An Exploration of the Social Neuroscience of Empathy and Autism Spectrum Disorder Behaviors in Anorexia Nervosa

by

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DEDICATION

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ABSTRACT

Introduction: For decades research has searched for an explanation of Anorexia Nervosa (AN) as a variant of other psychiatric disorders. Examples include primary pituitary disorder, schizophrenia, mood disorder, and anxiety disorders. One notable comparison is with autism spectrum disorders (ASD), in which behavioral and clinical observations indicate a diagnostic overlap. Cross examination of symptomology has indicated striking similarities, particularly in regards to eating disturbances and processes in executive functioning. As such, researchers have called for the comparison of neurocognitive profiles of AN and ASDs, in order to increase the understanding of the degree of overlap between these two conditions, of which would prove useful in the progression of treatment and intervention. Additionally, a theoretical framework has examined the similarities between AN and ASDs, and indicated that investigations conducted in this manner may lead to the understanding of endophenotypes relevant to AN. **Purpose:** The purpose of the present study is to investigate interpersonal factors; specifically, the ability to express empathy and the existence of ASD behaviors in a sample of AN patients compared to Health Controls (HC). While certain studies represent extensive data collected over many decades, these longitudinal studies were conducted within a narrowly defined sample of Swedish children, limiting its generalizability. A theoretical framework has been laid out towards defining social cognitive endophenotypes in AN and while this work draws on a tremendous amount of evidence, it has not been empirically validated. Building off of previous studies implicating comorbid diagnosis of ASDs in a subset of the AN population, the present study continues to explore the possible link between ASDs and AN. **Methods:** Data was collected on measures of empathy, emotional intelligence, autism behavior, and eating disorder behaviors across samples of AN (n = 16) and HC (n = 22). Independent samples t-tests were run to compare differences between groups on the above measures. Both confirmatory and exploratory analyses were run. **Results:** Significant differences were noted between groups on variable of autism spectrum disorder behaviors, alexithymia, and emotional intelligence. Analyses did not indicate significant differences between groups on measures of expressed empathy or emotional contagion. **Discussion:** The present study serves as a replication and expansion on previous research examining the relationship between AN and ASDs diagnoses. The present results continue to highlight the presence of ASDs behaviors within an AN sample in comparison to HC. However, the present results are limited by a small sample size and inherent difficulties in measurement when utilizing self-report measures.

Keywords: anorexia nervosa, autism spectrum disorders, social neuroscience, empathy

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LIST OF ABBREVIATIONS

AN	Anorexia Nervosa
ANr	Anorexia Nervosa restricting subtype
ANbp	Anorexia Nervosa binge-purging subtype
ASDs	Autism Spectrum Disorders
BMI	Body Mass Index
BN	Bulimia Nervosa
DSM-IV-TR	Diagnostic & Statistical Manual of Mental Disorders, Fourth Edition
EDNOS	Eating Disorder Not Otherwise Specified

CHAPTER 1

INTRODUCTION

Anorexia nervosa (AN) is defined as ridged, ritualized eating patterns that result in weight loss significantly below ideal body weight. Many cases are accompanied by severe medical complications and approximately 5% percent result in death (Steinhausen, 2002). More than 90% of eating disorders occur in females regardless of its manifestation as AN or Bulimia Nervosa (BN; American Psychological Association, 2000). The *Diagnostic and Statistical Manual of Mental Disorders IV-TR* estimates that AN effects approximately 3-5 of every 1,000 females (APA, 2000). While prevalent at all ages, AN tends to appear during adolescence, making this a critical time for intervention. Although etiology is typically explained through a biopsychosocial model, much lacks regarding a full understanding of the development of eating disorders (Jacobi, Hayward, de Zwaan, Kraemer, & Agras, 2004; Kaye, Klump, Frank, & Strober, 2000). One area some researchers believe to be fruitful is the role of genetics in AN (Tchanturia, Campbell, Morris, & Treasure, 2005). Specifically, Tchanturia and colleagues (2005) explored underlying central neural networks to better understand why some individuals develop eating disorders. Interestingly, there have been fewer neuropsychological studies of eating disorders than of any other major psychiatric disorder (Tchanturia et al., 2005), leaving this area of research relatively unexplored. This is especially disturbing as AN results in the highest mortality rates and eating disorders have the highest female to male ratios among all psychiatric disorders (Cook-Cottone, 2009).

The history of eating disorders highlights patterns of empirical work in which AN is described as a variant of another disorder (i.e., schizophrenia, mood disorder, pituitary disorder; Oldershaw, Treasure, Hambrook, Tchanturia, & Schmidt, 2011). Prior to Tchanturia et al. (2005)

work, a series of longitudinal studies beginning in the mid 1980s were conducted, indicating underlying autistic-like conditions in a subset of AN patients (Gillberg, 1985). Gillberg and Råstam (1992) observed a subgroup of AN patients to have characteristics congruent with a diagnosis of Autism Spectrum Disorders (ASDs) that included the restriction of social interactions, communication, and unique interest patterns. More recent theoretical research acknowledges the potential link between AN and ASDs through a theoretical examination of common social cognitive endophenotypes between the two disorders (Zucker, Losh, Bulik, LaBar, Piven, & Pelphrey, 2007). Although DSM-IV criteria lack diagnostic overlap, this research suggests similar underlying neuropsychiatric characteristics and information processing styles that include difficulties set shifting and a weak central coherence (Tchanturia et al., 2005). These distorted thinking patterns have been indicated as analogous to ASDs and are in fact so similar, it has led eating disorder researcher, Janet Treasure, to ask the question: *Is anorexia the female Asperger's?*

Although cognitive deficits appear similar between ASDs and AN, little research has explored the similarities in interpersonal and social function between these two groups. Among AN patients, interpersonal difficulties have been depicted as part of the phenomenology of AN, dating back to the 19th century (Pearce, 2004). In order to decipher the cause of these difficulties as a result of the illness itself, (i.e., self-induced starvation) or as occurring prior to onset, two strategies have been employed: (a) retrospective reports of childhood social functioning (Anderluh, Tchanturia, Rabe-Hesketh, & Treasure, 2003) and (b) patterns of comorbidity with childhood onset diagnosis defined by social deficits which include social phobia, (Hinrichsen, Wright, Waller, & Meyer, 2003; Melfsen, Waltiza, & Warnke, 2006) and separation anxiety disorder (Silberg & Bulik, 2005). Specifically, prevalence rates of social phobia range between

16% (Kaye, Bulik, Thornton, Barbarich, & Masters, 2004) and 88.2% (Hinrichsen et al., 2003). These reports support the presence of interpersonal difficulties prior to the onset of an eating disorder.

On the other side, the early onset of social impairments is a cardinal sign in the diagnosis of autism. In particular, individuals with autism lack eye contact, the ability to read social cues, and engage in reciprocal conversations (APA, 2000). Additionally, these individuals have a tendency to struggle to develop a pattern of mutual gaze, avoid physical contact with others, and prefer only to partake in activities independent of others (Volker, Thomeer, & Lopata, 2011). Therefore, qualitative impairment in social functioning is critical to the diagnosis and assessment of autism.

Specific to interpersonal difficulties is the ability to empathize with others. Deficits in empathy are consistent with the diagnosis of ASDs. However, AN patients have also been characterized as struggling with the display of empathy (Råstam, Gillberg, & Wentz, 2003). Empathy is recognized as the ability to understand what other individuals are thinking and feeling (Detecy & Ickes, 2009). Previous studies have examined the role of empathy in AN (Råstam et al., 2003; Wentz et al., 2005), however, these studies are limited by their narrowly defined population (i.e., an urban Swedish community) and examination of a variety of symptomology (i.e., Obsessive Compulsive Disorder, Obsessive-Compulsive Personality Disorder).

Hambrook, Tchanturia, Schmidt, Russell, and Treasure (2008) examined self-reports of empathy, systemizing, and autistic traits among AN patients. Results indicated significantly higher total scores than healthy controls on a measure of autistic traits with specific elevations on attention switching ($p = .001$), imagination ($p = .004$), and social skills ($p < .001$). No differences

were observed in empathy and systemizing between the two groups. Although Hambrook's et al. (2008) study does not indicate any difference in levels of empathy, a comparison group of ASD individuals was not utilized. Furthermore, other studies have indicated that patients with AN typically display similar characteristics with ASDs (Zucker et al., 2007), thus meriting a closer look at how these two diagnostic groups are similar and different in regards to interpersonal functioning.

Although empirical evidence points to AN patients displaying similar deficits in empathy to that of an ASD population, the roots of these deficits may differ. Prior research has illustrated neural deficits as the explanation for a lack of empathetic expression in ASDs (Dapretto, et al., 2006), however, through behavioral observations and clinical practice, present day researchers question if the "loss of self" AN patients display in relationships is due to a lack of empathy. That is, it has been hypothesized that AN patients behaviors are overly empathetic towards others, to the point that they lose themselves in the problems and struggles of others (Cook-Cottone, 2009). Hoffman (1981) identified "empathetic distress" as an immature form of empathy, a phenomena in which the person feels distressed by the state of another. Additionally, Haynos and Fruzzetti (2011) laid out a model indicating enhanced emotional sensitivity and reactivity which may influence AN patients to feel emotionally vulnerable and emotionally dysregulated. This occurrence may provide insight into the cause of those with AN to be hypersensitive to the behaviors and actions of others around them while demonstrating neglect of their own internal cues of hunger and self-nourishment. Specific AN behaviors such as restriction, excessive exercise, and purging may serve a compensatory role, allowing patients to dysfunctionally self-engage and regulate. It is therefore the aim of the current study to systematically decipher if AN patients expression of empathy and social functioning is

congruent, or divergent from the social deficits observed in ASDs in comparison to Health Controls (HC).

Diagnostic Criteria for Anorexia Nervosa and Autism Spectrum Disorder

The diagnostic criteria for AN and ASDs overlap minimally, making the present study complicated as no direct link in emotional and behavioral expression appear to exist between these two disorders. However, in order to ensure a clear understanding of both disorders, the criteria for each are presented below. With the upcoming publication of the fifth edition of the DSM, projected shifts are expected in diagnostic criteria and a discussion of these changes is also provided.

Anorexia Nervosa

Although the current *Diagnostic and Statistical Manual of Mental Disorders-IV-Text Revision* (DSM-IV-TR) recognizes three major eating disorders (i.e., AN, Bulimia Nervosa (BN), and Eating Disorder Not Otherwise Specified (EDNOS), only the criteria for AN will be presented here. AN is typically classified as an intense fear of gaining weight, distorted body image, amenorrhea (in females) and pursuit of an abnormally low body weight (i.e., below 85% of normal weight for age and height) through the restriction of food intake. Additionally, the diagnostic criteria of AN includes greater diagnostic specificity, as subtypes are distinguished between restrictive and binge/purge. Restrictive subtype refers to individuals who engage in excessive food restriction and/or excessive exercise, while the binge/purge subtype refers to those AN individuals with a history of binge eating and purgative behavior via self-induced vomiting, misuse of laxatives, or other inappropriate compensatory behaviors.

The current diagnostic system evaluates eating disorders based on weight along with behavioral and psychopathological constructs (Mitchell, Cook-Myers, & Wonderlich, 2005).

However, criteria set for AN are not always determined based on empirical evidence. For instance, the criterion that AN patients are less than 85% of expected weight for height was not established based on scientific evidence, and as such, these criteria may be too restrictive, leaving the majority of eating disorder patients to fall in the category of Eating Disorder Not Otherwise Specified (EDNOS; 49 to 71%) verses AN patients (3 to 17%). The diagnosis of EDNOS is traditionally utilized when a patient exhibits some features of AN or BN, but does not meet full diagnostic criteria and carries little meaning in regards to the clinical symptoms evident.

In a meta-analysis, Thomas et al. (2009) examined the psychopathology of EDNOS in comparison to AN, BN, and Binge Eating Disorder (BED). One hundred-twenty-five studies were identified from 1987 to 2007. Results indicated that among patients diagnosed with EDNOS, a significant percentage could have otherwise been diagnosed with AN. However, they did not meet the diagnostic criteria for amenorrhea. As such, it is anticipated that the AN diagnosis criterion D (amenorrhea), will change in the upcoming version of the DSM.

Subtypes of AN. Two subtypes of AN are recognized in the DSM-IV-TR. These include a restricting (ANr) type and binge-eating/purging (ANbp) type. The restricting subtype indicates that the patient does not engage in binge-eating or purging behavior that includes self-induced vomiting or the misuse of laxatives, diuretics or enemas, whereas patients diagnosed with the binge-eating/purging subtypes do.

Implications of diagnostic migration. Recent empirical evidence points to the tendency of diagnostic migration, the shifting of symptomology between AN and BN, and clouding the nosology of separate disorders (Milos, Spindler, Schyder, & Fairburn, 2005; Thomas, Vartanian, & Brownell, 2009). As such, Fairburn and Bohn (2005) promote a transdiagnostic perspective of

eating disorders, such that a single unitary category is created, merging AN, BN, and EDNOS into one. Additionally, Uher et al (2004) provides empirical evidence suggesting that deficits in similar brain regions (i.e., medial prefrontal cortex) are at play in both AN and BN implicating the transdiagnostic model at the neural level. In response, Birmingham, Touyz, and Harbottle (2009) argue against such a decision, stating that the distinctions between AN, BN, and ENDOS, would prevent specificity when making clinical diagnoses. Moreover, in contrast to the transdiagnostic model, evidence has supported the notion that the subtype of restrictive AN should remain separate (Clinton, Button, Norring, & Palmer, 2004; Collier & Treasure, 2004).

Shifts in diagnostic criteria. With the upcoming publication of the fifth edition of the DSM, it is anticipated that AN will remain as a distinct disorder (American Psychiatric Association DSM-5 Development, 2010). However, criteria are projected to shift in order to reduce the emphasis on specific percentages of weight loss (i.e., less than 85% of expected body weight), refusal to maintain body weight, and an intense fear of gaining weight. Additionally, criteria indicating amenorrhea in postmenarcheal females is anticipated to be removed to better reflect the tendency of many AN patients to report at least some menstrual activity. The subtypes of Restricting Type and Binge-Eating/ Purging Type are predicted to remain the same.

Pervasive Development Disorders and Autism Spectrum Disorders

The diagnosis of autism falls in the class of pervasive development disorders (PDDs), a category that also includes Asperger's Disorder, childhood disintegrative disorder (CDD), Rett's disorder, and Pervasive Development Disorder – Not Otherwise Specified (PDD-NOS). This group of disorders has been classified as such due to the "assumed neurodevelopment nature of the conditions and the pervasiveness of their effects across different developmental domains" (Volker et al., 2011, p. 501). As defined in the DSM-IV-TR, autism disorder is marked by three

major domains that include (a) social interactions, (b) communication, and (c) restricted repetitive and stereotyped patterns of behavior, interests, and activities (APA, 2000). Within each domain, four possible domain specific symptoms are indicated. The diagnosis of autism disorder rests on the presence on six domain-specific symptoms across each of the three major domains. Impairments in the domain of social interactions may include the lack of nonverbal behaviors (i.e., eye-to-eye gaze, facial expression, body postures, and gestures to regulate social interaction), development of peer relationship, initiation of spontaneous seeking to share interests, and social or emotional reciprocity (APA, 2000). Additionally, impairments seen in the domain of communication include a delay or total lack of spoken language, impairment in ability for initiation of sustained conversation, stereotyped and repetitive use of language, and lack of varied and spontaneous make-believe play. Finally, within the domain of restricted repetitive and stereotyped patterns of behavior, interests, and activities, symptoms may include a preoccupation with one or more stereotypes or restricted interests, inflexible adherence to specific nonfunctional routines or rituals, stereotypes and repetitive motor mannerisms, and/or preoccupation with parts of objects. The onset of these delays or abnormal behavior in the area of social interaction, language, or symbolic play, occurs prior to the age of three years old, but may not be diagnosed until after the age of three.

Subtypes within the class of PDD. As the previous section indicated, five PDDs exist, of which there are three diagnoses relevant to autism that include: (a) autism disorder, (b) Asperger's disorder, and (c) PDD-NOS. The above section presents the diagnostic criteria for autism disorder implicating impairments in social interactions and communication, along with stereotypes and abnormal behaviors. Asperger's disorder differentiates itself from autism in that a language or speech delay is absent, but all other autistic-like symptomology is present.

Therefore, Asperger's disorder includes similar impairments in social interaction, along with repetitive and stereotyped patterns of behaviors, but excludes any significant delay in language or cognitive development. This also includes the development of age-appropriate self-help skills, adaptive behavior, and/or appropriate curiosity about the environment.

On the other hand, PDD-NOS is diagnosed when there is a severe and pervasive impairment in the development of reciprocal social interactions or verbal and nonverbal communication. Additionally, stereotyped behaviors, interests, or activities may be present but the criteria are not congruent with any other more specific Pervasive Developmental Disorder. This category includes "Atypical Autism" in which the presentation does not meet the criteria of Autistic Disorder due to the late onset, atypical symptomology, or subthreshold symptomatology (APA, 2000).

Shifts in diagnostic criteria. In anticipation of the upcoming publication of the DSM, several important changes are noted (American Psychiatric Association DSM-5 Development, 2010). Work groups project that the differentiation in classification will collapse into one set of diagnostic criteria labeling autism disorder, Asperger's disorder, and PDD-NOS all under the term of Autism Spectrum Disorders (ASDs). Additionally, the criteria in the domain of restricted interests and repetitive behaviors will only require the presence of two symptoms. In addition, it is anticipated that the domain specific criteria for social interactions and communication will merge so that three subdomain symptoms in this combined domain must be met. Finally, severity of symptoms will be measured as specified in Table 1.

Table 1. *Severity Level for DSM-V Criteria for ASD*[1]

Severity Level for ASD	Social Communication	Restricted Interests and Repetitive Behaviors
Level 3: Requiring very substantial support	Severe deficits in verbal and nonverbal social communication skills cause severe impairments in functioning; very limited initiation of social interactions and minimal response to social overtures from others.	Preoccupations, fixated rituals and/or repetitive behaviors markedly interfere with functioning in all spheres. Marked distress when rituals or routines are interrupted; very difficult to redirect from fixated interest or returns to it quickly.
Level 2: Requiring substantial support	Marked deficits in verbal and nonverbal social communication skills; social impairments apparent even with supports in place; limited initiation of social interactions and reduced or abnormal response to social overtures from others.	RRBs and/or preoccupations or fixated interests appear frequently enough to be obvious to the casual observer and interfere with functioning in a variety of contexts. Distress or frustration is apparent when RRB's are interrupted; difficult to redirect from fixated interest.
Level 1: Requiring support	Without supports in place, deficits in social communication cause noticeable impairments. Has difficulty initiating social interactions and demonstrates clear examples of atypical or unsuccessful responses to social overtures of others. May appear to have decreased interest in social interactions.	Rituals and repetitive behaviors (RRB's) cause significant interference with functioning in one or more contexts. Resists attempts by others to interrupt RRB's or to be redirected from fixated interest.

[1]Adapted from: http://www.dsm5.org/ProposedRevision/Pages/proposedrevision.aspx?rid=94#

Definition of Autism in Present Study. Due to the confusion and overlap in terms referring to autism, the present study will utilize the term Autism Spectrum Disorders (ASDs) to refer to autism disorder, Asperger's disorder, and PDD-NOS and therefore, utilizing the more

current view researchers have taken regarding the diagnosis of autism, indicating the utility of a continuum in which the severity of symptoms lies.

Differences in Diagnostic Criteria between AN and ASD

Prior to moving forward in the exploration of similarities in underlying endophenotypes of ASDs and AN, it is critical to acknowledge the already evident divergent criteria between these two disorders. Specifically, while AN is typically diagnosed in adolescence or young adulthood, ASD more often commences before the age of three years old. Additionally, although high functioning autism and individuals diagnosed with Asperger's disorder have well developed verbal skills, those individuals diagnosed with autism are often limited verbally. This difference is critical, as patients with AN most often display typical verbal and language development. Although prolonged starvation can delay processing speed and therefore, language production in patients with AN, re-feeding often remediates these difficulties allowing the individual to return to normal functioning. In relation to verbal and language development, is intellectual functionality. Again, those diagnosed with high functioning autism and/or Asperger's disorder often display strong cognitive skills and at times, superior intelligence. However, this is not always true of those diagnosed with autism in which IQ scores congruent with mental retardation are often evident. Furthermore, depending on the acuity of their disorder, AN patients typically display average intelligence. Finally, AN predominately occurs in females with a male to female ratio of 1:9 (Pawluck & Gorey, 1998). The opposite is true in ASDs where the prevalence of males to females is 7:1 (Williams, Thomas, Sidebotham, & Emond, 2008). Nonetheless, both disorders are considered rare, as AN is indicated as having a lifetime prevalence of approximately 0.5%, while the rate of autism is estimated as occurring in a range from 2 to 20 cases per 10,000 individuals (APA, 2000).

Statement of the Problem

Throughout the literature, investigators have attempted to explain the complex nature of AN by describing it as an variant of another disorder (i.e., primary pituitary disorder, schizophrenia, mood disorder, anxiety disorder; Oldershaw et al., 2011). Initially proposed by Gillberg (1983), through clinical and behavioral observations, a small, but consistent line of research has continued to describe the clinical symptoms of AN in comparison to ASDs. Research has pointed to similar cognitive, biological, and neuropsychological processes between ASDs and AN. Specifically, lines have been drawn between difficulties in set shifting and selective attention across both disorders, which may result in perfectionism in AN and an obsession with parts in objects in ASDs. Eating disturbances have been noted within the ASD population as patients have a tendency to restrict their diets due to sensitivity of smell or texture (Råstam, 2008; Scheck, Williams, & Smith, 2004). Therefore, researchers have speculated about the possible genetic link between AN, and ASDs.

Despite these commonalities research has not systematically explored social and interpersonal factors between patients diagnosed with AN and ASDs. While social impairments are a cardinal sign of ASDs, abnormal social functioning is not necessary for the diagnosis of AN. None-the-less, impaired social skills along with increased social anxiety, have been demonstrated among patients with AN. Specifically, Gillberg and Råstam (1992) point not only to the similarities in compulsions and rituals between both disorders, but also to the difficulties in social interactions that both patients with AN and ASDs demonstrate. However, a dearth of research exists regarding what the role of social cognitive factors play in the link between AN and ASDs.

