 5 6 |
| 3. I am comfortable with unexpected changes in plans                       | 1 2 3 4 5 6 |
| 4. It's hard for me to avoid getting sidetracked in conversation           | 1 2 3 4 5 6 |
| 5. I would rather talk to people to get information than to socialize      | 1 2 3 4 5 6 |
| 6. People have to talk me into trying something new                        | 1 2 3 4 5 6 |
| 7. I am "in-tune" with the other person during conversation ***            | 1 2 3 4 5 6 |
| 8. I have to warm myself up to the idea of visiting an unfamiliar place    | 1 2 3 4 5 6 |
| 9. I enjoy being in social situations                                      | 1 2 3 4 5 6 |
| 10. My voice has a flat or monotone sound to it                            | 1 2 3 4 5 6 |
| 11. I feel disconnected or "out of sync" in conversations with others ***  | 1 2 3 4 5 6 |
| 12. People find it easy to approach me ***                                 | 1 2 3 4 5 6 |
| 13. I feel a strong need for sameness from day to day                      | 1 2 3 4 5 6 |
| 14. People ask me to repeat things I've said because they don't understand | 1 2 3 4 5 6 |
| 15. I am flexible about how things should be done                          | 1 2 3 4 5 6 |
| 16. I look forward to situations where I can meet new people               | 1 2 3 4 5 6 |
| 17. I have been told that I talk too much about certain topics             | 1 2 3 4 5 6 |
| 18. When I make conversation it is just to be polite ***                   | 1 2 3 4 5 6 |
| 19. I look forward to trying new things                                    | 1 2 3 4 5 6 |
| 20. I speak too loudly or softly   | 1 2 3 4 5 6 |
| 21. I can tell when someone is not interested in what I am saying ***      | 1 2 3 4 5 6 |
| 22. I have a hard time dealing with changes in my routine                  | 1 2 3 4 5 6 |

- |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 23. I am good at making small talk ***                                      | 1 | 2 | 3 | 4 | 5 | 6 |
| 24. I act very set in my ways   | 1 | 2 | 3 | 4 | 5 | 6 |
| 25. I feel like I am really connecting with other people                    | 1 | 2 | 3 | 4 | 5 | 6 |
| 26. People get frustrated by my unwillingness to bend                       | 1 | 2 | 3 | 4 | 5 | 6 |
| 27. Conversation bores me ***   | 1 | 2 | 3 | 4 | 5 | 6 |
| 28. I am warm and friendly in my interactions with others ***               | 1 | 2 | 3 | 4 | 5 | 6 |
| 29. I leave long pauses in conversation                                     | 1 | 2 | 3 | 4 | 5 | 6 |
| 30. I alter my daily routine by trying something different                  | 1 | 2 | 3 | 4 | 5 | 6 |
| 31. I prefer to be alone rather than with others                            | 1 | 2 | 3 | 4 | 5 | 6 |
| 32. I lose track of my original point when talking to people                | 1 | 2 | 3 | 4 | 5 | 6 |
| 33. I like to closely follow a routine while working                        | 1 | 2 | 3 | 4 | 5 | 6 |
| 34. I can tell when it is time to change topics in conversation ***         | 1 | 2 | 3 | 4 | 5 | 6 |
| 35. I keep doing things the way I know, even if another way might be better | 1 | 2 | 3 | 4 | 5 | 6 |
| 36. I enjoy chatting with people ***  | 1 | 2 | 3 | 4 | 5 | 6 |

\*\*\* Refer to casual interaction with acquaintances, rather than to special relationships such as those with close friends or family members.

## Appendix T - Satisfaction with Life Scale

Below are five statements with which you may agree or disagree. Using the 1-7 scale below, indicate your agreement by selecting the appropriate number. Please be open and honest in your responding. The 7-point scale is as follows:

- 1 = strongly disagree
- 2 = disagree
- 3 = slightly disagree
- 4 = neither agree nor disagree
- 5 = slightly agree
- 6 = agree
- 7 = strongly agree

1. In most ways my life is close to my ideal. 1 2 3 4 5 6 7
2. The conditions of my life are excellent. 1 2 3 4 5 6 7
3. I am satisfied with my life. 1 2 3 4 5 6 7
4. So far I have gotten the important things I want in life. 1 2 3 4 5 6 7
5. If I could live my life over, I would change almost nothing. 1 2 3 4 5 6 7

## Footnote

<sup>1</sup> Three supplementary items, derived from the Pragmatic Rating Scale (Landa et al., 1992) were created in order to capture additional behavioral components related to social and communication deficits associated with ASD traits (i.e., interruptions, speech peculiarities, and stereotypic responses). However, based upon preliminary coding of these items conducted by two investigators for the three highest BAPQ scorers from the fall semester, little variability in coding across participants during both Interested and Bored conditions was observed (i.e., no participants obtained scores indicative of impairment on these items). Thus, these items were not coded for the remainder of participants and are not included in analyses.