Although similar cognitive endophenotypes may be underlying factors of ASDs and AN, the phonotypical expression of these genes differ tremendously. When comparing the diagnostic criteria for AN and ASDs, no overlay exists. Therefore, additional research examining the similarities and differences between AN and ASDs is critical in order to better understand the relationship between these disorders, particularly in regards to the role that social and interpersonal factors play.

Purpose of the Study

The purpose of this study is to replicate and extend the Oldershaw et al. (2011) study in order to systematically explore the similarities and differences between a AN sample and a HC sample in regards to expressed empathy, ASD characteristics, alexithymia, and emotional intelligence. Specifically, as in the Oldershaw et al. (2011) study, a focus on interpersonal functioning and the ability to express empathy will be maintained. In contrast, the present study will argument the Oldershaw et al. (2011) study through the utilization of additional measures to further explore the role of interpersonal functioning between both populations. Planned comparisons will be utilized in order to contrast these two populations across several measures of eating disorder behavior, ASDs symptomology, empathy, and emotional intelligence.

Significance of the Study

The broad significance of the present study is to underscore the role of empathy in social cognition and interpersonal functioning regarding the development and maintenance of AN in order to inform effective treatment modalities. As it stands now, little research has been conducted exploring the role of interpersonal functioning in AN (McIntosh, Bulik, McKenzie, Luty, & Jordan, 2000). While, Interpersonal Psychotherapy (IPP) has been demonstrated as inferior to other treatment modalities, AN patients remain motivated to improve the social

acceptance and interpersonal proficiencies (McIntosh et al., 2005; McIntosh et al., 2006). Additionally, patients with AN are often concerned, and at times, preoccupied with interpersonal acceptance (Bizeul, Sadowsky, & Rigaud, 2001). The Maudsely method of family therapy, to date, has been indicated as the most effective treatment for AN in adolescents, and perhaps so, as this treatment modality places an emphasis on the expression of the patient's needs within in the family (Smith & Cook-Cottone, 2011). As such, Zucker et al. (2007) suggests that basic social cognitive processes maybe lack and therefore, makes it more difficult for AN patients to engage in interventions such as IPP due to the emphasis on interpersonal factors. Research focused on the social cognitive function of AN patients has the potential to provide critical empirical evidence to inform evidence-based interventions. Utilization of such information, and its augmentation to existing protocol, may improve the effectiveness and treatment outcomes for AN patients. Similarly, improvement in interpersonal communication among family members may help to improve treatment outcomes in family therapy interventions. Eisler et al. (1997) work notes that patients who fare poorly in family therapy are more likely to reside in families that are critical of one another. A better understanding of the interpersonal styles and social tendencies of patients with AN may help to potentiate treatment interventions.

The present study further examines the link between ASDs characteristics in an AN sample and also explores interpersonal factors including empathy, emotional intelligence, and alexithymia. Prior studies (Gillberg, 1983; Gillberg, 1985; Gillberg & Råstam, 1992) have examined longitudinal data implicating overlap between ASDs and AN in both clinical samples and through behavioral observations. While these studies represents extensive data collected over many decades, significant limitations are at question (see section below). Additionally, this study was conducted within a narrowly defined sample of Swedish children. Other research has

indicated a high prevalence of self-reported autistic behaviors and traits among AN patients, but lacks replication (Hambrook et al., 2008). Finally, the theoretical work of Zucker et al. (2007) has laid out a roadmap towards defining social cognitive endophenotypes in AN, and while it draws on a tremendous amount of evidence, this evidence has not been empirically validated. In spite of these works, Zucker et al (2007) indicates that "individuals with interpersonal deficits are disproportionately represented among individuals with AN who exhibit a chronic course of illness and those individuals with interpersonal disturbance endorse symptoms of ASDs greater understanding of the nature and impact of ASDs in AN is needed" (p. 979). As such, much foundational research exists leading up to the present study and the aims of the present study rest in the need for "systematic exploration of the relation between AN and ASDs" (Zucker et al., 2007, p. 982).

Primary Research Questions

1. Is there a significant difference in autism spectrum behaviors as measured by the total score of the AQ in comparison to the healthy control group?
2. Is there a significant difference in eating disordered behaviors as measured by the total score of the EDE-Q6 in comparison to the health control group?
3. Is there a significant difference in empathy as measured by the total score of the BES in comparison to the health control group?
4. Is there a significant difference in emotional contagion as measured by the total score of the ECS in comparison to the health control group?
5. Is there a significant difference in alexithymia as measured by the total score on the TAS in comparison to the health control group?

6. Is there a significant difference in emotional intelligence as measured by the total score of the SSEIT, in comparison to the health control group?

Primary Hypotheses

1. It is hypothesized that the AN sample will demonstrate a higher level of autistic spectrum behaviors as measured by the total score on the AQ in comparison to the healthy control group.
2. It is hypothesized that the AN sample will demonstrate a higher level of eating disorder behaviors as measured by the EDE-Q6 in comparison to the healthy control group.
3. It is hypothesized that the AN sample will demonstrate a higher level of autistic spectrum of expressed empathy as measured by the BES in comparison to the healthy control group.
4. It is hypothesized that the AN sample will demonstrate a higher level of emotional contagion as measured by the ECS in comparison to the healthy control group.
5. It is hypothesized that the AN sample will demonstrate a higher level of alexithymia as measured by the TAS in comparison to the healthy control group.
6. It is hypothesized that the AN sample will demonstrate a lower level of emotional intelligence as measured by the SSEIT in comparison to the healthy control group.

Secondary Research Questions

1. Is there a significant difference in autism spectrum behaviors as measured by the subscales scores of the AQ in comparison to the healthy control group?
2. Is there a significant difference in eating disordered behaviors as measured by the subscale scores of the EDE-Q6 in comparison to the health control group?

3. Is there a significant difference in empathy as measured by the subscale scores of the BES, total score or subscale scores of the IRI, or the total score of the TEQ in comparison to the health control group?
4. Is there a significant difference in emotional contagion as measured by the subscale scores of the ECS in comparison to the health control group?
5. Is there a significant difference in alexithymia as measured by the subscale score on the TAS in comparison to the health control group?

Secondary Hypotheses

1. It is hypothesized that a statistically significant difference will exist between the AN and HC samples as measured by the subscale scores of the AQ.
2. It is hypothesized that a statistically significant difference will exist between the AN and HC samples as measured by the subscale scores of the EDE-Q6.
3. It is hypothesized that a statistically significant difference will exist between the AN and HC samples as measured by the subscale scores of the BES, total score or subscale scores of the IRI, or the total score of the TEQ.
4. It is hypothesized that a statistically significant difference will exist between the AN and HC samples as measured by the subscale scores of the ECS.
5. It is hypothesized that a statistically significant difference will exist between the AN and HC samples as measured by the subscale scores of the TAS.

Limitations

Several limitations are present in the current study. Due to the tremendous resources needed to conduct individual interviews with participants, it was deemed more efficient for self-report measures to be utilized in the present study. However, while more efficient there are

notable limitations to the utilization of self-report. This is particularly important regarding the assessment of behaviors that require a level of insight and introspection that is inherent in order to assess symptomology, along with interpersonal functioning. Another limitation inherent in the design of the study is the cross-sectional recruitment of subjects. That is, both the AN and HC samples are only assessed at one point in time. As a result, causality cannot be assumed. Taking a snap shot of each population allows for the interpretation of associations, but does not allow for the assessment of symptoms over time. To strengthen the assessment of each variable across populations, exclusion criteria are set in such, that homogeneous samples are selected. That is, demographic variables are limited to a restricted age range (18 - 60 years old) and gender (female).

Finally, the empirical work of Gillberg has been highly scrutinized and as a result of a heated debate regarding the validity and reliability of his study design. Specifically, two independent researchers requested access to Gillberg's database regarding a long-term research project on hyperactivity and attention-deficit disorders in children. The University of Gothenburg, where Gillberg was employed, denied access stating that it would violate the confidentiality of the research participants. However, the external researchers appealed the decision. Within a few days, the data in question had been destroyed by colleagues of Gillberg. And while claims have not been made regarding the data set collected in Gillberg's AN, and ASD studies, it is not without question that ethical concerns may exist (Gillberg v. Sweden, 2010). Therefore, it is important to keep this frame of reference as the field propels forward due to the fact that Gillberg's research serves as foundational to the present study.

Conceptual Definitions of Variables

Alexithymia. A state of deficiency in understanding, processing, or describing emotions

Anorexia Nervosa. One type of eating disorder that is characterized by a refusal to maintain a healthy body weight and on obsessive fear of gaining weight.

Autism spectrum disorders. Encompasses the spectrum of disorders that including Autism Disorder, Asperger syndrome, and Pervasive Developmental Disorder Not Otherwise Specified. While diagnostic criteria vary, all forms of autism involve deficits in social interaction and communication along with a restricted interest and repetitive behaviors.

Diagnostic co-morbidity. Meeting the criteria for two separate but co-existing psychiatric disorders.

Emotional contagion. The tendency to catch and feel emotions that are similar to and influenced by others.

Emotional intelligence. Is an ability to identify, assess, and control the emotions of oneself, of others, and of groups.

Empathy. The capacity to recognize and, to some extent, share feelings that are being experiences by others.

Systemizing. The drive to analyze of construct a system (i.e., anything that follows rules or lawful patterns).

CHAPTER 2

LITERATURE REVIEW

Course and Phenomenology of Anorexia Nervosa

Kaye, Fudge, and Paulus (2009) report AN to be one of the most homogenous psychiatric disorders, as "there is a narrow range of age of onset (early adolescents), stereotypic presentation of symptoms and course, and relative gender specificity" (p.573). However, despite the similarity in presentation, AN remains one of the most difficult disorders to treat as patients' ego-syntonic nature creates a powerful will to resist eating and weight gain. Additionally, little is known regarding the aetiology and whether or not AN is a result of a disturbance in appetite pathways, or if the disturbance in eating results from a lack of coping mechanisms normally utilized to help manage other psychological difficulties, such as anxiety and/or preoccupations with weight gain (Kaye et al., 2009). What is known, and widely accepted, is that both state and trait related characteristics exist to cause the initial development of and substantial continuation of AN.

To better understand premorbid, genetically-determined trait characteristics of which contribute to the development of AN, Anderluh et al. (2003) examined retrospective reports of childhood traits associated with obsessive-compulsive disorder (OCD) symptoms in eating disorder patients. Traits assessed included perfectionism (65.4%), inflexibility (76.9%), rule-bound processing (61.5%), excessive doubt and cautiousness (i.e., excessive fear of making a mistake; 27.3%), and drive for order and symmetry (38.5%). By way of logistic regression analysis, results indicated that the number of OCD traits present in childhood greatly influenced the likelihood for the development of an eating disorder. Specifically, with every additional trait reported, the likelihood of developing an eating disorder increased nearly 7-fold (odd ratio = 6.9, 95% CI = 2.9-16.6, $p < 0.0001$). Additionally, the state of starvation and emaciation that results

from a prolonged bout of AN can have profound effects on the functioning of the brain, and may in fact exaggerate the premorbid traits and accelerate or exasperate the symptomology of AN (Kaye et al., 2009). Known to remediate after recovery, these state-like characteristics appear to allow a patient with AN to continually strive for additional weight loss, despite severe malnutrition.

Prevalence of Autistic Traits in Anorexia Nervosa

In 1983, Gillberg posed the question "Are autism and anorexia nervosa related?" and indicated his initial observations regarding similar symptomology between these disorders (p. 428). These ideas are reflected in his statement that patients with AN are resistant to change, demonstrate aloofness, and problems with social relations; characteristics often seen in children diagnosed with autism. As a pioneer in the field, Gillberg (1983) opened up the question to explore if there may be common biochemical disturbances as a result of brain damage, starvation or cultural factors that result in autism in males and anorexia in females. This statement reflects the notation of an underlying genetic link between AN and ASDs, outside the influences of starvation and sociocultural factors. Specifically, one of Gillberg's initial observations occurred in a study of 171 families with a child diagnosed with autism or psychotic features (Gillberg, 1985). Of the families assessed, Gillberg (1985) selected four, each who had a male child diagnosed with autism. It was indicated that three out of these four families had a first degree female relative who had been independently diagnosed with AN. To explore this further, Gillberg (1985) interviewed children along with their corresponding family members. Results indicated that all children diagnosed with autism were also mentally retarded, whereas none of the patients with AN were. Furthermore, no notable psychosocial or environmental factors could explain the familiar association between AN and ASDs, making heredity a more plausible

explanation (Gillberg, 1985). The present researchers cautioned that although there appears to be a commonality in these families, these results are not meant to suggest that in all cases these conditions are connected and that other environmental factors not accounted for in the present study could serve as contributing factors. Although an important study, it should be noted that the present article refers to the diagnosis of autism as infantile autism (IA) as presented in the DSM-III. The symptoms and criteria used to diagnose both autism and AN, differ from the DSM-IV-TR criteria. Additionally, inclusion criteria are not clearly outlined in the aforementioned article.

Since bringing light to the above phenomenon, Gillberg and colleagues have dedicated several decades of research on a longitudinal study, following a cohort of AN patients in Göteborg, Sweden. In their initial study, these researchers identified 51 sixteen year old AN patients, along with a parallel sample of health controls matched on characteristics of age, sex, and school (Gillberg & Råstam, 1992). This cohort of individuals ranged in ages of 10 to 17 years old (M = 16), of which the majority were females (n = 48). Subjects were psychiatrically examined within 18 months of the onset of their disorder and all were diagnosed based on DSM-III-R criteria for eating disorders. Baseline assessment included a semi-structured family-genetic and developmental history, which encompassed psychiatric, neurodeveopmental, and pre-morbid psychiatric problems. Additionally, measures of eating habits, depression, personality, adaptability, and family communication were assessed along with physical exams conducted with the identified patient. Finally, all parents and children were interviewed regarding their social interactions. Results from the baseline assessment indicated a significant portion of AN patients exhibiting symptoms congruent with autistic-like behaviors which included: obsessive-compulsive behaviors; attention, motor control, and perceptual problems in early childhood that

remediated before the age of ten along with perfectionistic behaviors (Gillberg & Råstam, 1992; $p < 0.001$). Additionally, individuals diagnosed with both ASDs and AN typically had worse treatment outcomes. Follow-up assessments included a comprehensive neurodevelopmental exam, structured clinical interviews, a neuropsychological battery and the assessment of neurodevelopmental disorders such as ASDs. At 6-year follow-up nearly 29% ($n = 15$) of AN patients had an empathy disorder and 39% ($n = 20$) had Asperger's syndrome or other autistic-like conditions (Gillberg, Råstam, & Gillberg, 1995). Moreover, a familial link was recognized as patients with AN were identified as having more relatives with social impairments, typically exhibited in autism (Råstam et al., 2003). Gillberg and Råstam (1992) point to the similarities in compulsions and rituals present in both disorders, along with difficulties in social interactions. In combination these studies point to similar underlying neuropsychiatric characteristics between AN, and ASD (Gillberg et al., 2010).

Table 2. *Gillberg's Longitudinal Studies*

	Study 1*[a]	Study 2**[b]	Study 3**[c]	Study 4**[d]
Mean Age (yrs)	16	21	24	32
Years after Onset	0	6-7	10	18
N of AN Patients	51	51	48	51
N of Comparison Group	51	51	51	51
Total *N*	102	102	99	102
% indicating symptoms of ASD/Empathy Disorder	7.8% (*n*=4)	7.8% (*n*=4)	18.7% (*n*=10)	11.7% (*n*=6; across all 4 studies)

*Original Study
**Follow up study
[a] Råstam (1992)
[b] Gillberg, Råstam, & Gillberg (1994)
[c] Råstam, Gillberg, & Wentz (2003)
[d] Gillberg et al. (2010)

Case studies implicating comorbidity. In addition to the Gillberg studies, several case reports exist implicating the existence of individuals diagnosed with autism in childhood developing AN in adolescence (Fisman, Steele, Short, Byrne, & Lavallee, 1996; Kinnell, 1983; Stiver & Dobbins, 1980). The first known case study is presented by Stiver and Dobbins (1980).

The present case included a Caucasian female diagnosed with AN and Autism. Autistic symptomology included social avoidance, unstained eye contact, fixed blank stares, stereotypical behaviors such as hand flapping, physical aggression, and masturbation. Initial features of AN and eating disturbance began at the age of 12 years old when the present child progressively decreased her food consumptions. These changes were noted at both school and home, and it is indicated that the child's mother was currently on a diet and frequently discussed her dieting behavior at home. It was speculated that these conversations where adversely affecting the child's own beliefs about body image. Additionally, it was noted that the child engaged in frequent conversations that referenced fat and thin people, and a desire to be thin. Several months later, the child began to refuse food all together stating that she could not eat because the food made her sick. Behaviors continued to a degree to which noticeable weight loss occurred and the child indicated a distorted perception of eating.

Implicated in another case study, Kinnell (1983) reported an 18-year-old female who presented characteristics of autism that included social unresponsiveness, a delay in speech development until the age of five, and an indication of feeding problems. It was stated that at the age of 8 years old, the child had to be tube-fed for many meals. Additionally, she engaged in self-mutilation behaviors and tichotillomaina. Behaviors included head-banging, eye-poking, biting, and scratching her body. Furthermore, abnormal behaviors were exhibited around feeding that included, but were not limited to, grabbing or stealing food, force-feeding other patients, hair-pulling or bed wetting after feeding, regurgitations, and vomiting during and after meals. It is indicated that at the age of 16 year-old the child's weight had decreased significantly that she had to be put on bed rest. After several months she gained a significant amount of weight and as such, she was placed on a diet. As a result the child developed eating behaviors more typically

noted in the diagnosis of BN. Several months later the patient began refusing food resulting in a subsequent reduction in her weight. Furthermore, at the time the article was written the child had not yet had a menstrual cycle nor developed secondary sexual characteristics. The author notes that due to being mentally retarded, psychological symptoms (i.e., disordered body image, intense fear of gaining weight) of AN were un-identifiable.

Fisman et al. (1996) indicated the dual diagnosis of AN in a high functioning autistic 13-year-old, Caucasian female. Specifically, symptoms of AN included: obsessions with weight and physical appearance, resulting weight loss as she ate less (no longer ate breakfast or lunch), excessive exercise, a belief that she was fat and unattractive, unsuccessful attempts at self-induced vomiting, and use of deceptive techniques to convince her parents she had eaten (i.e., leaving empty wrappers out in the open). Additionally, the present child struggles with several physiological ailments that included stomach cramps, constipation, lethargy, dry skin, dry mouth, intolerance to cold, hair loss, and prolonged amenorrhea (patient reported two months duration although parents believed this to be misrepresented by the child). Prior to the development of AN symptoms, this child had been diagnosed with autism at the age of four years old. As an infant it was reported that the child was not cuddly and made no eye contact. Additionally, she did not engage in social smiling and did not speak until she was five years old. Current symptoms of autism included her limited ability to think abstractly, lack of social peer relationships and social skills, despite the desire for such friendships. This patient also had several preoccupations with red hair, convertible cars, Ninja turtles, and violent movies. Obsessive-compulsive tendencies were also noted that included hand washing, repeated showing, repeated checking and closing of doors, and constant straightening of furniture. These compulsion behaviors led to significant sleep disturbance. Furthermore, the present child described her desire to stay thin in relation to a

fear of growing up and the belief that she may be "put away." At the age of 11 years old, hospitalization was recommended due to significant weight and sleep loss, and although initially resistant, the child's eating habits and preoccupations with weight remediated through the use of a structured behavioral approach. Social relationships improved with peers, although they were reported to still be awkward and one-sided.

In summary, several case studies exist implicating a dual diagnosis of AN and ASDs. However, several of these studies utilized the diagnostic criteria of the DSM-III and therefore, these patients may not have qualified for the diagnosis of an ASDs utilizing today's criteria. Additionally, it could be argued that in the present cases the patient's obsession or fixation revolved around weight and size and while meeting the diagnosis of AN, may not have experienced the psychological symptoms of an eating disorders as fear of gaining weight but as an obsession to not be fat.

Commonalities in Information Processing, Eating Behaviors, and Social Cognitive Styles

Several studies have suggested that AN and ASDs share common features. Specifically, Råstam (2008) indicates similarities regarding the resistance to change, insistence of sameness, obsessiveness, and social impairments (p. 36). Zucker et al. (2007), suggest the existence of a subgroup of AN patients to possess cognitive styles very similar to that of ASDs individuals, which includes difficulties in set shifting, along with a weak central coherence. Furthermore, these two clinical groups share similar obsessive and ritualistic personality styles, and disturbances in eating behavior. The present section reviews these commonalities along with disturbances in eating behavior within the ASDs population. Taken together, these commonalties across disorders serve as a platform for the present study.

Patterns of disturbed eating behaviors. While poor social interactions, deficits in communication, and lack of behavioral flexibility are considered cardinal signs of autism, eating disturbances are also indicated as occurring at a high rate (Råstam, 2008). Although eating disturbances may not lead to a clinically diagnosable eating disorder, evidence suggests that children with a feeding disorder in early childhood are more likely to develop an eating disorder, and more specifically, AN in adolescents (Jacobi e al., 2004; Råstam, 1992). And while exceptional, documented cases of co-morbid diagnoses of AN and ASDs exist (i.e., Fisman et al., 1996; Gillberg, Gillberg, Råstam, & Johansson, 1996) with comorbidity indicated as high as 12% in one sample (Gillberg et al., 1995). Still, others have stated that the high propensity of low body weight among a male population of patients diagnosed with ASDs is likely due to chance (Bölte, Özkara, & Poustka, 2002). In spite of the aforementioned study, relevant literature does point to the existence of disordered eating patterns within the ASDs population. It is important to note that most studies have indicated eating disorder behavior by way of one's BMI, rather than as a result of eating attitudes or beliefs that drive the restrictive behavior (Kalyva, 2009).

Kalyva (2009) reports that among a sample of 56 adolescent girls diagnosed with ASDs, a higher risk for developing eating problems was evident in comparison to matched controls. Specifically, significant differences were observed in bulimic behaviors and food preoccupations ($F[1,110] = 9.32$, $p < .01$), oral control ($F[1,110] = 3.84$, $p < .05$) and overall eating problems ($F[1,110] = 5.94$, $p < .05$) among patients with ASDs. Additionally, parental reports upheld these findings, while also indicating significance in dieting behaviors ($F[1,110] = 4.09$, $p < .05$). Interestingly, daughters ($M = 14.37$, $SD = 8.76$) significantly reported more eating problems ($t[55] = 6.85$, $p < .001$) than their mothers ($M = 11.81$, $SD = 7.66$). Furthermore, nearly 27% of females diagnosed with ASDs report eating attitudes within the clinical significant range as

measured on the EAT-26, which represented a significant difference between healthy controls ($\chi^2 = 7.67$, $p < .05$; Kalvya, 2009).

With the purpose to discuss the potential link between AN and ASDs, the Råstam (2008) review explores eating disturbances often exhibited within the ASDs population. These disturbances include odd reactions to food stimuli as it relates to taste and odors, and while distinct from a clinically diagnosable eating disorder such as AN, these sensitive and selective eating behaviors share commonalities to eating disorders. Specifically, the occurrence of food refusal, pica, rumination, vomiting, and selective eating within the ASDs population is discussed as these habits are most congruent and reflective of an AN diagnosis.

The repetitive regurgitations of recently ingested food, is called rumination, and has been described as occurring in adolescents and adults diagnosed with ASDs (Luiselli, Medeiros, Jasinowski, Smith, & Cameron, 1994). Williams, Darlymple, and Neal (2000) indicate many children with autism struggle to try new foods, which results in limiting their diet and demonstrating strong preferences for the same foods (Kerwin, Eicher, & Gelsinger, 2005). Additionally, pica, the eating of inedible non-food substances, has been reported to occur in adult cases of autism in which mental retardation was also co-occurring. For instance, Kinnell (1985) reports that in a sample of 70 adults diagnosed with MR and autism, three indicated chronic pica, along with thirty-three patients who demonstrated occasional symptoms of pica.

Selective eating is indicated as more predominate in males than females (Timimi, Douglas, & Tsiftsopoulou, 1997). Such behaviors include eating a restricted amount of foods, and in some cases, only eating foods of a certain color, texture, brand, or smell. Furthermore, the fear of eating new foods, a term called food neophobia, is evident within the ADSs population (Cooke, Carnell, & Wardle, 2006). In these cases, the selectiveness of food intake does not affect

weight per se, but is often seen as a result of ritualistic behavior. In addition to eating disturbances in autism, Råstam (2008) reviews the literature regarding Asperger's disorder. Significantly lower BMI (i.e., below the 10th percentile), in relation to abnormal eating, has been observed within this population (Hebebrand et al., 1997). Specifically, Bölte et al. (2002), explored BMI in a sample of 103 subjects diagnosed with autism or Asperger Disorder as an indicator of comoribitiy of AN and ASDs. Results indicated that 28% of the males have a BMI in the fifth percentile or below, but that none of the cases (males or females), met the full criteria for AN. Instead, significance in hyperactivity was found to influence BMI. In both autism and Asperger's disorder, abnormally large amounts of water, referred to as psychogenic polydipsi, is apparent in some cases (Terai, Munesue, & Hiratani, 1999; Raja, Azzoni, & Giammarco,1998). Råstam (2008) indicates several underlying mechanisms that may be at play in explaining these eating disturbances in ASDs. Specifically, these researchers point to sensory abnormalities (i.e., hyper or hypersensitivity to auditory, visual, tactile stimuli and to taste/smell), restricted interests of particular foods, strict routines regarding food preparation, poor motor functioning required in the feeding process, avoidance of social interactions during meals, and gastrointestinal problems.

Martins, Young, and Robson (2008) examined eating behaviors in children diagnosed with ASDs (n = 58), their normally developing sibling (if applicable; n = 31) and their mothers (n = 164). Additionally, 106 typically developing children were recruited and were matched with those children diagnosed with ASDs based adaptive behavior skills, including, communication, socialization, and daily living skills (as based on the Vineland Adaptive Behavior Scale). Gender and age differences were minimized when possible, and children originating from the same family, remained matched. Results indicated that the feeding skills of those with ASDs were poorer (F[1,40] = 6.36; p < .05); food avoidance behaviors were significantly higher (F[1,40] =

21.87; $p < .01$); and the demonstration of neophobic eating behaviors were increased ($F[1,40] = 30.41$; $p < .01$) in comparison to both the normal developing children and siblings of children with ASDs. The indication of ritualistic feeding behaviors did not significantly differ between groups. However, mothers of children with ASDs were significantly less in control of the child's eating ($F[1,40] = 16.88$; $p < .01$), whereas mothers were significantly more in control of normally developing children ($F[1,40] = 4.60$; $p < .05$).

Contrary to the aforementioned studies, Johnson, Handen, Mayer-Costa, and Sacco (2008) compared a sample of children diagnosed with autism ($n = 19$; $M_{age} = 39.20$ months; $SD = 8.98$) to healthy controls ($n = 15$; $M_{age} = 36.4$ months; $SD = 9.46$) between the ages of two to four years. Results indicated little difference between each groups' food or nutritional intake (i.e., calories, vitamins, minerals, fiber, water), although some significant differences in eating behaviors were demonstrated that included throwing up food and a higher rates of food refusal based on texture, color, and type when children diagnosed with ASDs were compared to healthy controls.

Information processing. Patterns of rigidity, an instance on sameness, and a focus on detail, are all styles of information processing that overlap between individuals with AN and ASDs. Evidence for the existence of these predisposing factors within a significant proportion of AN patients called for the development of a novel treatment intervention, and cognitive remediation therapy, in order to target the neuropsychological deficits and associated information processing styles observed within the AN population (Wood, Al-Khairulla, & Lack, 2011). Based on the schizophrenia cognitive remediation model designed by Delahunty and Morice (1993), the present intervention involved a ten session in which AN patients were asked to perform several cognitive tasks that included the creation of geometric figures in which the

patient was asked to draw and describe complex geometric shapes, illustrations to help patients view several illustrations within one picture, Stroop material to assist in the attendance of different aspects of one stimulus (i.e., color or word), manipulations of letters and words, infinity signs in which the patient had to draw figures based on various rules, line bisection in which the patient was encouraged to make different estimations in lengths of lines, token towers to include sorting tasks, and hand tasks in which the patient has to switch between different sequences of hand movements (Tchanturia, Davies, & Campbell, 2007). While evidence is only preliminary, large improvements in cognitive flexibility were observed. The following sections present a review on each of the neurocognitive deficits viewed as similar between the AN and ASDs populations.

Cognitive rigidity. In their theoretical review, Zucker at el. (2007) indicated that cognitive rigidity negatively impacted interpersonal functioning and relationships in AN, however; it is noted that a direct link remains unclear and understudied. Regardless, when examining interpersonal relationships, it is important to consider the role of cognitive rigidity. Noteworthy, empirical research has indicated both individuals diagnosed with AN and ASDs to demonstrate difficulties in behavioral and cognitive flexibility (Zucker et al., 2007). This lack of cognitive flexibility is often at the core of AN and ASDs. Specifically, individuals with AN frequently demonstrate comorbidities with OCPD and OCD, of which are disorders defined by rigidity (Halmi et al., 2005). Additionally, the diagnostic criteria for ASDs indicate the presence of repetitive behavior that include a preoccupation with objects or parts of objects, patterns of interest that are unusual in their narrowness or intensity of pursuit, and/or extreme rigidity or insistence on sameness (APA, 2000). Of particular interest, is the instance of sameness, described in the DSM-IV as the "apparent inflexible adherence to specific, nonfunctional

routines or rituals" and is often demonstrated within the ASDs population (APA, 2000; p. 71). As such, everyday routines are affected, as individuals with ASDs may insist on eating a restricted diet of the same foods (Ahearn, Castine, Nault & Green, 2001) and resist changes in environmental factors (Greaves, Prince, Evans, & Charman, 2006). Additionally, parents of children with ASDs often go to extreme measures to accommodate their child's needs and resistant against a change in routine (i.e., wearing the same clothes, eating the same foods).

The Empathising-Systemising Hypothesis seeks to explain restrictive and repetitive behaviors evident in the diagnosis of ASDs (Hill, 2004). The need for sameness and inability to demonstrate flexibility in thinking patterns (i.e., set-shifting) is thought to explain the rigidity and preservative behavior evident in ASDs. It is believed that these difficulties reflect an underlying executive dysfunction, which has also been linked to prefrontal cortex dysfunction as evidenced on functional imaging studies (Gilbert, Bird, Brindley, Frith, & Burgess, 2008; Shafritz, Dichter, Baranek, Belger, 2008).

Similar difficulties have also been evidenced within the AN population, as rigidity is often exhibited in the fashion of preference for particular order and symmetry. In a study comparing patients diagnosed with OCD versus patients with a comorbid diagnosis of OCD and AN, those in the AN-OCD group indicated a stronger need for symmetry and orderliness relative to the OCD only group (Matsunaga et al., 1999). Additionally, repeated studies have demonstrated that patients with AN shy away from novelty seeking (Karwautz, Troop, Rabe-Hesketh, Collier, & Treasure, 2003). Therefore, individuals with AN have a tendency to resist trying new things and work to avoid harm, such that they seek out known experiences in order to feel safe and comfortable in their routine. Furthermore, symptoms of OCPD are highly prevalent in patients with AN, such that they may appear in childhood (Anderluh et al., 2003), and at times

persevere after recovery (Tchanturia et al., 2004). Symptoms of OCPD included excessive rigidity and perfectionism, need for order and control, and a preoccupation with details (APA, 2000).

Poor set shifting. The ability to set-shift is necessary in order to adapt behaviors to those of the environment and tends to be a difficult process for patients with AN and ASDs (Holliday, Tchanturia, Landau, Collier, & Treasure, 2005; Yerys et al., 2009). Both populations have demonstrated a tendency to be concrete and rigid in their thinking and therefore, demonstrate an inability to change past patterns of thinking (e.g., display of preservative and stereotyped behaviors).

In their review, Roberts, Tchanturia, Stahl, Southgate, and Treasure (2007) examine 15 selected studies to broadly explore set-shifting abilities in eating disorders and indicated consistent deficits across all types, durations, and state of illness. Within the AN population, it is hypothesized that poor set-shifting abilities act as a pre-existing vulnerability that may play a role in etiology as theses abilities appear persistent, despite otherwise normal cognitive functioning (Steinglass, Walsh, & Stern, 2006). Tchanturia et al. (2004) worked to determine if poor set-shifting abilities occurred as a result of starvation, or as a preceding effect due to the development of an eating disorder by comparing samples of patients diagnosed with AN prior to treatment, patients in long term recovery from AN, and healthy controls. Results indicated improvements in set-shifting abilities after treatment, although difficulties were still evident. Thus, some aspects of set-shifting appears to be related to both state and trait characteristics. McAnarney et al. (2011) examined set-shifting abilities in 24 adolescents diagnosed with AN restrictive subtype (ANr). Results indicate significant differences in set-shifting abilities between groups ($F[1, 25.5] = 4.04$, $p = .006$).

A neurobiological model of AN has been posed by Steinglass and Walsh (2006), who theorize that the repetitive, stereotyped behaviors in AN, are a result of deficits in implicit learning and set shifting capacity, and maladaptively assists patients to manage anxiety around gaining weight. Attempts to find a biomarker in set-shifting abilities, Nakazato et al. (2010) indicated significantly higher levels of serum glutamine concentrate in women diagnosed with AN, than in healthy controls ($ES = 0.87$). Furthermore, an association between severity of illness and elevated concentrations of serum glutamine were noted. It is hypothesized that elevations of serum glutamine are a byproduct of starvation and the breakdown of muscle and gluconeogenesis. The results of this study however, did not indicate a connection between set-shifting abilities and serum glutamine levels. Nonetheless, Holliday et al. (2005) indicate evidence towards impaired set-shifting ability as an endophenotype of AN, as pairs of sisters discordant for AN and healthy unrelated controls were compared on their set-shifting abilities. Results indicated that affected (with AN) and unaffected sisters demonstrated difficulty on set-shifting tasks than unrelated healthy controls.

Within the ASDs population, less empirical evidence is available. However, diagnostic criteria including restricted repetitive and stereotyped patterns of behavior, interests, and activities that often result in a preoccupation with one or more stereotypes or restricted interests, inflexible adherence to specific nonfunctional routines or rituals, stereotypes and repetitive motor mannerisms, and preoccupation with parts of objects. In part, this symptomology relevant to ASDs may be indicative of impaired set shifting and therefore, reflects an increase in preservative and reduced novelty processing. Yerys et al. (2009) report on a study; a cohort of high functioning children (ages 6-13 years old) with ASDs, in comparison to a matched control sample. The Intradimensional/ Extradimensional (ID/ED) Shift Test from the Cambridge

Neuropsychological Test Automated Battery was utilized. Results indicated no difference in the amount of shifts made, although the ASDs population demonstrated significantly more errors than the control sample when completing reversal shifts. A positive correlation was found between the number of errors made on reversal shifts and the number of repetitive behavioral symptoms. Maes, Eling, Wezenberg, Vissers, and Kan (2010) examined set-shifting abilities in an adult sample (M = 38.4; SD = 14.8) diagnosed with ASDs. Results indicated impairments in set shifting, compared to healthy controls.

Central Coherence. The term central coherence refers to the superior preference for detail at the expense of global configuration. O'Riordan and Plaisted (2001) indicated that a weak central coherence is constructed by two independent dimensions involving both a deficit in global integration and also a superior focus on detail. First indicated by Frith (1989) within the ASDs population, it is suggested that a weak central coherence may in part explain the obsessive preoccupations evident in individuals with autism. Those who demonstrate a weak central coherence struggle to be able to see the bigger more global picture, and instead focus more intently at a detail level to process information. Lawson, Baron-Cohen, & Wheelwright (2004) suggest that this deficit relates to the inability to understand and view the overall meaning of a situation. As a result, an overreliance and focus on detail may drive these individuals to think more systematically.

Empirical evidence has indicated similar processing styles within the AN population. Lopez et al. (2008) examined 42 AN patients (M_{age} = 28.4; SD = 9.6) and 42 healthy controls (M_{age} = 26.3; SD = 6.4) matched on age, IQ, and sex, on measures of central coherence. Both samples completed measures of visuospatial and verbal aspects of central coherence. Results indicated that in comparison to the healthy controls, patients diagnosed with AN, demonstrated

strengths in local and detailed processing, and weaknesses in global processing. Similar results were mirrored by Southgate, Tchanturia, and Treasure (2008) utilizing different measures and finding that patients with AN, displayed a bias toward processing information at a level of detail rather than viewing the gestalt. Additionally, Lopez, Tchanturia, Stahl, and Treasure (2009) investigated central coherence in a group of recovered ED patients, including those diagnosed with AN and BN. Results from a battery of neuropsychological tests, indicated weak coherence even after recovery. Lopez et al. (2009) indicate these results to be indicative of a weak coherence to stable conditions, verse state and therefore, may be an endophenotype for ED.

Deficit of social functioning. Social isolation of patients within both AN and ASDs populations is prevalent. Within the AN population, this is evident in the fact that AN patients are at a significantly greater risk to commit suicide (Keel et al., 2003). Specifically, AN patients are at a 57-fold greater risk of death from suicide relative to age-matched peers indicating the social isolation and loneliness AN patient experience. Additionally, the cognitive-interpersonal maintenance model poses that AN behaviors, specifically the restricting subtype, is maintained by both intrapersonal and interpersonal factors, rather than maintained by concerns regarding weight or shape (Schmidt & Treasure, 2006).

Similarly, social impairments are a cardinal sign for the diagnosis of ASDs. Specific impairments may include a lack of nonverbal behaviors (i.e., eye-to-eye gaze, facial expression, body postures, and gestures to regulate social interaction), development of peer relationship, initiation of spontaneous seeking to share interests, and social or emotional reciprocity (APA, 2000). Additionally, Simonoff et al. (2008) report on the comorbidity of 255 children diagnosed with Pervasive Developmental Disorders. Results indicated that 41.9% of children also were diagnosed with an anxiety or phobic disorder, and of this percentage, 29.2% had a comorbid

diagnosis of social anxiety. Therefore, social functioning among the ASDs population was almost always impaired.

Premorbid Difficulties in Social Functioning. Several studies have indicated the presence of social difficulties prior to the onset of disturbed eating in AN (Bulik, Sullican, Fear, & Joyce, 1997; Kaye et al., 2004; Silberg & Bulik, 2005) and suggests anxiety as a significant pathway to the development of AN. Utilizing a large sample from the Price Foundation Collaborative Genetics Study, Kaye et al. (2004) explored the comorbidity of anxiety disorders in eating disorder patients. A subsection of the sample included AN patients (n = 97) in which the prevalence of anxiety was examined. Within this sample, a statistically significant portion of patients were diagnosed with at least one anxiety disorder (55%). Although several types of anxiety disorders (i.e., generalized anxiety disorder, specific phobias, agoraphobia, post-traumatic stress disorder) were evaluated, of interest was of the 22% of patients diagnosed with social anxiety disorder. Additionally, 74% of the entire sample of eating disorder patients (both AN and BN) indicated a diagnoses of social anxiety that preceded the development of their eating disorders. This is in comparison to only 26% of the same sample, indicating the development of their eating disorder prior to or at the same time as the development of social anxiety. Utilizing a longitudinal twin study design, Silberg and Bulik (2005) investigated the covariance of genetic and environmental risk factors between anxiety and eating disorders. Most relevant to the present study was the link between separation anxiety and eating disorder. Kaye et al. (2004) conducted a study to evaluate the comorbidity of anxiety disorders in both anorexia and bulimia nervosa. Narrowing in on the AN sample 97 (M = 26.64; SD = 9.71) individuals with AN were recruited. Of that sample, 55% were noted as having been diagnosed with at least one anxiety disorder, with 22% indicating a social phobia and another 13% indicating a

generalized anxiety disorder. Zucker et al. (2007) conclude that "the course of social anxiety suggests that it predates the eating disturbance" (p. 979).

Within the ASDs population, Melfsen et al. (2006) conducted a study to investigate the extent of social anxiety within a broad range of disorders. The sample included 341 school-aged children and adolescents (M = 12.72 years old; SD = 2.72) recruited from both an outpatient and inpatient hospital. Noteworthy, were the patients indicated to experience an increase in social anxiety within the ASDs sample (M = 20.77; SD = 13.77) in comparison to the health controls (M = 12.51; SD = 7.87), although differences were not statistically significant. Zucker et al. (2007) state that "these results paint a picture of rigid, socially introverted individuals who strive for order and sameness and have difficulty apprehending interpersonal interactions" (p. 983).

Attachment. Insight on the role of attachment presents a different view on how early distributions in significant relationships may precipitate interpersonal deficits in AN. Rooted in the work of Bowlby (1973), attachment theory bases its explanation of interpersonal learning on the reliability and accessibility of caregivers to the needs of their young children. Therefore, how adults respond to themselves and to others is seen as a function of how their caregivers responded to them when they were young. If children's needs are met in a relatively consistent manner, these individuals will grow to develop secure attachments, and positive working models with themselves and with others. If children's needs are not met, these individuals may develop insecure attachments and therefore, negative working models of themselves as unworthy, or others as unreliable. Due to these developmental schemas, individuals may experience conflict in expressing certain behaviors in fear of the consequences of expressing that behavior (Horowitz, Rosenberg, Bartholomew, 1993).

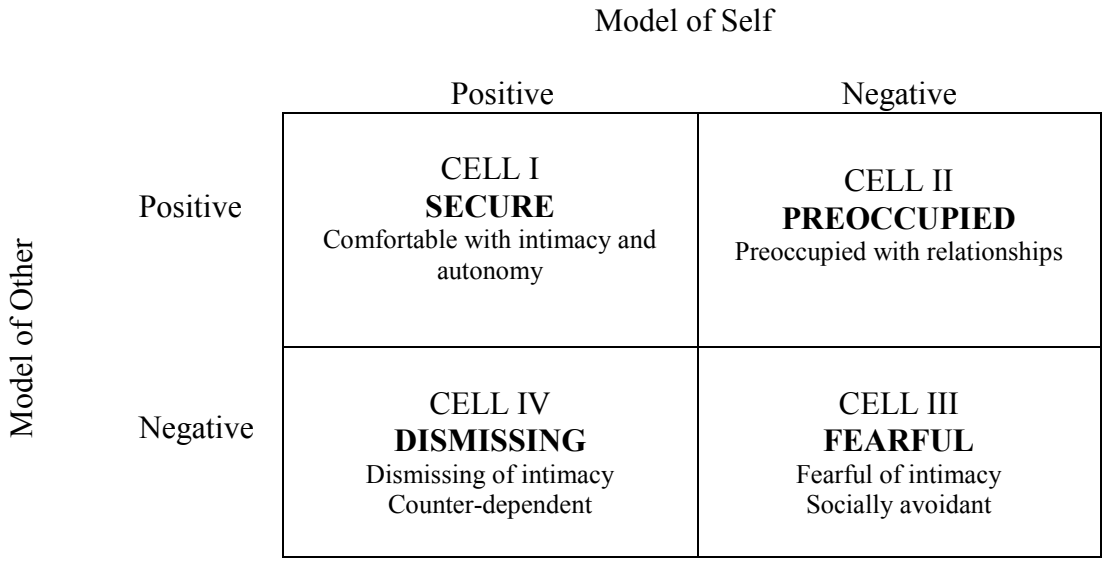


Figure 1. Four Theoretical Attachment Styles

More recent work conducted by researchers Troisi, Massaroni, and Cuzzolaro (2005) examined early separation anxiety and attachment disturbances indicating a higher prevalence in adult women with AN. More specifically, anxious, insecure attachment styles are consistent in the literature among patients diagnosed with an ED, and dismissive attachment styles are often evident in both patients with AN and their parents (Ward, Ramsay, & Treasure, 2000; Ward et al., 2001). Dalgleish, Tchanturia, Serpell, Hems, de Silva, and Treasure (2001) indicate that poor recall of attachment-related memories may play a role in characterizing dismissive attachment within the AN population. And while growing attention in the literature has indicated disruptions in attachment in AN Zucker et al. (2007) indicate that such research does not implicate the presence of maternal or paternal neglect, suggesting that "attachment disturbance provides an index of disruption in early parent-child communication, and for our purposes, provided evidence for early disturbances in social interactions only" (p. 980).

Perspective taking. Stemming from the early work on Theory of Mind (ToM), Baron-Cohen (2002) draw upon neurocognitive strengths (systemizing) and weaknesses (empathizing) observed in individuals diagnosed with ASDs. The ability to infer what others are thinking

(ToM) and understand others emotions (eToM), play a critical role in the ability to express empathy for others. Individuals with ASDs have consistently demonstrated impairments in emotional recognition (Harrison, Sullivan, Tchanturia, & Treasure, 2009; Oldershaw et al., 2011). To date, empirical evidence does not support the present model in patients with AN (Hambrook et al., 2008). Through self-report, patients with AN did not indicate a preference or tendency towards systemizing relative to healthy controls. Also noteworthy is that AN patients did not indicate a preference towards empathizing (Hambrook et al., 2008). In their review, Oldershaw et al. (2011) point out that these results may be a reflection of the limitations of the study. That is, procedures utilized to measure systemizing and empathizing within the ASDs population may not be valid or reliable within the AN population, particularly due to the gender bias inherent within each diagnostic category. Specifically, it is indicated that items on the measure used in the Hambrook et al. (2008) emphasize interests more relevant to males (i.e., collecting stamps, trainings) and therefore, the utilization of a scale more relevant to females may yield different results.

At least one study has explored ToM in AN. Tchanturia et al. (2004) observed poor performance on ToM tasks to be higher in AN patients than in matched healthy controls. In a follow-up study, Hambrook et al. (2008) examined self-reports of empathy, systemizing, and autistic traits among AN patients. A term related to ToM is "responsively", defined as the ability of individuals to sense and respond to other verbal and nonverbal cues (Dix, 1991). Responsively has been linked to ToM, as mothers who are able to model perspective taking and share their own mental state with their children have been shown to have children with superior ToM skills (Ruffman, Perner, & Parkin, 1999). Zucker et al. (2007) suggest that the role of responsively in

feeding behavior could provide insight into a mothers' ability to sense and respond to her child's signals of hunger and satiety.

The Role of Empathy

Empathy has been recognized as the ability to understand what others are thinking and feeling (Batson, 2009). This term was first coined by Tichener (1909) from the German word Einfühlung, to mean projecting oneself onto another's situation. Since then researchers, philosophers, cognitive scientist, neurophysiologists, and developmental psychologists have all studied empathy, and each developed their own conceptualization. As such, no unified construct of empathy exists. Batson (2009) identifies eight distinct concepts of empathy that include: (a) cognitive empathy, knowing or understanding another person's internal state (Eslinger, 1998; Preston & de Waal, 2002); (b) imitation/motor mimicry, the adoption of posture or expression of an observer (Dimberg et al., 2000; Gorden, 1995; Lipps, 1903; Tichener, 1909); (c) emotional contagion/affective empathy, feeling what another person is feeling (Hatfield, Cacioppo, & Rapson, 1994; Zahn-Waxler, Robinson, Emde, 1992); (d) intuiting, projecting oneself into another's situation, which has more recently been termed ToM (Lipps, 1903; Titchener, 1909); (e) psychological empathy/perspective taking, imagining how another person is thinking or feeling (Ruby & Decety, 2004; Wispe, 1968); (f) imagine-self perspective, "changing places in fancy" or role talking of another person's position, which is similar to intuiting oneself another another's situation; (g) empathetic distress/personal distress, feeling distress by the emotional state of another, concerned an immature form of empathy (Batson, 1991; Hoffman, 1981); and (h) empathetic concern, refers to congruence (i.e., the valance of the emotion but not identical nature of the feeling expressed) in response to other-oriented emotions (i.e., the emotions felt are felt for the other person; Batson, 1991). Due to the complex nature of empathy, along with the

similar but divergent term sympathy, it is difficult to differentiate a clean construct. To help clarify specific tenants of empathy, several theoretical models are presented.

As a construct, empathy has been operationally defined in a variety of ways, each conceptualized through different theoretical models. Some researchers focus on the cognitive aspects of knowing another person's internal state (Preston & de Waal, 2002), while others emphasize the changes of postural and facial expression to match that of another person (Dimberg, Thunberg, & Elmebed, 2000). One model, proposed by Preston and de Waal (2002), focuses on the perception-action of empathy, such that the observer's neural circuitry matches that of the individual expressing emotions.

Empathy in AN. Previous studies have examined the role of empathy in AN (Gillberg et al., 1996; Råstam, Gillberg, Wentz, 2003; Wentz et al., 2005). However, these studies are limited by their narrowly defined population, (i.e., an urban Swedish community), and examination of a variety of symptomology (i.e., Obsessive Compulsive Disorder, Obsessive-Compulsive Personality Disorder). Regardless, results from these studies have indicated that patients with AN typically display similar characteristics of empathy to that of patients with ASDs (Gillberg et al., 1996).

Although little empirical research has been conducted to replicate the findings of Gillberg and colleagues, in a pilot study Hambrook et al. (2008) examined autistic traits in anorexia nervosa in addition to empathy and systemizing. Patients included 22 women (M = 26.73, SD = 4.77) who met DSM-IV criteria for AN, with a comparison group of 45 health controls (M = 32.51, SD = 9.63). In 2000, Guttman and Laporte also examined empathy in a cohort of patients diagnosed with ANr. Measures were administered to both the patient along with both parents. Results indicated normal levels of expressed empathy among both the AN patients and their

parents. In a follow up study, Guttman and Laporte (2002) again examined a cohort of AN patients in levels of empathy, but also examined alexithymia. It was indicated that AN patients are more alexithymic than their parents, and an inverse relationship exists between the capacity for empathy and alexithymia.

Empathy in ASD. Lawson et al (2004) found individuals with ASDs to be logical systemizers that demonstrate impaired empathetic understanding. From a neurological perspective, functional magnetic resonance imaging (fMRI) studies have been conducted implementing underling dysfunction in brain networks and are regarded as underpinnings for empathetic behavior in ASDs (Schulte-Rüther et al., 2011). In a review article, Smith (2009) implicates the empathy imbalance hypothesis (EIH) in ASDs, indicating that according to this hypothesis, individuals with ASDs demonstrate a deficit in cognitive empathy (CE), but a heightened capacity for basic emotional empathy (EE). Smith (2009) therefore indicated that individuals with ASDs, according to this theory, have what is termed, EE-dominated empathic imbalance, or a deficit in CE and a surplus of EE.

The Mirror Neuron System

The recent discovery of the Mirror Neuron System (MNS) has been considered one of the most important discoveries in cognitive neuroscience (Yuan & Hoff, 2008). However, the MNS has also raised debate among researchers regarding the function of this area of the brain (Gallese, Fadiga, Foggassi, Rizzolatti, 1996; Rizzolatti, Fadiga, Gallese, & Fogassi, 1996). First identified in macaque, the MNS exists in the ventral premotor cortex (labeled area F5; Gallese & Goldman, 1998). Area F5 contains neurons that code for the specific motor behavior of the action of the hand (i.e., grasping, holding, tearing, bring objects to the mouth; Iacoboni, 2008). What makes the MNS unique, is that researchers observed:

> …mirror neurons fire both while a monkey performs goal-directed actions and while it observes the same actions performed by others. This observation-execution matching system is thought to provide a neural mechanism by which others' actions and intentions can be automatically understood (Dapretto, et al, 2005, p. 28).

Therefore, the ability of the MNS to fire both during action execution, and action observation, is what makes this identified area of the brain unique (Leslie, Johnson-Frey, & Grafton, 2003). Prior to the discovery of the MNS, researchers believed perception (i.e., observation) and motor (i.e., execution) neurons to function separately (Iacoboni, 2008). It was not until the discovery of the MNS that the interconnectedness of motor and perception neurons was acknowledged.

A breadth of research exists to suggest the existence of MNS in humans in a similar area of the brain (i.e., the pars opercularis in the inferior frontal gyrus and the rostral part of the posterior parietal cortex; Iacoboni et al., 1999) to that of F5, as identified in macaques. However, the same invasive methodological procedures utilized to study single-cell activity in the brains of macaques (i.e., implantation of electrons in the brain) are not feasible with humans (Iacoboni, 2009). Therefore, neurological research is conducted with humans at a system-level through the study of behavioral observations of neurological patients (i.e., lesion studies), brain imaging (i.e., fMRI), and transcranial magnetic stimulation (TMS). Although differences exist regarding the observation of the MNS in humans and macaques, a correlation between methodologies exists. Nonetheless, in humans, other brain regions besides the pars opercularis in the inferior frontal gyrus have also been labeled as having an active role in the MNS.

Specifically, Chong, Cunninghton, Williams, Kanwisher, and Matingler (2008) observed the activation of the right inferior parietal lobe independent of an action being executed or

observed, thus defining two separate, but interconnected properties of the MNS (i.e., motoric vs. perceptual). Additionally, Van der Gaag, Minderaa, and Keysers (2007) explored the MNS in terms of facial expression. Results identified the inferior frontal gyrus and posterior parietal cortex to be responsible for the motorical aspects of facial expressions, whereas the amygdala and the insula are responsible for the emotional states associated with facial expressions. In humans, the rostral part of the posterior parietal cortex, in addition to the posterior part of the inferior frontal gyrus, has been observed on fMRI as an area of the brain consisting of mirror neurons (Iacoboni et al., 1999). Despite the acknowledgement of the existence of the MNS in humans, debate exists about the role the MNS takes in humans (Dapretto et al., 2005; Rizzolatti et al, 1996). Activation of mirror neurons has been observed during imitations, actions observations, and intention understanding (Iacoboni et al., 1999). Additionally, the MNS has been suggested to play a critical role in a human being's ability to experience empathy (Gallese, 2003).

The Mirror Neuron System and its Role in Empathy. Due to the nature of the MNS, researchers have come to understand its role in imitation and mimicry. Iacoboni (2009) notes that neuroscience investigations support the notion that imitation and mimicry facilitate empathy. Because imitation occurs pervasively and automatically, it allows for the facilitation of social interactions, which in turn allows people to grow closer to one another (Iacoboni, 2009). As such, imitations allow foe recognition of emotions in others. It is through the recognition of emotions that moves individuals to greater empathy. The preceding theoretical proposition has been since supported in a series of experiments (i.e., Chartrand & Bargh, 1999).

Three areas of the human brain make up the "core circuit" for imitation (Iacoboni & Dapretto, 2006; see Figure 2 below). These areas consist of an anterior area in the inferior frontal

cortex (i.e., ventral premotor cortex [PMC], and the posterior inferior frontal gyrus [IFG]), a posterior area in the rostral part of the inferior parietal lobule (IPL), and the posterior sector of the superior temporal sulcus (STS). The MNS model is based on the basic understanding of the central nervous system's (CNS) motor circuitry. When a motor signal from the CNS is sent to the periphery, an efference copy is made and utilized in the creation of an internal model that predicts sensory feedback and estimates consequences of a motor command. In imitation and empathy, these brain regions function as a circuit. First, visual input comes through the posterior STS to the MNS (arrow number 1), the information then flows from the rostral IPL, where the information is coded motorically. Next, input flows to the ventral PMC, where the information is most likely concerned with the goal (or meaning) of the action (arrow number 2). The information is then sent back through these brain regions as an efference copy of motor imitative commands. This allows for a matching of sensory predictions of imitative motor plans and the visual description of the observed action (Iacobini & Dapretto, 2006).

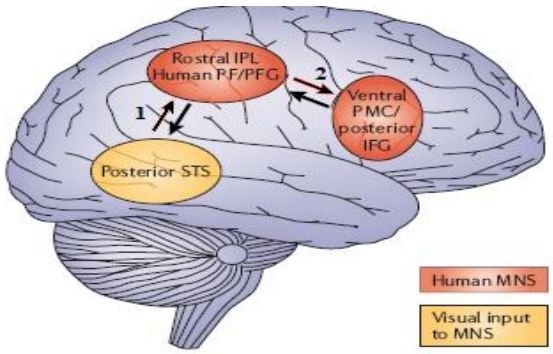


Figure 2. Neural Circuitry for Imitation[a]
[a]Adapted from Iacoboni & Dapretto, 2006

Despite the acknowledgement of the "core circuit" for imitation, additional investigation of the MNS in regards to its function in imitation has lead researchers to identify two different types of mirror neurons within the MNS. Approximately one-third of mirror neurons fire for the same exact executed action or observed action. The other two-thirds of the MNS actually fire for

the execution or observation of a similar goal-related action, but not the same identical action (Iacoboni, 2009). This evidence suggests flexibility in the firing of the MNS pertaining to the actions of the self and others. "This flexibility is an important property for successful social interactions because even though imitation is a pervasive phenomenon in humans, people do not imitate each other all the time but rather often perform coordinated, cooperative, complementary actions" (Iacoboni, 2009, p. 660).

Researcher and philosopher Vittorio Gallese has pioneered research to investigate the role of the MNS in the expression of empathy (Iacononi, 2008). Since then, much empirical evidence has illustrated a strong link between the MNS and empathy. Empathy plays a fundamental social role that allows for the sharing of experiences, needs, and goals across individuals (Carr, Iacoboni, Dubeau, Mazziotta, & Lenzi, 2002) and occurs from experiencing the similar actions of others (Gallese, 2003). For example, those who are highly empathetic may find themselves crying when they observe the pain of another. Thus, empathy allows individuals to feel for one another, and enables us to make a meaningful link between ourselves and others (Gallase, 2003).

Specifically, Gallese (2002) theorized that mirror neurons may constitute a neural mechanism enabling implicit action understanding. By simply observing an action, the same motor neurons are activated as if an individual were executing the same action (i.e., embodied stimulation). According to Gallasse (2002), it is this implicit, automatic, and unconscious process of embodied stimulation that enables the observer to use his/her own resources to penetrate the world of the other without the need of explicitly theorizing about it. These abilities give rise to a "common intersubjective space" allowing for an understanding one another's behaviors, affects, and emotions (Gallese, 2002, p.175). Empirical evidence exists to support Gallese's theoretical conceptualization of the MNS role in empathy. Through fMRI methodology, Kaplan and

Iacoboni (2006) observed significant correlation between the activation of the right inferior frontal mirror neuron areas and scores on a measure of emotional empathy in humans.

Research suggests that mirror neurons also code for facial actions, particularly with the mouth (Iacoboni, 2009). Through the use of fMRI methodology, Schulte-Rüther, Markowitsch, Fink, and Piefke (2007) found that empathy-related processing of emotional facial expressions involved brain areas implicated in both MNS and ToM mechanisms. Furthermore, evidence exists to suggest a connection between the MNS and the limbic system (i.e., emotions; Carr et al., 2002). This connection between systems allows humans to empathize with the experiences of others through the observation of emotions that are associated with a particular movement (i.e., facial expression).

Dysfunction of the Mirror Neuron System. Further evidence for mirror neuron activation leading to empathic interactions rests in the psychopathological implications evident when a deficit in mirror neurons is observed (Dapretto et al., 2005; Iacoboni & Dapretto, 2006). Autism research indicates that individuals with ASDs lack interpersonal skills with a specific deficit in their ability to express empathy (Iacoboni, 2008). Recent research indicates that at the core of ASDs may be a dysfunction in the MNS. Williams, Whiten, Suddendorf, and Perret (2001) hypothesized a connection between autism and the MNS due to the inability of children with autism to imitate another person's perspective. It was theorized that due to a lack of mirror neurons, autistic children would in turn exhibit a deficit in the ToM, the ability to translate behavior from another individual's perspective. These hypotheses were later tested by Dapretto et al. (2005) who employed fMRI methodology in children with ASDs. Specifically, results indicated no neural activity among the MNS in the pars opercularis (Dapretto et al., 2005). Also, Hadjikhani, Josephy, Snyde, and Tager-Flusber (2005) observed decreases in gray matter in the

areas belonging to the MNS in participants with ASDs. Iacoboni (2008) argues that the beneficial effects of imitation-based treatments for ASDs further implicate MNS involvement in these deficits.

In contrast, it is hypothesized that patients with AN are often overly attuned to others feelings, or enmeshed, to such an extent that it may be detrimental to their psychological well-being and capacity for self-care (Cook-Cottone, 2009). In this case, the dysfunction of the MNS in adolescents with AN causes them to be excessively focused on the behaviors and actions of others around them, while demonstrating neglect of their own internal cues of hunger and self-nourishment. Specific AN behaviors, such as restriction, excessive exercise, and purging, may serve a compensatory role, allowing patients to dysfunctionally self-engage and regulate emotions. Through the Attuned Representation Model (see Figure 3), Cook-Cottone (2006) illustrates how an individual's Authentic Self represents the capacity for attunement with external systems within the context of personal self-care and regulation. Due to a highly sensitive empathetic system those at-risk for eating disorders may have exceptional difficulty negotiating the management of, and attention to their own internal needs and drives.

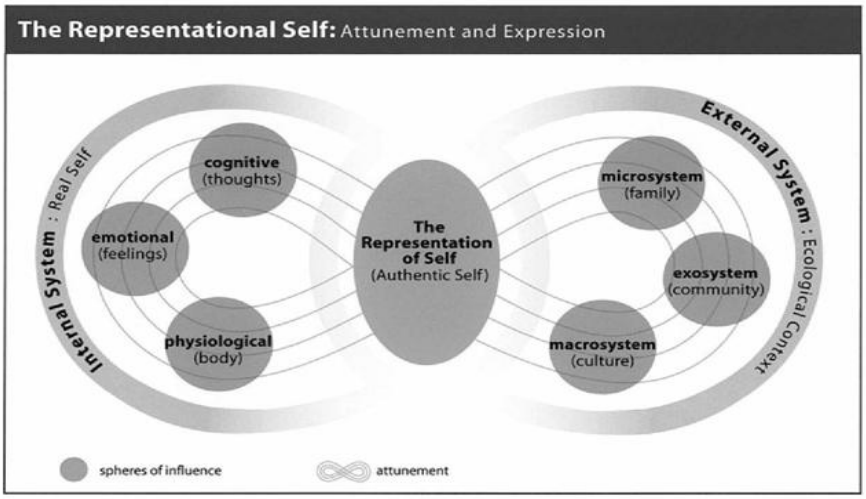


Figure 3. The Representational Attunement Model
Cook-Cottone (2006)

Although not conducted within a population of ANs, evidence for a dysfunctional MNS rests in a study that examined the effects of hunger on the MNS through the use of fMRI methodology (Cheng, Melzoff, & Decety, 2006). Results illustrated that when hungry, the MNS ignites a greater response. Implications from this study indicate how starving patients with AN may also exhibit similar indications of hyperactivity in the MNS. Furthermore, from a small sample size (n = 20) Sachdev, Mondraty, Wen, and Gulliford (2008) compared AN participants to healthy control women in regards to processing images of themselves verses images of others. Utilizing fMRI methodology, results indicated differences in brain activation between the two groups. When viewing images of themselves, AN patients lacked brain activation in compared to the control sample. Whereas in the control sample activation was noted in the precentral gyrus, superior parietal lobule, inferior occipital gyrus, and insula. However, AN patients indicated a reduced signal in the paracentral lobule, precuneus, superior temporal gyrus, cuneus, and the lingual gyrus. Implications are made by the authors suggesting that cognitive, perceptual, and emotional processing are suppressed in patient with AN. Apart from the two studies indicated above, researchers have yet to explore the specific neurological correlates of the MNS in AN. Illustrating the substantial dearth of literature in this area, Table 3 below illustrates prior research in the area of AN utilizing fMRI methodology.

Table 3. *fMRI studies conducted in Anorexia Nervosa*

Author/Year	Sample Size	AN	fMRI	Results
Sachdev et al., (2008)	10 Controls 10 AN	X	X	Participants viewed images of them self vs. non-self images. Differences between AN and controls were observed. Results indicated no differences between AN patients and controls when processing non-self-images. However, AN patients appear to lack activation relevant to the attentional system in the brain when viewing images of themselves.

Friederich et al., (2008)	15 Controls 13 AN	X	X	The current study examined cognitive flexibility in AN patients. In comparison to healthy controls, AN patients had a decreased activation of the bilateral thalamus, ventral anterior cingulate gyrus (ACC), ventral insula, dorsolateral prefrontal (DLPFC), premotor cortex, visual stream and cerebellum
Santel, Baving, Krauel, Munte & Rotte (2006)	10 Control 13 AN	X	X	Participants (AN and healthy controls) viewed both food and non-food stimuli for pleasantness in a hungry and a satiated state. When AN participants were satiated a decreased activation in left inferior parietal cortex was observed. When AN patients were hungry, they displayed weaker activation of the right visual occipital cortex than healthy controls.
Kingston, Szmukler Andrewes, Tress, & Desmond (1996)	41 Controls 46 AN (inpatients)	X	MRI	The current study measured tasks of attention, visuospatial, and memory. AN patients performed significantly worse than controls. No differences between groups were observed on tasks measuring flexibility and learning.
Muhlau et al., (2007)	AN: 22 (recovered) Controls: 37	X	MRI	A decrease in gray matter was evident in AN patients, which correlated with low body mass index. However, no decrease in white matter was observed in AN participants.
Wagner et al., (2008)	AN: 16 (recovered) Control: 16	X	X	Recovered AN illustrated significantly lower neural activation of the insula. However, no correlation existed between insular neural activity and pleasantness ratings for sucrose in recovered AN suggesting altered taste processing in AN.

Rational for Study

The present study seeks to expand the research of the social neuropsychological correlates associated with AN. A strong foundation has been built through both empirical literature and Zucker's et al. (2007) comprehensive review, implicating the need for such work. The present study seeks to replicate and expand on the Oldershaw et al. (2011) study that

measured empathy within an AN population. Therefore, this study will expand on previous literature, and provide additional empirical work in the area of social neuroscience of AN.

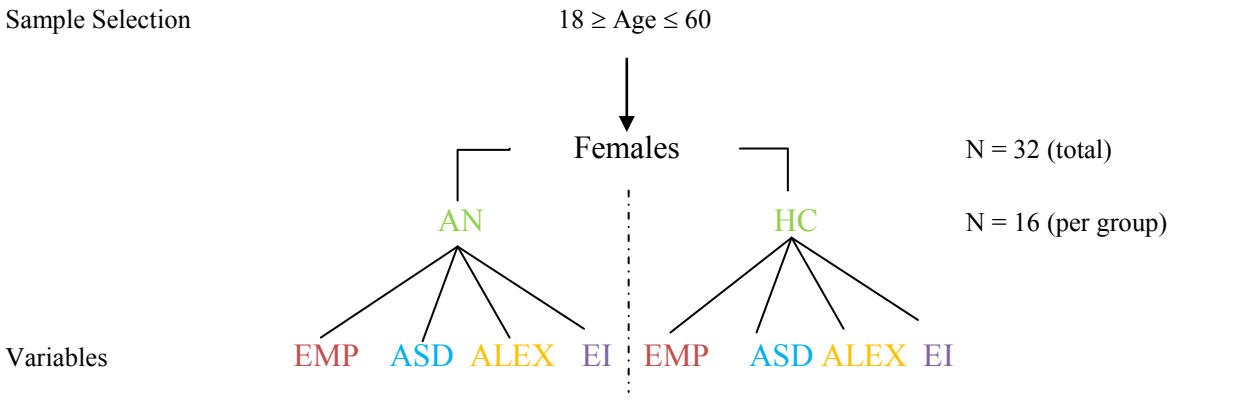
CHAPTER 3

METHODS

Research Design

The proposed research design includes a cross sectional study from a clinical population of AN patients and healthy controls in order to examine ASDs diagnostic criteria relevant to patients diagnosed with AN and individuals absent of a psychiatric diagnosis. Additionally, differences in expressed empathy, emotional contagion, eating disorder behavior, alexithymia, and emotional intelligence between both samples were examined. AN patients were recruited from outpatient or partial hospital settings along with community based eating disorder support groups across western and central New York. Independent samples t-tests were utilized to analyze significant differences between groups on measures of expressed empathy, emotional contagion, eating disorder behavior, alexithymia, and emotional intelligence. While a matched subjects design was not utilized, an attempt was made to balance demographic variables across samples.

Figure 5. *Design of Present Study*



AN = Anorexia Nervosa; HC = Healthy Control; EMP = Empathy; ASD = Austims Spectrum Disorder Behaviors; ALEX = Alexithymia; EI = Emotional Intellegence

Participants

The following study consists of a homogenous sample of only females from the ages of 18 to 60 years old who have a current diagnosis AN or are considered a health control (i.e., the absence of a psychiatric disorder). Post hoc power analyses were run through the G*Power 3.1.3 program, in order to

calculate the percent of power available to run a total of six comparisons. These results are presented in Table 13. Due to the difficulty in identifying and recruiting from the AN population, sixteen AN patients were recruited from outpatient and partial hospitalization settings. Twenty-two health control participants were recruited in the community.

Instruments

Following Institutional Review Boards (IRB) approval, a questionnaire including demographic information along with psychiatric history was administered by the present investigator, and used to gather information pertaining to age, birth date, weight, height, race, education, and history of mental illness in the participant and her family members. Additionally, the following measures of eating disorder symptomology, autism spectrum disorder traits, empathy, emotional contagion, alexithymia, and emotional intelligence was administered.

Eating disorders. Eating disorder behavior and AN symptomology was measured through the Eating Disorder Examination Questionnaire (EDE-Q6).

Eating Disorder Examination Questionnaire (EDE-Q6; Fairburn & Beglin, 2008). The EDE-Q6 is a self-report measure constructed from the interview version of the Eating Disorder Examination (EDE; Fairburn, 2008). The EDE-Q6 consists of 28 questions which ask the respondent to rate her/his eating pathology over the past 28 days. The EDE-Q6 consists of four subscales: Eating Concern, Shape Concern, Weight Concern, and Dietary Restraint; the higher the score the more indicative of eating pathology. Questions vary in type. Some require respondents to indicate how many days out of the past 28 days they engaged in a specific behavior by rating themselves on a 7 point scale scored from 0 = no days to 6 = everyday. Others require respondents to evaluate over the past 28 days how often they engaged in a behavior, but rate their behavior on a 7-point scale scored from 0 = not at all to 6 = markedly. A sample question is: On how many of the past 28 days have you been deliberately trying to limit the amount of food you eat to influence your shape or weight (whether or not you have succeeded).

Although the EDE has long been considered the gold standard for eating disorder assessment (Wilson, 1993), the EDE-Q6 has demonstrated comparable results to the EDE, most specifically in the assessment of AN (Passi, Bryson, & Lock, 2003; Wolk, Leob, & Walsh, 2005). Correlations between the EDE and the EDE-Q6 on each of the subscales are as follows: (a) Eating Concern = .67, (b) Dietary Restraint = -.71, (c) Weight Concern = .82 and (d) Shape Concern = .91. All correlations were significant at the .001 level. Additionally, internal consistency for the EDE-Q6 ranges from moderate to high correlations across all subscales (range .72 - .83). In addition, the internal consistency of the total score is .90 (Peterson et al., 2007).

Autism spectrum disorder. To measure ASDs the Autism – Spectrum Quotient (AQ), was utilized. The AQ was selected to serve as a self-report measure of autism spectrum disorder behavior, however is only validity administered to individuals ages 16 and older.

Autism-Spectrum Quotient. (AQ; Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001). The AQ serves as a quick and quantitative self-report measure of high functioning autism spectrum disorders characteristics. Due to the fact that it is free and readily available online and is widely utilized by practitioners, researchers, and individuals (Armstrong & Iarocci, 2013). It consists of 50-item that assess five factors: Social Skills (e.g., I prefer to do things with others rather than on my own), Attention Switching (e.g., I prefer to do things the same way over and over again), Attention to Detail (e.g., I often notice small sounds when others do not), Communication (e.g., Other people frequently tell me that what I've said is impolite, even though I think it is polite), and Imagination (e.g., If I try to imagine something, I find it very easy to create a picture in my mind). Participants rate their answers on a scale ranging from "definitely agree" to "definitely disagree." A higher score indicates more difficulty or a delay in that area of functioning. On items 1, 2, 4, 5, 6, 7, 9, 12, 13, 16, 18, 19, 20, 21, 22, 23, 26, 33, 35, 39, 41, 42, 43, 45, and 46 a score of 1 is indicated if the participant rated the item "definitely agree" or "slightly agree." On items 3, 8, 10, 11, 14, 15, 17, 24, 25, 27, 28, 29, 30, 31, 32, 34,

36, 37, 38, 40, 44, 47, 48, 49, and 50 a score of 1 is indicated if the participant rated the item "definitely disagree" or "slightly disagree." Items are rated on a 4-point scale; from definitely agree to definitely disagree. Higher scores represent more autistic tendencies with a minimum score of 0 and a maximum score of 50. A cut off score of 32 out of 50 is highly predictive of an ASD diagnosis, however this cut off score was not utilized in the present study.

Utilizing a non-clinical sample of 1005 subjects, generally low estimates of internal consistency were observed: Social Skill = 0.66, Attention Switching = 0.41, Attention to Detail = 0.60, Communication = 0.47 and Imagination = 0.40 (Hurst, Mitchell, Kimbrel, Kwapil, & Nelson-Gray, 2007). Additionally, the total score for the AQ = 0.67. However, a reasonable internal consistency of .82 was reported in the Hambrook et al. 2008 study in which an AN sample was utilized. Additionally, inverse correlations exist between the Empathy Quotient (Baron-Cohen & Wheelright, 2004), the Friendship and Relationship Quotient (Baron-Cohen & Wheelwright, 2003), and positively correlated with the Systemizing Quotient (Baron-Cohen, Richler, Bisarya, Gurunathan, &Wheelwright, 2003).

Prior research has also examined criterion related validity of the AQ and suggested good discriminative and predictive validity when comparing the AQ and clinicians' DSM IV diagnosis of ASDs (Woodbury-Smith, Robinson, Wheelwright, & Baron-Cohen, 2005). Armstrong and Iarocci (2013) examined convergent validity between the SRS and AQ in a sample of 8 – 19 year old individuals diagnosed with high-functioning ASD and found significant correlation between SRS and AQ scores (r = .64, p = .00).

Empathy.

The Basic Empathy Scale (BES; Jolliffe & Farrington, 2006). The Basic Empathy Scale is a 20-item scale that measures factors of both affective and cognitive empathy. Cronbach alpha for both cognitive and affective empathy are reported as .79 and .85, respectively (Jolliffe & Farrington, 2006). The authors report the correlation between the two subscales to be r = - .41 in males and r = .43 in

females (both significant at $p < .0001$) indicating both overlap and a degree of differentiation between the two subscales. Confirmatory factor analysis was undertaken by the authors who indicated that the goodness of fit (GFI) index for the two factor model to be 0.88 for males and 0.86 for females, the adjusted goodness-of-fit index (AGFI) to be 0.85 for males and 0.83 for females, and the root mean square residual (RMS) to be 0.07 for males and 0.06 for females (Jolliffe & Farrington, 2006). All criteria used to assess goodness-of-fit were higher when utilizing the two factor model rather than a one factor model. A sample item includes: "My friend's emotions don't affect me much." Each item is rated on a five-point response scale from 1 representing strongly disagree to 5 representing strongly agree. Additionally, gender differences were observed indicating that males, compared to males, scored significantly higher ($t = 17.6$, $p < .0001$, $d = 1.33$). Concurrent validity indicates moderate correlations between the total score of the Basic Empathy Scale and the total score of the Interpersonal Reactivity Index, suggesting similar ability to measure empathy as a construct, but doesn't indicated the measures as redundant ($r = .53$ males, $r = .43$ females). Finally, a weak negative correlations exist between the Basic Empathy Scale and the Toronto Alexithymia Scale ($r = -.17$ males, $r = -.20$ females).

Interpersonal Reactivity Index (IRI; Davis, 1980). The Interpersonal Reactivity Index (IRI) is a 28-item self-report measure of empathy to assess the "reactions of one individual to the observed experiences of another" (Davis, 1993, p. 113). Specifically, the IRI treats the measurement of empathy through a multidimensional approach, rather than as a single unipolar construct. The IRS contains four subscales (i.e., Fantasy Scale, Perspective Taking, Empathic Concern, Personal Distress) in addition to a total score. Items are rated from "Does not describe me well" to "Describes me very well" on a 5-point Likert scale. Several items are reversed scored, including items 3, 4, 7, 12, 13, 14, 15, 18, and 19. The Fantasy Scale (FS) measures the tendency to get caught up in fictional stories and imagine oneself in the same situations as fictional characters. This scale assesses the tendency to imaginatively transpose oneself into the feelings and actions of fictitious characters in

books, movies, and plays. The Perspective Taking (PT) scale measures the tendency to take the psychological point of view of others and assesses the extent to which individuals spontaneously (try to) adopt others' points of view. The Empathic Concern (EC) scale measures sympathy and concern for others and the extent of individuals' feelings of warmth, compassion, and concern for others. The Personal Distress (PD) scale measures the extent of individuals feelings of anxiety and discomfort as a result of another's negative experience and addresses the tendency to experience distress in stressful situations (e.g. "In emergency situations, I feel apprehensive and ill-at-ease.").

Cronbach alphas across subscales indicated moderate correlations ranging from .71 to .77. Test-rest reliabilities also indicate moderate correlations and range from .62 to .71. The IRI has been argued to have shortcomings in that other researchers indicated its items to better equate to sympathy rather than empathy (Jolliffe & Farrington, 2006). Additionally, it has been argued that this scale does not yield a measure of cognitive empathy nor has it been normed on a clinical sample. However, the IRI was selected for the present study as it offers the measurement of several potentially important subscales which are not available through other measures of empathy. The IRI items are each rated on a 5-point Likert scale ranging from 1 = does not describe me well to 5 = describes me very well. A sample item includes: "I daydream and fantasize, with some regularity, about things that might happen to me."

The Toronto Empathy Questionnaire (TEQ; Spreng, McKinnon, Mar, & Levine, 2009). The Toronto Empathy Questionnaire (TEQ), was created as a broad, unidimensional self-report measure of empathy. However, the authors do indicate that the TEQ is closer to an emotional measure of empathy but captures more cognitive aspects of empathy as well. The TEQ was developed though the consensus of prior scales including the IRI, Autism Quotient, Reading the mind in the Eyes Task, Interpersonal Perception Task, and Empathy Quotient. The TEQ consists of 16 questions that encompass many theoretical facets of empathy. Items are rated on a five point Likert scale ranging from 0 = never to 4 = always. Scores are summed to generate a total score. A sample question includes: "When someone else

is feeling excited, I tend to get excited too." Spreng et al. (2009) indicate no gender differences suggesting men and women provide similar response. Cronbach's alpha for the total score of the TEQ is .85. Additionally, score on the TEQ were negatively correlated to the AQ (r = -.30, p < .01) and positively correlated to the IRI subscale of Empathetic Concern (r = .74, p < .001) and Perspective Taking (r = .35, p < .001).

Emotional contagion. Emotional contagion is considered the susceptibility of a person to others' emotions which is often generated through afferent feedback (Doherty, 1997). One's susceptibility to emotion is often driven by genetics, gender, early experiences, and personality characteristics. The Emotional Contagion Scale will be used in the present study as a measure of this construct.

Emotional Contagion Scale (ECS; Doherty, 1997). The Emotional Contagion Scale (ECS) measures the differences in the susceptibility to emotional contagion. This scale consists of 15 statements in which each items is rated by the respondent using a 4 point scale (1 = never true for me to 4 = always true for me). The higher the score the more susceptible to emotion a person is indicated. The two subscales are generated from the ECS, a positive subscale created from items that include happiness and love and a negative subscale that includes emotions of fear, anger, and sadness. A total score is also generated. Cronbach's alpha is .82 for the positive subscale, .80 for the negative subscale, and .90 for the total score. Additionally test-retest reliability after three weeks were highly correlated (r = .84, p < .001). Additionally, factor loadings ranged from .46 to .69.

Alexithymia. Alexithymia is described as difficulties in perceiving, differentiating, and expressing one's own emotions (Nemiah & Sifneos, 1970). Individuals who are indicated as being alexithymic are often characterized as having a restricted range of mental imagery and a cognitive style that is oriented towards external stimuli (Müller, Bühner, & Ellgring, 2004). Therefore, these individuals have a reduced or diminished ability to identify or communicate feelings. The ability to recognize one's own feelings is regarded as important to be able to recognize the feelings in others and thus, in the

ability to display empathy. For instance, Davies, Stankov, and Roberts (1998) demonstrated that alexithymia was weakly and negatively correlated with empathy as measured on the Questionnaire Measure of Emotional Empathy. The Toronto Alexithymia Scale – 20 (TAS-20) is considered the most commonly used measure of alexithymia and therefore will be utilized in the present study.

Toronto Alexithymia Scale - 20 (TAS-20; Bagby, Parker, & Taylor, 1994). The Toronto Alexithymia Scale (TAS) is a 20-item measure of alexithymia, which has been revised from the 26 - item scale. Several items are reversed scored (4, 5, 10, 18, 19). Factor analysis confirmed the construction of the TAS-20's three scales that include: (a) difficulty identifying feelings and distinguishing between feelings and the bodily sensations of emotional arousal (DIF, 7 items; e.g., "I am often confused about what emotion I am feeling"; (b) difficulty describing feelings to others (DDF, 5 items; e.g., It is difficult for me to find the right words for my feelings), (c) externally-oriented thinking (EOT, 8 items; "I prefer talking to people about their daily activities rather than their feelings"). The authors indicated the combination of the second and third scale reflect an operatory thinking component, of which indicated a preference for external details rather than thought content related to feelings, fantasies, or other internal experiences. Participants are asked to rate each item on how much they agree with the statement utilizing a 5-point Likert scale ranging from 1 (*strong disagree*) to 5 (*strongly agree*). The TAS-20 has since become the most widely used measure of this construct due to its good internal consistency. Specifically, in a study of 1,001 adolescents and young adults ages 13 to 21 years old, Cronbach's alpha for each of the scales ranged from moderate to high correlations; DIF for males .72 and for females .71, DDF for males .74 and for females .81, EOT for males .68 and .64 for females. Cronbach's alpha for the total score across both males and females is .81. Additionally, confirmatory factor analysis indicated the three-factor model of the TAS-20 to be a satisfactory fit in the young adult sample.

Emotional intelligence. Emotional intelligence is indicated as consisting of three categories that include appraisal and expression of emotion, regulation of emotion and utilization of emotions in problem solving (Salovey & Mayer, 1990). The Schutte Self Report Emotional Intelligence Test (SSEIT) was selected to assess emotional intelligence in the present study.

Schutte Self Report Emotional Intelligence Test. The Schutte Self Report Emotional Intelligence Test (SSEIT) will be utilized in order to assess emotional intelligence within both the populations. Devised from 33-items, this self-report measure, measures an overall composite score of emotional intelligence along with four factors that include: (a) perceiving emotions in one self and others (b) expressing emotion (c) understanding/analyzing emotion in self and others, and (d) the utilization of emotion (Salovey & Mayer, 1990). All questions are rated on a 5-point Likert Scale. All 33 items are summed to obtain a total score of EI. Scores range from 33 – 165, with a higher score indicated more emotional intelligence. The internal consistency equals .90, and test-retest reliability equals .78 (over a 2-week period; Schutte et al., 1998).

Procedures

Anorexia Nervosa Participants. Recruitment took place through fliers distributed to eating disorder clinics and outpatient providers who specialize in the treatment of eating disorders. Upon completing the consents, participants were provided a one-time assessment battery and asked to complete the demographic information along with the above indicated questionnaires. Each assessment battery took the participants approximately forty-five minutes to one hour to complete. Each assessment packet was de-identified and replaced with a numerical code in order to protect confidentiality. All information was shredded following the required amount of time specified by the IRB.

Healthy Control Participants. Recruitment took place through the distribution of fliers throughout the Western New York community, on college campus, and in local businesses. At times the use of snowball recruitment was utilized. Upon completion of the consents, participants were provided a

one-time assessment battery. Participants took approximately forty-five minutes to an hour to complete the assessment. Each assessment packet was de-identified and replaced with a numerical code in order to protect confidentiality. All information was shredded following the required amount of time specified by the IRB.

Primary Research Questions

1. Is there a significant difference in autism spectrum behaviors as measured by the total score of the AQ in comparison to the healthy control group?
2. Is there a significant difference in eating disordered behaviors as measured by the total score of the EDE-Q6 in comparison to the health control group?
3. Is there a significant difference in empathy as measured by the total score of the BES in comparison to the health control group?
4. Is there a significant difference in emotional contagion as measured by the total score of the ECS in comparison to the health control group?
5. Is there a significant difference in alexithymia as measured by the total score on the TAS in comparison to the health control group?
6. Is there a significant difference in emotional intelligence as measured by the total score of the SSEIT, in comparison to the health control group?

Primary Hypotheses

1. It is hypothesized that the AN sample will demonstrate a higher level of autistic spectrum behaviors as measured by the total score on the AQ in comparison to the healthy control group.
2. It is hypothesized that the AN sample will demonstrate a higher level of eating disorder behaviors as measured by the EDE-Q6 in comparison to the healthy control group.
3. It is hypothesized that the AN sample will demonstrate a higher level of autistic spectrum of expressed empathy as measured by the BES in comparison to the healthy control group.

4. It is hypothesized that the AN sample will demonstrate a higher level of emotional contagion as measured by the ECS in comparison to the healthy control group.
5. It is hypothesized that the AN sample will demonstrate a higher level of alexithymia as measured by the TAS in comparison to the healthy control group.
6. It is hypothesized that the AN sample will demonstrate a lower level of emotional intelligence as measured by the SSEIT in comparison to the healthy control group.

Secondary Research Questions

1. Is there a significant difference in autism spectrum behaviors as measured by the subscales scores of the AQ in comparison to the healthy control group?
2. Is there a significant difference in eating disordered behaviors as measured by the subscale scores of the EDE-Q6 in comparison to the health control group?
3. Is there a significant difference in empathy as measured by the subscale scores of the BES, total score or subscale scores of the IRI, or the total score of the TEQ in comparison to the health control group?
4. Is there a significant difference in emotional contagion as measured by the subscale scores of the ECS in comparison to the health control group?
5. Is there a significant difference in alexithymia as measured by the subscale score on the TAS in comparison to the health control group?

Secondary Hypotheses

1. It is hypothesized that a statistically significant difference will exist between the AN and HC samples as measured by the subscale scores of the AQ.
2. It is hypothesized that a statistically significant difference will exist between the AN and HC samples as measured by the subscale scores of the EDE-Q6.

3. It is hypothesized that a statistically significant difference will exist between the AN and HC samples as measured by the subscale scores of the BES, total score or subscale scores of the IRI, or the total score of the TEQ.
4. It is hypothesized that a statistically significant difference will exist between the AN and HC samples as measured by the subscale scores of the ECS.
5. It is hypothesized that a statistically significant difference will exist between the AN and HC samples as measured by the subscale scores of the TAS.

Statistical Analysis

Analyses on demographic variables including age, race, and educational status were conducted to ensure no significant differences between the groups. While matching of participants was not utilized, an attempt was made to balance demographic variables. Following this preliminary analysis, all subsequent research questions will be addressed by running independent samples t-test to compare the means of the AN and HC groups. Confirmatory analyses will be conducted for the primary research questions. In order to reduce the likelihood of Type I errors, the statistical tests have been Bonferroni corrected across the six hypotheses. This yielded a comparison-wise alpha of .0083 in order to maintain a family-wise alpha of .05 for the primary hypotheses. All of the primary hypotheses are directional (i.e., one-tailed tests). Effect sizes were calculated utilizing Cohen's *d* with pooled standard deviations in the denominator (Cohen, 1988). Exploratory analyses were conducted on the secondary research questions. These exploratory hypotheses were tested without an alpha correction in order to maintain statistical power. All were examined using two-tailed tests at an alpha level of 0.05. Effect size estimates were calculated using effect size *d*, again using the pooled standard deviations in the denominator (Cohen, 1988).

CHAPTER 4

RESULTS

The following results section is organized via each research question, and corresponding primary and secondary research questions. Prior to addressing each research question however, demographic pertaining to the sample are presented. Additionally, when conducting independent samples t-tests, there are several statistical assumptions that must be addressed in order to ensure the statistics are interpretable. For each research question, the results and finding of the analysis are presented.

Demographic Variables

The demographic variables were compared between the AN (n = 16) and HC (n = 22) groups. The mean age of the AN group was 31.5 years old (SD = 12.53) and the mean age of the HC was 28.8 years old (SD = 11.71). The difference between groups in terms of age is not significant (t[36] = .677, p = .503). The mean height for the AN group is 165.4 inches (SD = 8.02) and the HC group is 164.3 (SD = 5.51). The difference between groups was not significant (t[36] = .514, p = .611). The mean weight for the AN group is 118 pounds (SD = 20.57) and the mean weight for the HC group is 134 pounds (SD = 17.07). A statistically significant difference was noted between groups (t[36] = -2.61, p = .013). When comparing the two groups based on Body Mass Index (BMI) the AN group had a mean of 19.6 (SD = 2.94) and the HC group had a mean of 22.6 (SD = 2.73). A statistically significant difference existed between groups when comparing BMI (t[36] = -3.22, p = .003).

Table 4. *Comparison of Demographic Variables Between Groups*

	Group	***N***	**Mean**	***SD***	***SE* Mean**	**Sign**
Age	Anorexia Nervosa	16	31.5	12.53	3.13	.503
	Healthy Control	22	28.8	11.71	2.50	
Height	Anorexia Nervosa	16	165.4	8.02	2.01	.611
	Healthy Control	22	164.3	5.51	1.17	
Weight	Anorexia Nervosa	16	118.2	20.57	5.14	.013

	Healthy Control	22	134.1	17.07	3.64	
BMI	Anorexia Nervosa	16	19.6	2.94	.73	.003
	Healthy Control	22	22.6	2.73	.58	

*Equal variences not assumed

When comparing the samples on the demographic variable of race the AN group and the HC group similar frequencies were noted. Specifically, Caucasians represented approximately half of both the AN and HC samples. While the HC samples included both Indian and Asian participants, these occurred in a smaller frequency. Lastly, both the AN and HC groups included individuals who are Biracial.

Table 5. *Frequencies of Demographic Variables Within Groups*

	Group	**Caucasian *n*(%)**	**Asian *n*(%)**	**Indian *n*(%)**	**Biracial *n*(%)**
Race	Anorexia Nervosa	15(47)	0(0)	0(0)	1(33)
	Healthy Control	17(53)	2(100)	1(100)	2(66)
	Total	32	2	1	3

When comparing the samples on the demographic variable of education the AN group and the HC group variations in frequencies were noted. In the AN sample the majority of participants had completed a graduate degree (either Masters or Doctor trained), was in the process of completing a graduate degree or had completed high school. However, in the HC sample, the majority of the sample had completed their Bachelor's degree or was in the process of completing their Bachelor's degree.

Table 6. *Frequencies of Demographic Variables Between Groups*

	Group	**High School *n*(%)**	**Some College *n*(%)**	**Completed College *n*(%)**	**Some Graduate *n*(%)**	**Graduate *n*(%)**
Education	Anorexia Nervosa	4(80)	2(19)	2(22)	4(66)	4(57)
	Healthy Control	1(20)	9(81)	7(78)	2(34)	3(43)
	Total	5	11	9	6	7

Therefore, when comparing the two samples on demographic variables there were no significant differences in the groups across age, and height. Additionally, similar frequencies exist between groups on variables of race and education. However, significant differences occurred across variables of weight and BMI. It is expected however, that the AN group exhibits a lower than normal weight due to the clinical nature of an eating disorder diagnosis.

Addressing Statistical Assumptions

Independent t-test assumptions. The following assumptions need to be addressed when running independent t-tests. First, the populations being compared should follow a normal distribution. In order to ensure this assumption was met, skewness and kurtosis statistics were checked and histograms were visually examined. Additionally, it is noted that the two populations being compared should have the same variance. Therefore, the Levene's Test of Equal Variances was utilized. In the case were an equal variances could not be assumed, the corrected degrees of freedom were used. Lastly, it is critical that the samples be independent from each other. Both the AN and HC samples were collected separately of each other and therefore, can be assumed to be independent samples.

Primary Research Question 1

Symptomology of autism spectrum behaviors was measured using the Autism Quotient (AQ), a self-report for adults ages 18 years and older. Participants rate their answers on a scale ranging from "definitely agree" to "definitely disagree." A higher score indicates more difficulty or a delay in that area of functioning. Examining the total AQ score a significant difference between groups was noted, indicating significantly more autism spectrum behaviors in the AN than the HC group (AN: M = 24.5[SD = 7.73]; HC: M = 15.0[SD = 6.00]; t[36] = 4.24, $p < .001$ (one tailed), d = 1.40).

Secondary Research Question 1

Exploratory analysis were also run to examine the subscale scores on the AQ between the AN and HC groups. On the Social Skills subscale the AN group had a mean of 5.0 (SD = 2.70) and the HC had a mean of 1.9 (SD = 1.78), with a statistically significant difference between groups (t[24] = 4.0, $p < .001$ (two tailed), d = 1.40). Therefore, the AN group demonstrates more difficulty with social skills in comparison to the HC group. On the subscale of Attention Switching the AN group had a mean of 6.88 (SD = 2.25) and the HC group had a mean of 3.86 (SD = 2.25), with a statistically significant difference between groups (t[36] = 4.07, $p < .001$ (two tailed), d = 1.33). Therefore, the

AN group demonstrates more difficulty with the ability to demonstrate flexibility when switching their attention from one activity to other. On the subscale of Communication the AN group had a mean of 3.2 (*SD* = 1.9) and the HC had a mean of 1.5 (*SD* = 1.54). There was a significant difference between groups (t[36] = 3.02, p = .005 (two tailed), d = 1.00), with the AN group demonstrating more difficulty communicating effectively. No significant differences were noted between groups on the subscales of Attention to Detail (AN: M = 6.5[*SD* = 2.85]; HC: M = 5.3[*SD* = 2.59]; t[36] = 1.33, p = .191, (two tailed), d = .44) and Imagination (AN: M = 2.9[*SD* = 1.77]; HC: M = 2.5[*SD* = *1*.73]; t[36] = .760, p = .452 (two tailed), d = .23).

Table 7. *Comparison of Autism Spectrum Behaviors Between Groups*

	Group	*N*	Mean	*SD*	*SD* Mean	Sign
AQ Total Score[a]	Anorexia Nervosa	16	24.5	7.73	1.93	< .001**
	Healthy Control	22	15.0	6.00	1.28	
AQ Social Skills[b]	Anorexia Nervosa	16	5.0	2.70	.68	< .001*
	Healthy Control	22	1.9	1.78	.34	
AQ Attention Switching[b]	Anorexia Nervosa	16	6.8	2.25	.56	< .001*
	Healthy Control	22	3.8	2.25	.48	
AQ Attention To Detail[b]	Anorexia Nervosa	16	6.5	2.85	.71	.191
	Healthy Control	22	5.3	2.59	.55	
AQ Communication[b]	Anorexia Nervosa	16	3.2	1.90	.48	.005*
	Healthy Control	22	1.5	1.54	.33	
AQ Imagination[b]	Anorexia Nervosa	16	2.9	1.77	.44	.453
	Healthy Control	22	2.5	1.73	.37	

*Significant at a .05 level (two tailed)
**Significant at a .0083 level (one tailed)
[a]Primary Research Question
[b]Secondary Research Question

Primary Research Question 2

The Eating Disorder Examination Questionnaire 6.0 (EDE-Q6) was utilized to examine differences in eating disorder behavior between groups. The EDE-Q6 was adapted from the interview based EDE and consists of 36 items that are scored on a 7-point scale. Eating disorder behavior is

measured over a 28-day period with some symptoms being rated across a two or three month period. Four subscales (i.e., Eating Concern, Shape Concern, Weight Concern, and Dietary Restraint) are calculated along with a total score. Regarding the total score for the EDE-Q6 the AN group had a mean score of 4.4 (*SD* = 1.04) and the HC group had a mean score of .77 (*SD* = .66). There was a statistically significant difference between groups ($t[34] = 12.8$, $p < .001$ (one tailed), $d = 4.33$), with the AN group more overall eating disordered behaviors than the HC group.

Secondary Research Question 2

Exploratory analyses were run on the subscale of the EDE-Q6. On the subscale of Restraint the AN group had a mean score of 4.2 (*SD* = 1.5) and the HC group had a mean score of .75 (*SD* = .92). There was a statistically significant difference between groups ($t[23] = .8.10$, $p < .001$ (two tailed), $d = 2.88$) in which the AN group displayed more restraint of food in their diet. On the subscale of Eating Concern the AN group had a mean score of 4.1 (*SD* = 1.48) and the HC group had a mean score of .26 (*SD* = .30). There was a statistically significant difference between groups ($t[15.9] = 10.0$, $p < .001$ (two tailed), $d = 3.91$), with the AN group displaying more concern with eating than the HC group. On the subscale of Shape Concern the AN group had a mean score of 4.8 (*SD* = 1.31) and the HC group had a mean score of 1.2 (*SD* = .81). There was a statistically significant difference between groups ($t[34] = 10.0$, $p < .001$(two tailed), $d = 3.44$), with the AN group displaying more shape concern than the HC group. On the subscale of Weight Concern the AN group had a mean score of 4.7 (*SD* = .85) and the HC group had a mean score of .87 (*SD* = .87). There was a statistically significant difference between groups ($t[35] = 13.5$, $p < .001$(two tailed), $d = 4.45$), with the AN group displaying more weight concern than the HC group.

Table 8. *Comparison of Eating Disorder Behaviors Between Groups*

	Group	*N*	Mean	*SD*	*SD* Mean	Sign
EDE-Q6 Total[a]	Anorexia Nervosa	15	4.4	1.04	.27	< .001**
	Healthy Control	21	.77	.66	.14	
EDE-Q6 Restraint[b]	Anorexia Nervosa	16	4.2	1.50	.38	< .001*
	Healthy Control	22	.75	.92	.20	
EDE-Q6 Eating Concern[b]	Anorexia Nervosa	16	4.1	1.48	.37	< .001*
	Healthy Control	22	.26	.30	.06	
EDE-Q6 Shape Concern[b]	Anorexia Nervosa	15	4.8	1.31	.34	< .001*
	Healthy Control	21	1.2	.81	.18	
EDE-Q6 Weight Concern[b]	Anorexia Nervosa	16	4.7	.85	.21	< .001*
	Healthy Control	21	.87	.87	.19	

*Significant at a .05 level (two tailed)
**Significant at a .0083 level (one tailed)
[a]Primary Research Question
[b]Secondary Research Question

Primary Research Question 3

The Basic Empathy Scale is a 20-item self-report measure that are rated from "Strong Agree" to "Strongly Disagree" on a 5-point Likert scale. The scale is divided into two subscales, Cognitive Empathy and Affective Empathy, along with a total score. On the BES total score the AN group had a mean score of 55.5 (*SD* = 5.73) and the HC group had a mean score of 57.7 (*SD* = 3.65). No statistically significant difference was noted between groups (t[34] = -1.39, p = .172 (one tailed), d = -.48).

Secondary Research Question 3

Exploratory analyses were conducted on the subscales of the BES, the total and subscales of the IRI, and the total score of the TEQ. On the Cognitive Empathy subscale of the BES, the AN group had a mean score of 21.8 (*SD* = 2.39) and the HC group had a mean score of 22.9 (*SD* = 1.80). No statistically significant difference between groups (t[35] = -1.42, p = .162 (two tailed), d = -0.53) was evident. On the subscale of Affective Empathy the AN group had a mean score of 33.7 (*SD* =

3.90) and the HC group had a mean score of 34.9 (*SD* = 3.09). No statistically significant difference between groups (*t*[35] = -1.03, *p* = .306 (two tailed), *d* = -0.35) existed.

The Interpersonal Reactivity Scale (IRS) is a 28-item self-report. The IRS contains 4 subscales (i.e., Fantasy Scale, Perspective Taking, Empathic Concern, Personal Distress) in addition to a total score. Items are rated from "Does not describe me well" to "Describes me very well" on a 5-point Likert scale. On the IRI total score the AN group had a mean score of 66.7 (*SD* = 14.30) and the HC group had a mean score of 71.3 (*SD* = 10.62). No statistically significant difference was noted between groups (*t*[36] = -1.158, *p* = .255 (two tailed), *d* = -0.37). On the subscale of Fantasy, the AN group had a mean score of 15.3 (*SD* = 7.14) and the HC group had a mean score of 18.1 (*SD* = 5.63). No significant difference between groups (*t*(36) = -1.39 *p* = .172 (two tailed), *d* = -0.44) was noted. On the subscale of Perspective Taking the AN group had a mean score of 14.9 (*SD* = 6.07) and the HC group had a mean score of 20.4 (*SD* = 4.59). There was a statistically significant difference between groups (*t*[36] = -3.16, *p* = .003 (two tailed), *d* = -1.05), indicating that the AN group displayed more difficulty with perspective taking than the HC group. On the subscale of Empathetic Concern the AN group had a mean score of 22.9 (*SD* = 4.82) and the HC group had a mean score of 22.8 (*SD* = 3.25). No statistically significant difference between groups (*t*[36] = 0.78, *p* = .938 (two tailed), *d* = .025) was evident on this scale. On the subscale of Personal Distress the AN group had a mean score of 13.6 (*SD* = 7.23) and the HC group had a mean score of 10.0 (*SD* = 5.72). No statistically significant difference between groups (*t*[36] = 1.7, *p* = .097 (two tailed), *d* = 0.56) was noted on this scale.

The final measure of empathy that was administered was the Toronto Empathy Questionnaire. This scale consists of 16 items rated from "Never" to "Always" on a 5-point Likert scale. Only a total score is generated on this scale. On the total score the AN group had a mean score of 33.4 (*SD* = 3.69)

and the HC group had a mean score of 33.0 (*SD* = 2.77). A statistical difference between groups (*t*[33] = .371, *p* = .713 (two tailed), *d* = 0.13) was not detected.

Table 9. *Comparison of Empathy Between Groups*

	Group	*N*	Mean	*SD*	*SD* Mean	Sign
BES Total[a]	Anorexia Nervosa	15	55.5	5.73	1.48	.086
	Healthy Control	21	57.7	3.65	.80	
BES Cognitive[b]	Anorexia Nervosa	16	21.8	2.39	.60	.162
	Healthy Control	21	22.9	1.80	.39	
BES Affective[b]	Anorexia Nervosa	15	33.7	3.90	1.01	.306
	Healthy Control	22	34.9	3.09	.66	
IRI Total[b]	Anorexia Nervosa	16	66.7	14.30	3.58	.255
	Healthy Control	22	71.3	10.62	2.26	
IRI Perspective[b]	Anorexia Nervosa	16	14.9	6.07	1.52	.003*
	Healthy Control	22	20.4	4.59	.98	
IRI Fantasy[b]	Anorexia Nervosa	16	15.3	7.14	1.79	.172
	Healthy Control	22	18.1	5.63	1.20	
IRI Empathic Concern[b]	Anorexia Nervosa	16	22.9	4.82	1.21	.938
	Healthy Control	22	22.8	3.25	.69	
IRI Personal Distress[b]	Anorexia Nervosa	16	13.6	7.23	1.81	.097
	Healthy Control	22	10.0	5.72	1.22	
TEQ Total[b]	Anorexia Nervosa	14	33.4	3.69	.99	.713
	Healthy Control	21	33.0	2.77	.60	

*Significant at a .05 level (two tailed)
**Significant at a .0083 level (one tailed)
[a]Primary Research Question
[b]Secondary Research Question

Primary Research Question 4

In order to measure emotional contagion between the two groups the Emotional Contagion Scale (ECS) was administered. The ECS is rated from never to always on a 4 point scale. Six subscale scores are calculated to assess a person's ability to pick up on four basic emotions (i.e., happiness, love, fear, anger, sadness) along with a subscale to assess the participant's interest in others' emotions. On the total score the AN group had a mean score of 54.4 (*SD* = 6.63) and the HC group had a mean score of 56.0

(*SD* = 8.76). A statistical difference between groups (*t*[33] = .371, *p* = .269 (one tailed), *d* = -0.20) was not detected.

Secondary Research Question 4

Exploratory analyses were conducted on the subscale scores of the ESC. On the subscale score of Happiness the AN group had a mean score of 9.9 (*SD* = 1.50) and the HC group had a mean score of 9.8 (*SD* = 1.44). A statistical difference between groups (*t*[36] = .118, *p* = .906 (two tailed), *d* = 0.07) was not detected. On the subscale score of Love the AN group had a mean score of 8.3 (*SD* = 3.09) and the HC group had a mean score of 9.8 (*SD* = 1.82). A statistical difference between groups (*t*[23] = -1.76, *p* = .092 (two tailed), *d* = -0.62) was not detected. However, a moderate effect size is noted. On the subscale score of Interest the AN group had a mean score of 9.9 (*SD* = 1.12) and the HC group had a mean score of 10.7 (*SD* = 1.29). A statistical difference between groups (*t*[36] = -1.90, *p* = .072 (two tailed), *d* = -0.65) was not detected. On the subscale score of Fear the AN group had a mean score of 9.1 (*SD* = 1.67) and the HC group had a mean score of 8.8 (*SD* = 2.26). A statistical difference between groups (*t*[36] = .46, *p* = .649 (two tailed), *d* = 0.15) was not detected. On the subscale score Anger of the AN group had a mean score of 8.6 (*SD* = 1.82) and the HC group had a mean score of 8.4 (*SD* = 2.15). A statistical difference between groups (*t*[36] = .39, *p* = .696 (two tailed), *d* = 0.10) was not detected. On the subscale score of Sadness the AN group had a mean score of 8.6 (*SD* = 2.19) and the HC group had a mean score of 8.5 (*SD* = 2.04). A statistical difference between groups (*t*[36] = .025, *p* = .980 (two tailed), *d* = 0.05) was not detected.

Table 10. *Comparison of Emotional Contagion Between Groups*

	Group	***N***	**Mean**	***SD***	***SD* Mean**	**Sign**
ECS Total[a]	Anorexia Nervosa	16	54.4	6.63	1.66	.269
	Healthy Control	22	56.0	8.76	1.87	
ECS Happiness[b]	Anorexia Nervosa	16	9.9	1.50	.38	.906
	Healthy Control	22	9.8	1.44	.31	
ECS Love[b]	Anorexia Nervosa	16	8.3	3.09	.77	.092

	Healthy Control	22	9.8	1.82	.39	
ECS Interest[b]	Anorexia Nervosa	16	9.9	1.12	.28	.072
	Healthy Control	22	10.7	1.29	.27	
ECS Fear[b]	Anorexia Nervosa	16	9.1	1.67	.42	.649
	Healthy Control	22	8.8	2.26	.48	
ECS Anger[b]	Anorexia Nervosa	16	8.6	1.82	.46	.696
	Healthy Control	22	8.4	2.15	.46	
ECS Sadness[b]	Anorexia Nervosa	16	8.6	2.19	.55	.980
	Healthy Control	22	8.5	2.04	.44	

*Significant at a .05 level (two tailed)
**Significant at a .0083 level (one tailed)
[a]Primary Research Question
[b]Secondary Research Question

Primary Research Question 5

The Toronto Alexithymia Scale was utilized in order to measure one's ability to understand their own emotions. Items are scored on a 5-point scale from "strongly disagree" to "strongly agree". On the total score the AN group had a mean score of 59.4 (*SD* = 17.32) and the HC group had a mean score of 45.2 (*SD* = 15.28). A statistically significant difference between groups ($t[35] = 2.65$, $p = .006$ (one tailed), $d = .88$) is noted.

Secondary Research Question 5

Exploratory analyses were conducted on the subscales of the TAS. On the subscale of Difficulty Identifying Feelings the AN group had a mean score of 23.3 (*SD* = 8.56) and the HC group had a mean score of 13.8 (*SD* = 6.46). There was a statistically significant difference between groups ($t[36] = 3.87$, $p < .001$ (two tailed), $d = 1.28$), with the AN group displaying more difficulty identifying their own feelings than the HC group. On the subscale of Describing Feelings the AN group had a mean score of 17.6 (*SD* = 6.35) and the HC group had a mean score of 13.3 (*SD* = 5.41). There was a statistically significant difference between groups ($t[36] = 2.27$, $p = .029$ (two tailed), $d = 0.74$), with the AN group displaying more difficulty describing their own feelings than the HC group. On the subscale of Externally Oriented Thinking the AN group had a mean score of 18.6 (*SD* = 5.54)

and the HC group had a mean score of 18.0 (*SD* = 6.04). No statistically significant difference was present between groups (*t*[35] = .266, *p* = .792 (two tailed), *d* = 0.10).

Table 11. *Comparison of Alexithymia Between Groups*

	Group	*N*	Mean	*SD*	*SD* Mean	Sign
TAS Total[a]	Anorexia Nervosa	16	59.4	17.32	4.33	.006**
	Healthy Control	21	45.2	15.28	3.33	
TAS Difficulty Identifying[b]	Anorexia Nervosa	16	23.3	8.56	2.14	< .001*
	Healthy Control	22	13.8	6.46	1.38	
TAS Describing Feelings[b]	Anorexia Nervosa	16	17.6	6.35	1.59	.029*
	Healthy Control	22	13.3	5.41	1.15	
TAS Externally Oriented[b]	Anorexia Nervosa	16	18.6	5.54	1.38	.792
	Healthy Control	21	18.0	6.04	1.32	

*Significant at a .05 level (two tailed)
**Significant at a .0083 level (one tailed)
[a]Primary Research Question
[b]Secondary Research Question

Primary Research Question 6

The Schutte Self Report Emotional Intelligence Test (SEIT) was used to measure differences in emotional intelligence between groups. The SEIT is rated on a 5-point scale from "strongly agree" to "strongly disagree." Items 5, 28, and 33 are reversed scored. Only a total score is calculated and a higher score is related to higher emotional intelligence. When comparing the total score the AN group had a mean score of 119.0 (*SD* = 16.81) and the HC group had a mean score of 136.14 (*SD* = 15.67). There was a statistically significant difference between groups (*t*[36] = - 3.22, *p* = .0015 (one tailed), *d* = -1.06), with the AN group displaying less emotional intelligence than the HC group.

Table 12. *Comparison of Emotional Intelligence Between Groups*

	Group	*N*	Mean	*SD*	*SD* Mean	Sign
SEIT Total[a]	Anorexia Nervosa	16	119.00	16.81	4.20	.0015**
	Healthy Control	22	136.14	15.67	3.34	

**Significant at a .0083 level (one tailed)
[a]Primary Research Question

CHAPTER 5

DISCUSSION

The purpose of the present study was to compare expressed empathy, alexithymia, emotional intelligence along with characteristics congruent with a diagnosis of ASDs between an AN sample and a sample of HC. The present study included female adults ranging in ages of 18 years old to 60 years old. This sample was selected due to the fact that eating disorders affect individuals across the lifespan and that AN predominately occurs in a higher ratio to the female population (Pawluck & Gorey, 1998). Previous research has proposed a link between AN and ASDs (i.e., Hambrook et al., 2008; Zucker et al., 2007) and while there are often social impairments associated with both ASDs and AN little is understood about the similarities between these two clinic populations (Zucker et al., 2007). Gillberg, Råstam, Wentz and Gillberg (2007) report a subgroup of AN patients to also suffer from comorbid ASDs. Additionally, difficulties with set shifting and weak central coherence have been noted as similarities between these two groups (Lopez et al., 2008; Tchanturia et al., 2005).

This study aimed to contribute to the present literature in order to continue to understand the potential link between AN and ASDs. Specifically, the present study acts as a replication and extension of the Hambrook et al. (2008) study which examined self-reports of empathy, systemizing, and autistic traits among AN patients. While similar methodologies were employed across both studies, the present study expanding on the limitations presented in the Hambrook et al. (2008) study. Specifically, the present study expanding on the number and type of measures administered. While a primary measure of empathy was chosen, several other measures of empathy were also utilized, each different from the measure of empathy used in the Hambrook et al. (2008) study. The rational for this was that Hambrook et al. (2008) noted in the limitations section of their study that the Empathy Quotient (EQ; Baron-Cohen & Wheelwright, 2004) used in their study may be biased towards socially desirable responding and therefore, recommended the use of a more sensitive instrument of empathy. Also different, was the

present study added a measure of alexithymia and emotional intelligence. The same measure of ASD behaviors was utilized in attempt to replicate the findings from the Hambrook et al. (2008) study.

Demographic Variables and Eating Concern Across Samples

Demographic variables indicated no significant differences between the HC and the AN samples on variable of age, height, education, or race. However, significant differences did exist between the two groups on the variable of weight and BMI. Due to the fact that data was collected on a clinic sample of eating disorder patients it is expected that these differences would exist. Additionally, when evaluating eating behavior as measured by the EDE-Q6 significant differences existed between the AN and HC group across all subtest scores (i.e., Restraint, Eating Concern, Shape Concern, Weight Concern) and the total score with the AN demonstrating significantly higher levels of eating disorder behavior. While subjects were not matched on demographic variables, an attempt was made to balance demographic variables between groups.

Post Hoc Power Analysis

Post hoc power analyses were run in order to determine the amount of statistical power that exists to detect differences between groups on each of the comparisons. Due to the difficulty to access the population of AN patients, only a small sample size was collected. In order to help protect the power, one-tailed t-tests were utilized and the alpha levels were Bonferroni corrected for six comparisons with a comparison wise alpha level of .0083 in order to maintain a family wise alpha of .05. Post hoc power analysis indicated plenty of power to detect differences between groups on certain measures and reduced power to detect differences between groups on other measures.

Table 13. *Post Hoc Power Analysis*

Measure	**Pooled Effect Size**	**Statistical Power**
AQ	1.40	95%
EDE-Q6	4.33	>99%
BES	-0.48	15%
ECS	.20	4%
TAQ	.88	56%
SEIT	1.06	76%

Anorexia Nervosa and Traits of Autism Spectrum Disorder

The diagnostic criteria for AN and ASDs overlap minimally and no direct link in emotional and behavioral expression appear to exist between these two disorders. However, previous research has highlighted the existence of ASD traits within an AN population (Gillberg & Råstam, 1992; Hambrook et al., 2008; Zucker et al., 2007). Moreover, eating disturbances have been noted within the ASDs population (Råstam, 2008; Scheck et al., 2004). Gillberg and colleagues dedicated several decades of research on a longitudinal study, following a cohort of AN patients in Göteborg, Sweden. Fifty-one sixteen-year-old AN patients, along with a parallel sample of health controls matched on characteristics of age, sex, and school (Gillberg & Råstam, 1992) were followed over several years. At the 6-year follow-up nearly 29% (n = 15) of AN patients had an empathy disorder and 39% (n = 20) had Asperger's syndrome or other autistic-like conditions (Gillberg et al., 1995) which points to similar underlying neuropsychiatric characteristics between AN, and ASD (Gillberg et al., 2010).

The present study supports previous research indicating overlap between AN and ASDs as a significant difference exists between AN (M = 24.5, SD = 7.73) and HC (M = 15.0, SD = 6.00) on the total score of the AQ ($p < .001$), a self-report measure of ASD traits. A large effect size was noted (d = 1.40). Additionally, the present analysis has 95% power to detect an actually difference between groups. Therefore, it is highly likely the present difference is due to an actual difference rather than statistical error. Moreover, Hambrook et al. (2008) study indicates significant differences between an AN group and HC on the Total Score (p = <.001).

Several, exploratory analyses were also run which indicated significant differences to exist on the subscales of Social Skills (AN: M = 5.0, SD = 2.70; HC: M = 1.9, SD = 1.78; $p < .001$), Attention Switching (AN: M = 6.8, SD = 2.25; HC: M = 3.8, SD = 2.25; $p < .001$), and Communication (AN: M = 3.2, SD = 1.90; HC: M = 1.5, SD = 1.54; p = .005). While these results are in line with the Hambrook et al. (2008) study, replication of these results is necessary with a larger sample. The Hambrook et al.

(2008) study indicates significant differences between an AN group and HC on the subscales of Attention Switching ($p < .001$), Imagination ($p = .004$), and Social Skills ($p < .001$). Therefore, similar results are seen across the subscales of Attention Switching and Social Skills. Differences exist across the studies on the subscales of Communication and Imagination. These results support previous findings for the existence of ASDs traits within the AN population. Specifically, the existence of a subgroup of AN patients to possess cognitive styles similar to ASDs has been noted. This includes similarities regarding the resistance to change, insistence of sameness, difficulties with set shifting, and social impairments have been noted (Råstam, 2008; Zucker et al., 2007).

Attention switching. In the present study, attention switching was measured as a subscale of the AQ and a significant difference ($p < .001$) between the AN ($M = 6.8$, $SD = 2.25$) and HC ($M = 3.8$, $SD = 2.25$) samples was noted indicating the AN group demonstrated more difficulties with attention switching. Attention switching has been described as synonymous to set shifting. The ability to set-shift is necessary in order to adapt behaviors to those of the environment. Previous research indicates attention switching to be a difficult process for patients with AN and ASDs (Holliday et al., 2005; Oldershaw et al., 2011; Yerys et al., 2009). Both populations have demonstrated a tendency to be concrete and rigid in their thinking and therefore, demonstrate an inability to change past patterns of thinking (e.g., display of preservative and stereotyped behaviors).

In a review of set-shifting abilities in eating disorders, it was indicated that deficits in this skill exists across all types of eating disorders and regardless of duration or state of illness (Roberts et al., 2007). As such, it is hypothesized that poor set-shifting abilities act as a pre-existing vulnerability that may play a role in etiology as theses ability appears persistent, despite otherwise normal cognitive functioning (Steinglass et al., 2006). While difficulties were still evident, improvements in set-shifting abilities were noted after treatment (Tchanturia et al., 2004). From a functional stand point, it has been theorized that repetitive, stereotyped behaviors in AN, are a result of deficits in implicit learning and set

shifting capacity, and maladaptively assists patients to manage anxiety around gaining weight (Steinglass & Walsh, 2006).

While the present study did not directly assess set-shifting abilities within the ASD population, some empirical evidence exists to indicate similar difficulties. Evident from the diagnostic criteria, restricted repetitive and stereotyped patterns of behavior, interests, and activities, that often result in a preoccupation with one or more stereotypes or restricted interests, inflexible adherence to specific nonfunctional routines or rituals, stereotypes and repetitive motor mannerisms, and preoccupation with parts of objects are inherent in an ASDs diagnosis. Empirical evident supports this notion, indicating that set shifting difficulties are prevalent within the ASDs population (Maes et al., 2010; Yerys et al., 2009).

One study has examined an AN sample in comparison to previous data collected on the ASDs population (Oldershaw et al., 2011). Matching subjects on IQ, despite significant differences in age (i.e., AN group was significantly older), results indicated that on the set shifting abilities did not differ significantly ($p > 0.05$). Therefore both groups demonstrated similar mistakes when switching attention.

*Social skills and communication***.** In the present study, a significant difference was noted in social skills (AN: $M = 5.0$, $SD = 2.70$; HC: $M = 1.9$, $SD = 1.78$; $p < .001$) and communication (AN: $M = 3.2$, $SD = 1.90$; HC: $M = 1.5$, $SD = 1.54$; $p = .005$) between the AN and HC group. Previous research indicates interpersonal difficulties as part of the phenomenology of AN (Pearce, 2004). Patterns of comorbidity with childhood onset diagnosis of AN have been observed to have difficulties in social deficits which include social phobia, (Hinrichsen et al., 2003; Melfsen et al., 2006) and separation anxiety disorder (Silberg & Bulik, 2005). Specifically, prevalence rates of social phobia range between 16% (Kaye et al., 2004) and 88.2% (Hinrichsen et al., 2003). These reports support the presence of interpersonal difficulties prior to the onset of an eating disorder. Additionally, it is indicated that the cognitive rigidity caused by set-shifting difficulties can negatively impeded interpersonal functioning and social relationships (Zucker at el., 2007).

While not directly assessed in the present study, the early onset of social impairments is a cardinal sign in the diagnosis of an ASD diagnosis. Specifically social skills deficits include lack eye contact, in ability to read social cues, and in ability to engage in reciprocal conversations (Volker et al., 2011). Therefore, qualitative impairment in social functioning is critical to the diagnosis and assessment of autism. Additionally, as in the AN literature, evidence suggests comoribiity of ASD and social phobia (Simonoff et al., 2008). While only exploratory comparisons and replication of the results are necessary, the present study supports previous research indicating social skills deficits within an AN similar to those observed within the ASD population.

Anorexia Nervosa and Expressed Empathy

Connected to interpersonal functioning is the ability to empathize with others. While deficits in empathy are characteristic of a diagnosis of ASDs due to the difficulties in social functioning, AN patients have also been characterized as struggling with the display of empathy (Råstam et al., 2003). Empathy is recognized as the ability to understand what other individuals are thinking and feeling (Detecy & Ickes, 2009). While previous studies have examined the role of empathy in AN (Råstam et al., 2003; Wentz et al., 2005) limitations of these studies exist including the narrowly defined population and inclusion of a variety of symptomology (i.e., Obsessive Compulsive Disorder, Obsessive-Compulsive Personality Disorder). Additionally, Hambrook et al. (2008) examined empathy between AN and HC control, but lacked a comparison group to ASDs. Moving closer to the goal of a direct comparison of empathy between AN and ASDs, Oldershaw et al. (2011) compared an AN sample to data collected on ASDs in previous studies.

In the present study, the Basic Empathy Scale (BES) was selected to measure differences in empathy between groups. Results on the total score of this measure did not indicate significant differences between groups (p = .086) although a moderate effect size is noted (d = -0.48). In order to

detect a true difference between populations a larger sample size is necessary as there was only 15% power to detect an actual difference.

Additionally, exploratory analyses were run to on the subscales of the BES along with the total score and subscale scores of the Interpersonal Reactivity Scale (IRI) and the Toronto Empathy Scale (TES). Similar to previous finding in the Hambrook et al. (2008) study were indicated. Across all measures of empathy, no significant differences existed between the AN and HC groups were observed except for on the measure of IRI where there was a significant difference on the subscale of Perspective Taking (AN: $M = 14.9$, $SD = 6.07$; HC: $M = 20.4$, $SD = 4.59$; $p = .003$). These results are comparable to the Hambrook et al. (2008) study where no statistically significant differences were noted between groups on the Empathy Quotient.

*Perspective taking***.** In the present study, a statistically significant difference was observed between the AN and HC groups on the subscale of Perspective Taking ($p = .003$), however these results need to be replicated with a larger sample as the present study only indicates exploratory results. Throughout the literature, Perspective Taking has been described as Theory of Mind of which two types are indicated, the ability to infer what others are thinking (ToM) and the ability understand others emotions (eToM), each which play a critical role in the ability to express empathy for others. Previous research has constantly indicated that individuals with ASD demonstrate impairments in ToM and eToM (Harrison et al., 2009). In the Oldershaw et al. (2011) study, three tasks of empathy that assessed incremental levels of empathy including the Reading the Mind in the Eyes task (basic emotion recognition), the Reading the Mind in the Voice task (basic emotional Theory of Mind), and Reading of the Face task (advanced emotional Theory of Mind) when comparing AN to HC (Oldershaw et al., 2010). Results indicated AN to score significantly better than ASDs participants when recognizing emotions in the eyes (RME), the ability to recognize emotional and mental states from the eye region of the face. However, the ASDs participants were superior to the AN group at inferring emotions felt by

film characters (RMF), the ability to infer complex emotional and mental states expressed during interactions between characters in short film clips. No differences were noted on the Reading the Mind in Voices, a task measuring the ability to infer complex emotional and mental states using only content and intonation of spoken sentences taken out of context. In combination with the present study, it appears that AN patients demonstrate difficulty demonstrating Perspective Taking when compared to HC. And in comparison to an ASDs sample it appears that individuals with AN may struggle with understanding another's' emotion by reading emotions from the eye region of the face. However, individuals with AN demonstrated inferior abilities to infer emotions when reading interactions between characters in a film.

Anorexia Nervosa and Emotional Contagion

Emotional contagion is considered the susceptibility of a person to others' emotions which is often generated through afferent feedback (Doherty, 1997). In the present study no significant differences were observed on the construct of emotional contagion on the total score ($p = .269$, $d = .20$). Additionally, exploratory analyses did not indicate on any of the subscale scores of Happiness, Love, Fear, Anger, Sadness, or Interest in Other's Emotions. Therefore, it appeared that patients with AN are susceptible to another person's emotions similarly to HC. To date, this is the first study to employ the use of a scale measuring emotional contagion in an AN sample. Therefore, no comparison data exists. However, the present study does not support the notion that AN individuals have more difficulty picking up the emotions of others in comparison to HC.

Anorexia Nervosa and Alexithymia

Alexithymia is described as difficulties in perceiving, differentiating, and expressing one's own emotions (Nemiah & Sifneos, 1970). Individuals who are indicated as being alexithymic are often characterized as having a restricted range of mental imagery and a cognitive style that is oriented towards external stimuli (Müller er al., 2004). Therefore, these individuals have a reduced or diminished

ability to identify or communicate feelings. The ability to recognize one's own feelings is regarded as important to be able to recognize the feelings in others and thus, in the ability to display empathy.

In the present study, a significant difference was observed on the total score of the TAS with the AN sample demonstrating an higher level of alexithymia (p = .006). Additionally, a large effect size was noted (d = .88), however the present comparison only had 56% power to detect a difference. These results match findings from Guttman and Laporte (2002) who report the AN group to demonstrate significantly higher levels of alexithymia than a non-clinical sample in addition to difficulty identify feelings and expressing feelings. Interestingly, the AN group was also compared to individuals diagnosed with Borderline Personality Disorder, of which the AN demonstrated significantly lower levels of alexithymia, but still higher than the non-clinical sample. These results however, differ from a study indicating no differences in AN and HC in alexithymia using the TAS-20 in a teenage sample, however, a subgroup of patients did demonstrate significantly higher scores (Råstam et al., 1997). Therefore, it is possible alexithymia may be a contributing factor to maintaining AN. Due to the fact that one's eating disorder often aids in ways to regulate emotion the inability to identify or describe ones' feelings may help maintain the cycle of an eating disorder.

Several exploratory analyses were also run on the subscales of the TAS. While no significant differences were noted in externally oriented thinking, there was a significant difference between groups in the ability to identify feelings and describe feelings.

Anorexia and Emotional Intelligence

Conceptualized according to Salovey and Mayer's model of EI (Salovey & Mayer, 1990), emotional intelligence includes emotional regulation along with recognition and management of emotions. This model identifies four variables that include identifying emotion in oneself and others, using emotion to reason, problem-solve, and make decisions, understanding/analyzing emotion, and managing emotion. A significant difference was noted between the AN and HC groups on a measure of emotional intelligence

indicating that AN demonstrate less emotional intelligence than HC (p = .0015). A large effect size was noted (d = 1.06) indicating a strong likelihood that the present study detected a true difference between groups. These results mirror previous findings that indicate AN as a disorder of emotional dsyregulation (Haynos & Fruzzetti, 2011) along with difficulties with emotional regulation Harrison, Tchanturia, & Treasure, 2010).

Implications

The broad significance of the present study was to underscore the role of empathy in social cognition and interpersonal functioning regarding the development and maintenance of AN in order to inform effective treatment modalities. However, little was gleamed from the present results as it relates to the impact empathy plays in the etiology or maintenance of AN. As it stands now, little research has been conducted exploring the role of interpersonal functioning in AN (McIntosh et al., 2000).

Results do indicate that AN, when compared to HC, struggle in area of functioning that are similar to the ASDs population. This includes, social skills, communication, and set shifting. Additionally, AN patients demonstrate difficulty gaining others' perspectives in relationships which is close related to social cognitive difficulties that individuals with ASDs demonstrate. Additionally, AN patients demonstrated higher levels of alexithymia and lower levels of emotional intelligence in comparison to HC. In combination, the results from this study paint a picture of how AN is maintained. Often times patients with AN utilize their disorder as their voice to express their needs and wants. With difficulties engaging in appropriate social skills and communication, and also struggling to not only understand another person's perspective while experiencing difficulty identifying and describing their own emotions, AN patients may rely heavily on eating disorder behaviors to engage in emotional regulation and cope with stressors in interpersonal relationships. Therefore, psychotherapy that helps to target both the interpersonal and intrapersonal difficulties that AN patients lack would help them to not only function better in their relationships but also understand their own emotional states more clearly.

Continued research focused on the social cognitive function of AN patients has the potential to provide critical empirical evidence to inform evidence-based interventions. Utilization of such information, and its augmentation to existing protocol, may improve the effectiveness and treatment outcomes for AN patients. Similarly, improvement in interpersonal communication among family members may help to improve treatment outcomes in family therapy interventions.

Limitations

Several limitations exist. First, although the present study used sufficient power to detect a true difference in some comparisions, replication with a larger sample size would strengthen the generalizability of the findings. Additionally, ideality an ASDs sample would have been collected in order to make direct comparisons between the AN and ASDs samples, and future research could look into expanding on the present study in this way. In terms of methodology, all measures utilized are self-report. While self-report measures are deemed more efficient, the assessment of behaviors that require a level of insight and introspection in order to assess symptomology is compromised. Moreover, individuals with AN often minimize or mask their symptoms and therefore, tend to be poor self-reports. Additionally, clinical interviews were not conducted in order to assess for eating disorder symptomology. Instead, self-report of diagnosis was utilized. While, all AN patients were required to have received a clinical diagnosis by a mental health professional in order to qualify for the study self-report of diagnoses is not always accurate. Additionally, comorbidity was not assessed and therefore, may impact the present results. Moreover, the HC individuals were not screened for an absence of mental health issues and therefore, the present study relied on their accurate reporting of a lack of a clinical diagnosis. Another limitation inherent in the design of the study is the cross-sectional recruitment of subjects such that AN and HC samples are only assessed at one point in time. Moreover, snowball recruitment was often utilized as participants identified individuals they know who also may be

interested in participating (Feldman & Meyer, 2007). This may limit that sample pool as well. As a result, it is unclear if causality is affected by sampling.

Future Research

The present study should be replicated to include a direct comparison of AN and ASDs populations. Controlling for IQ by selecting a population of high functioning individuals diagnosed with ASDs would be important. Additionally, consideration for gender differences in populations needs to be taken into account and perhaps a mixed gender sample should be utilized. Moreover, more sophisticated measures of empathy should be employed that exclude self-report. The results in the present study may be influenced by the fact that individuals may perceive themselves as more empathetic than they actually are. Therefore, an unbiased measure of empathy would help strengthen the design of the study. Finally, it findings from the present study suggest that the incorporation of social and emotional regulation skills in the treatment of AN is warranted. While novel treatment interventions such as cognitive remediation therapy have been designed in order to target the neuropsychological deficits and associated information processing styles observed within the AN population (Wood et al., 2011) empirical validation for these treatment protocols is necessary.

Future studies should also explore the possibility that emotional intelligence or alexithymia may mediate the relationship that exists regarding the ability of patients with AN to express empathy. Due to the small sample size, the present study was not able to evaluate such effects, however additional research that explores these effects may provide an entry for intervention and highlight malleable factors that impact the relationship between AN and empathy.

REFERENCES

Ahearn, W. H., Castine, T., Nault, K., & Green, G. (2001). An assessment of food acceptance in children with autism or pervasive developmental disorder – not otherwise specified. *Journal of Autism and Developmental Disorders, 31*(5), 505 – 511.

American Psychiatric Association (APA; 2000). *The Diagnostic and Statistical Manual Fourth Edition- Text Revised (DSM-IV-TR).* Washington, DC: American Psychiatric Association.

American Psychiatric Association DSM-5 Development. (2010). Retrieved from: http://www.dsm5.org/Pages/Default.aspx

Anderluh, M. B., Tchanturia, K., Rabe-Hesketh, S., & Treasure, J. (2003). Childhood obsessive-compulsive personality traits in adult women with eating disorders: Defining a broader eating disorder phenotype. *American Journal of Psychiatry, 160*, 242-247.

Armstrong, K., & Iarocci, G. (2013). Brief report: The autism spectrum quotient has convergent validity with the Social Responsiveness Scale in a high-functioning sample. *Journal of Autism and Developmental Disorders.* 10.1007/s10803-013-1769-z

Bagby, R. M., Parker, J. D. A., & Taylor, G. J. (1994). The twenty-item Toronto alexithymia scale: Item selection and cross-validation of the factor structure. *Journal of Psychosomatic Research, 38*, 23 – 32.

Baron-Cohen, S. (2002). The extreme male brain theory of autism. *Trends in Cognitive Sciences, 6*(6), 248 – 252.

Baron-Cohen, S., Richler, J., Bisarya, D., Gurunathan, N., & Wheelwright, S. (2003). The Systemising Quotient (SQ): An investigation of adults with Asperger syndrome or high functioning autism and normal sex differences. *Philosophical Transactions of the Royal Society, Series B, Special issue on "Autism: Mind and Brain," 358,* 361–374.

Baron-Cohen, S., & Wheelwright, S. (2003). The Friendship Questionnaire (FQ): An investigation of adults with Asperger syndrome or high functioning autism, and normal sex differences. *Journal of Autism and Developmental Disorders, 33,* 509–517.

Baron-Cohen, S., & Wheelwright, S. (2004). The empathy quotient: An investigation of adults with Asperger syndrome or high functioning autism, and normal sex differences. *Journal of Autism and Developmental Disorders, 23*(2), 163 – 175.

Baron-Cohen, S., Wheelwright, S., Skinner, R., Martin, J., & Clubley, E. (2001). The autism-spectrum quotient (AQ): Evidence from Asperger syndrome/high-functioning autism, males and females, scientists and mathematicians. *Journal of Autism and Developmental Disorders, 31*(1), 5 – 17.

Batson, C. D. (1991). *The altruism question. Toward a social-psychological answer*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Batson, C. D. (2009). These things called empathy: Eight related but distinct phenomena. In J. Decety & W. Ickes (Eds.), *The Social Neuroscience of Empathy* (pp. 3 – 15). Cambridge, MA: The MIT .

Birmingham, C. L., & Touyz, S., & Harbottle, J. (2009). Are anorexia nervosa and bulimia nervosa separate disorders? Challenging the 'transdiagnostic' theory of eating disorders, *European Eating Disorder Review, 17*, 2-13.

Bizeul, C., Sadowsky, N., Rigaud, D. (2001). The prognostic value of initial EDI scores in anorexia nervosa patients: A prospective follow-up study of 5 – 10 years. Eating Disorder Inventory. *European Psychiatry, 16*(4), 232 - 238.

Bowlby, J. (1973). *Attachment and loss, Vol. 2: Separation.* New York, NY: Basic Books.

Bölte, S., Özkara, N., & Poustka, F. (2002). Autism spectrum disorders and low body weight: Is there really a systematic association?, *International Journal of Eating Disorders, 31*, 3, 349-351.

Bulik, C., Sullivan, P., Fear, J., & Joyce, P. (1997). Eating disorders and antecedent anxiety

disorders: A controlled study. *Acta Psychiatrica Scandinavica, 96*, 101-107.

Carr, L., Iacoboni, M., Dubeau, M., Mazziotta, J. C., & Lenzi, G. L. (2002). Neural mechanisms of empathy in humans: A relay from neural systems for imitation to limbic areas. *Neuroscience, 100*(9), 5497-5502.

Chartrand, T. L., & Bargh, J. A. (1999). The chameleon effect: The perception-behavior link and social interaction. *Journal of Personality and Social Psychology, 76*, 893-910.

Cheng, Y., Meltzoff, A. N., & Decety, J. (2007). Motivation modulates the activity of the human mirror-neuron system. *Cerebral Cortex, 17*, 1979-1986.

Chong, T., Cummington, R., Williams, M. A., Kanwisher, N., Mattingley, J. B. (2008). fMRI adaptation reveals mirror neurons in humans inferior partietal cortex. *Current Biology, 18*, 1576-1580.

Clinton, D., Button, E., Norring, C., & Palmer, R. (2004). Cluster analysis of key diagnostic variables from two independent samples of eating-disorder patients: Evidence for a consistent pattern. *Psychological Medicine, 34*, 1035-1045.

Cohen, J. (1988). Statistical power analysis for the behavioral sciences. Hillsale, NJ: Elbaum.

Collier, D. A., & Treasure, J. L., (2004). The aetiology of eating disorders. *British Journal of Psychiatry, 185*, 363-365.

Cooke, L., Carnell, S., & Wardle, J. (2006). Food neophobia and mealtime food consumption in 4 – 5 year old children. *International Journal of Behavioral Nutrition and Physical Activity, 3*, 14, online.

Cook-Cottone, C. P. (2006). The attuned representation model for the primary prevention of eating disorders: An overview for school psychologists. *Psychology in the Schools, 43*, 223-230.

Cook-Cottone, C. P. (2009). The neuropsychology of eating disorders in women. In E. Fletcher-Janzen (Ed.), *Neuropsychology of women*. New York, NY: Springer Publishing.

Dalgleish, T., Tchanturia, K., Serpell, L., Hems, S., de Silva, P., & Treasure, J. (2001). Perceived control over events in the world in patients with eating disorders: a preliminary study. *Personality and Individual Differences, 31*, 453-460

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

Davies, M., Stankov, L., & Roberts, R. D. (1998). *What remains of emotional intelligence*? Unpublished manuscript.

Davis, M. H. (1980). A multidimentsional approach to individual differences in empathy. JSAS *Catalog of Selected Documents in Psychology, 10*, 85.

Davis, M. H. (1983). Measuring individual differences in empathy: Evidence for a multidimensional approach, *Journal of Personality and Social Psychology, 44*(1), 113 – 126.

Delahunty, A., & Morice, R. (1993). *A training programme for the remediation of cognitive deficits in schizophrenia*. Albury, NSW: Department of Health.

Detecy., J., & Ickes, W. (2009). *The social neuroscience of empathy*. Cambridge, MA: MIT Press.

Dimberg, U., Thunberg, M., & Elmehed, K. (2000). Unconscious facial reactions to emotional facial expressions. *Psychological Science, 11*(1), 86 – 89.

Dix, T. (1991) The affective organization of parenting: Adaptive and maladaptive processes. *Psychological Bulletin. 110,* 3–25

Doherty, R. W. (1997). The emotional contagion scales: A measure of individuals differences. *Journal of Nonverbal Behavior, 21*, 131-154.

Eisler, I., Dare, C., Russell, G. F. M., Szmukler, G. I., le Grange, D., & Dodge, E., (1997). Family and individual therapy in anorexia nervosa. A 5-year follow up. *Achieves of General Psychiatry, 54*, 1025-1030.

Eslinger, P. J. (1998). Neurological and neuropsychological bases of empathy. *European Neurology.* 193 – 199.

Fairburn, C. G., (2008). Cognitive Behavior Therapy and Eating Disorders. New York, NY: Guilford Press.

Fairburn, C. G., & Beglin, S. J. (2008). Eating Disorder Examination Questionnaire. In: Fairburn CG, editor. *Cognitive behavior therapy and eating disorders*. (pp. 308 – 314). New York, NY: Guilford Press

Fairburn C.G., & Bohn K. (2005). Eating disorder NOS (EDNOS): An example of the troublesome "not otherwise specified" (NOS) category in DSM-IV. *Behaviour Research and Therapy, 43*, 691–701.

Feldman, M. B., & Meyer, I. H. (2007). Eating disorder in diverse lesbian, gay, and bisexual populations. *International Journal of Eating Disorders, 40*(3), 218-226.

Fisman, S., Steele, M., Short, J., Byrne, T., & Lavallee, C. (1996). Case study: Anorexia nervosa and autistic disorder in an adolescent girl. *Journal of American Academy of Child and Adolescent Psychiatry, 35*(7). 937-940.

Friederich, H. C., Zastrow, A., Kaiser, S., Stippich, C., Tchanturia, K., Herzog, W. (2008). Cognitive inflexibility in anorexia nervosa – An FMRI perspective. *European Psychiatry, 23*(2), s46-s47.

Frith, U. (1989). *Autism: Explaining the enigma*. Oxford: Blackwell Science.

Gallese, V. (2002). The roots of empathy: The shared manifold hypothesis and the neural basis of intersubjectivity. *Psychopathology, 36*, 171-180.

Gallese, V. (2003). The roots of empathy: The shared manifold hypothesis and the neural basis of intersubjectivity. *Psychopathology, 36*, 171-180.

Gallese, V., Fadiga, L., Fogassi, L., & Rizzolatti, G. (1996). Action recognition in the premotor cortex. *Brain, 119*(2), 593-609.

Gallese, V., & Goldman, A. (1998). Mirror neurons and the simulation theory of mind-reading. *Trends in Cognitive Science, 12*, 493-501.

Gilbert, S. J., Bird, G., Brindley, R., Frith, C. D., & Burgess, P. W. (2008). Atypical recruitment of medial prefontal cortex in autism spectrum disorders: An fMRI study of two executive function tasks. *Neuropsychologia, 46*, 2281 – 2291.

Gillberg, C. (1983). Are autism and anorexia nervosa related? *British Journal of Psychiatry, 142,* 428.

Gillberg, C. (1985). Autism and anorexia nervosa: Related conditions? *Nord Psykiatr Tidsskr, 39*, 307-312.

Gillberg, C., Billstedt, E., Wentz, E., Anckarsater, H., Rastam, M., & Gillberg, C. (2010). Attention, executive functions, and mentalizing in anorexia nervosa eighteen years after onset of eating disorder. *Journal of Clinical and Experimental Neuropsychology, 32*(4), 358 – 365.

Gillberg, C., Gillberg, C., Råstam, M., & Johansson, M. (1996). The cognitive profile of anorexia nervosa: A comparative study including a community-based sample. *Comprehensive Psychiatry, 37*(1), 23 – 30.

Gillberg, C., & Råstam, M. (1992). Do some cases of anorexia nervosa reflect underlying autistic-like conditions? *Behavioral Neuropsychology, 5*, 27-32.

Gillberg, C., & Råstam, M, & Gillberg, C. (1994). Anorexia nervosa: Physical health and neurodevelopment at 16 and 21 years. *Developmental Medicine and Child Neurology, 36*, 567 – 575

Gillberg, C., & Råstam, M, & Gillberg, C. (1995). Anorexia nervosa 6 years after onset: 1. Personality disorders. *Comprehensive Psychiatry, 35*, 61 – 69.

Gillberg, C., Råstam, M., Wentz, E., & Gillberg, C. (2007). Cognitive and executive functions in anorexia nervosa ten years after onset of eating disorder. *Journal of Clinical and Experimental Neuropsychology, 26*(2), 170 – 178.

Gillberg v. Sweden: Conviction of professor for refusal to grant access to sensitive research date not in breach of ECHR (2010). Retrieved from: http://strasbourgobservers.com/2010/11/22/european-court-of-human-rights-gillberg-v-sweden.

Gorden, R. M. (1995). Sympathy, simulation, and the impartial spectator. *Ethics, 105*, 727, 742.

Greaves, N., Prince, E., Evans, D. W., & Charman, T. (2006). Repetitive and ritualistic behaviour in children with Prader-Willi syndrome and children with autism. *Journal of Intellectual Disability Research, 50*(Pt 2), 92 – 100.

Guttman, H. A., & Loporte, L. (2000). Empathy in families of women with borderline personality disorder, anorexia nervosa, and a control group. *Family Process, 39*(3), 345-358.

Guttman, H. A., & Loporte, L. (2002). Alexithymia, empathy, and psychological symptoms in family context. *Comprehensive Psychiatry, 43*(6), 448 - 455.

Hadjikhani, N., Joseph, R., Snyder, J., & Tager-Flusberg, H. (2006). Anatomical differences in the mirror neuron system and social cognition network in autism. *Cerebral Cortex, 16*, 1276-1282.

Halmi, K., Agras, W. S., Crow, S., Mitchell, J., Wilson, G., Bryson, S., et al. (2005). Predictors of treatment acceptance and completion in anorexia nervosa. *Archives of General Psychiatry, 62*, 776 – 781.

Halmi, K. A., Eckert, E., Marchi, P., Sampugnaro, V., Apple, R., & Cohen, J. (1991). Comorbidity of psychiatric diagnoses in anorexia nervosa. *Achieves of General Psychiatry, 48*, 712-719.

Hambrook, D., Tchanturia, K., Schmidt, U., Russell, T., & Treasure, J. (2008). Empathy, systemizing, and autistic traits in anorexia nervosa: A pilot study. *British Journal of*

Clinical Psychology, 47, 335-339.

Harrison, A., Sullivan, S., Tchanturia, K., & Treasure, J. (2009). Emotion recognition and regulation in anorexia nervosa. *Clinical Psychology and Psychotherapy, 16*(4), 348-356.

Harrison, A., Tchanturia, K., & Treasure, J. (2010). Attentional bias, emotion recognition, and emotion regulation in Anorexia: State or trait? *Biological Psychiatry, 68*, 755-761.

Hatfield, E., Cacioppo, J. T., & Rapson, R. L. (1994) Emotional contagion. New York, NY: Cambridge University Press.

Haynos, A. F., & Fruzzetti, A. E. (2011). Anorexia nervosa as a disorder of emotional dysregulation: Evidence and treatment implications. *Clinical Psychology: Science and Practice, 18*(3), 183 – 202.

Hebebrand, J., Henninghausen, K., Nau, S., Himmelmann, G. W., Schulz, E., Schafer, H., & Remschmidt, H. (1997). Low body weight in male children and adolescents with schizoid personality disorder of Asperser's disorder. *Acta Psychiatrica Scandinavica, 96*, 64-67.

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

Hinrichsen, H., Wright, R., Waller, G., & Meyer, G. (2003). Social anxiety and coping strategies in the eating disorders. *Eating Behaviors, 4*(2), 117 – 126.

Hoffman, M. L. (1981). The development of empathy. In J. P. Rushton & R. M. Sorrentino (Eds.), *Altruism and helping behavior: Social, personality, and Developmental Perspectives* (pp. 41 – 63). Hillsdale, NJ: Erlbaum.

Holliday, J., Tchanturia, K., Landau, S., Collier, D., & Treasure, J. (2005). Is impaired set-shifting an endophenotype of anorexia nervosa? *American Journal of Psychiatry, 162*, 2269-2275.

Horowitz, L. M., Rosenberg, S. E., & Bartholomew, K. (1993). Interpersonal problems, attachment styles, and outcome in brief dynamic psychotherapy. *Journal of Consulting and Clinical Psychology, 61*(4), 549 – 560.

Hurst, R., Mitchell, J., Kimbrel, N., Kwapil, T., & Nelson-Gray, R. (2007). Examination of the reliability and factor structure of the Autism Spectrum Quotient (AQ) in a non-clinical sample. *Personality and Individual Differences, 43*, 1938-1949.

Iacoboni, M. (2009). Imitation, empathy, and mirror neurons. *Annual Review of Psychology, 60*, 653-670.

Iacoboni, M. (2008). *The New Science of How We Connect With Others: Mirroring People*. New York, NY: Farrar, Straus, and Giroux.

Iacoboni, M., & Dapretto, M. (2006). The mirror neuron system and the consequences of its dysfunction. *Nature Publishing Group, 7*, 942-951.

Iacoboni, M., Woods, R. P., Brass, M., Bekkering, H., Mazziotta, J. C., & Rizzolatti, G. (1999). Cortical mechanisms of human imitation, *Science, 286*, 2526-2528.

Jacobi, C., Hayward, C., de Zwaan, M., Kraemer, H. C., & Agras, W. S. (2004). Coming to terms with risk factors for eating disorders: Application of risk terminology and suggestions for a general taxonomy. Psychological Bulletin, 130(1), 19 – 65.

Johnson, C. R., Handen, B. L., Mayer-Costa, M., & Sacco, K. (2008). Eating habits and dietary status in young children with autism. Journal of Developmental and Physical Disabilities, 20, 437 – 448.

Jolliffe, D., & Farrington, D. P. (2006). Development and validation of the Basic Empathy Scale. *Journal of Adolescence, 29*, 589 – 611.

Kalyva, E. (2009). Comparison of eating attitudes between adolescent girls with and without Asperger syndrome: Daughters' and mothers' report. *Journal of Autism and Developmental Disorders, 39*, 480-486.

Karwautz, A., Troop, N., Rabe-Hesketh, S., Collier, D., & Treasure, J. (2003). Personality disorders and personality dimensions in anorexia nervosa. *Journal of Personality Disorders, 17*(1), 73 – 85.

Kaye, W. H., Bulik, C. M., Thornton, L., Barbarich, N., & Masters, K. (2004). Comorbidity of

anxiety disorders with anorexia and bulimia nervosa. *American Journal of Psychiatry, 161*, 2215-2221.

Kaye, W. H., Fudge, J. L., & Paulus, M. (2009). New insights into symptoms and neurocircuit function of anorexia nervosa. *Nature Reviews: Neuroscience*, *10*, 573 - 584.

Kaye, W. H., Klump, K. L., Frank, G. K., & Strober, M. (2000). Anorexia and bulimia. *Annual Review of Medicine, 51*, 299 – 313.

Keel, P. K., Dorer, D. J., Eddy, K. T., Franko, D., Charaton, D. L., & Herzog, D. B. (2003). Predictors of mortality in eating disorders. *Archives of General Psychiatry, 60*, 179 – 183.

Kerwin, M. L., Eicher, P. S., & Gelsinger, J. (2005). Parental report of eating problems and gastrointestinal symptoms in children with pervasive developmental disorders. *Children's Health Care, 34*, 221 – 234.

Kingston K., Szmukler G., Andrewes D., Tress B., & Desmond P. (1996). Neuropsychological and structural brain changes in anorexia nervosa before and after refeeding *Psychological Medicine. 26*(1):15-28.

Kinnell, H. G. (1985). Pica as a feature of autism. *British Journal of Psychiatry, 147*, 80-82.

Kinnell, H. G. (1983). Feeding difficulties in infantile autism, *Nursing Times, 79*, 52-53.

Lawson, J., Baron-Cohen, S., Wheelwright, S. (2004). Empathising and systemizing in adults with and without Asperger syndrome. *Journal of Autism and Developmental Disorders, 34*, 301 – 310.

Leslie, K. R., Johnson-Frey, S. H., & Grafton, S. T. (2003). Functional imaging of face and hand imitation: Towards a motor theory of empathy. *NeuroImage, 21*, 601-607.

Lipps, T. (1903). Einfuhlung, inner Nachahmung, ung Organ-empfindungen. *Archiv fur die gesamte Psychologie, 1,* 185 – 204.

Lopez, C., Tchanturia, K., Stahl, D., & Treasure, J. (2009). Weak central coherence in eating disorders: A step towards looking for an endophenotype of eating disorders. *Journal of Clinical and Experimental Neuropsychology, 31*(1), 117-125.

Lopez, C., Tchanturia, K., Stahl, D., Booth, R., Holliday, J., & Treasure, J. (2008). An examination of the concept of central coherence in women with anorexia nervosa. *International Journal of Eating Disorders, 41*(2), 143-152.

Luiselli, J. K., Medeiros, J., Jasinowski, C., Smith, A., & Cameron, M. J. (1994). Behavioral medicine treatment of ruminative vomiting and associated weight loss in an adolescent with autism, *Journal of Autism and Developmental Disorders, 24*(5), 619-629.

Maes, J., Eling, P., Wezenberg, E., Vissers, & Kan, C. C. (2010). Attentional set shifting in autism spectrum disorder: Differentiating between the role of perseveration, learned irrelevance, and novelty processing. *Journal of Clinical and Experimental Neuropsychology, 33*(2), 210-217.

Martins, Y., Young, R. L., & Robson, D. C. (2008). Feeding and eating behaviors in children with autism and typically developing children. *Journal of Autism and Developmental Disorders, 38,* 1878 – 1887.

Matsunaga, H., Kiriike, N., Iwasaki, Y., Miyata, A., Yamagami, S. & Kaye, W. (1999). Clinical characteristics in patients with anorexia nervosa and obsessive-compulsive disorder, *Psychological Medicine, 29*, 407 – 414.

McAnarney, E. R., Zarcone, J., Singh, P., Michels, J., Welsch, S., Litteer, T. et al (2011). Restrictive anorexia nervosa and set-shifting in adolescents: A biobehavioral interface. Society for Adolescent Health and Medicine. DOI: 10.1016/j.jadohealth.2010.11.259.

McIntosh, V. V. W., Bulik, C. M., McKenzie, J. M., Luty, S. E., & Jordan, J. (2000). Interpersonal psychotherapy for anorexia nervosa. *International Journal of Eating Disorders, 27*, 125-139.

McIntosh, V. V. W., Jordan, J., Carter, F. A., Luty, S. E., McKenzie, J. M., Bulik, C. M., et al (2005). Three psychotherapies fore anorexia nervosa: A randomized, control trial. *American Journal of Psychiatry, 163,* 741-747.

McIntosh, V. V. W., Jordan, J., Luty, S. E., Carter, F. A., McKenzie, J. M., Bulik, C. M., et al. (2006). Specialist supportive clinical management for anorexia nervosa. *International Journal of Eating Disorders, 39*, 625-632.

Melfsen, S., Walitza, S., & Warnke, A. (2006). The extent of social anxiety in combination with mental disorders. *European Child & Adolescent Psychiatry, 15*, 111 – 117.

Milos G., Spindler A., Schnyder U., & Fairburn C. G. (2005). Instability of eating disorder diagnoses: prospective study. *British Journal of Psychiatry, 187*, 573–578

Mitchell, J. E., Cook-Myers, T., & Wonderlich, S. A. (2005). Diagnostic criteria for anorexia nervosa: Looking ahead to DSM-V. *International Journal of Eating Disorders, 37*, S95 – S97.

Muhlau, M., Gaser C., Ilg, R., Conrad, B., Leibl, C., Cebulla, MH., Backmund, H., Gerlinghoff, M., Lommer, P., Schnebel, A., Wohlschlager, A. M., Zimmer, C., & Nunnemann, S. (2007). Gray matter decrease of the anterior cingulate cortex in anorexia nervosa *American Journal of Psychiatry. 164*(12):1850-7

Müller, J., Bühner, M., & Ellgring, H. (2004). The assessment of alexithymia: Psychometric properties and validity of the Bermond-Vorst Alexithymia Questionnaire. *Personality and Individual Differences*, *37*(2), 373–391

Nakazato, M., Hashimoto, K., Schmidt, U., Tchanturia, K., Campbell, I. C., Collier, D. A., Iyo, M., & Treasure, J. (2010). Serum glutamine, set-shifting ability and anorexia nervosa. *Annals of General Psychiatry, 9*, 1-9.

Nemiah, J. C., & Sifneos, P. E. (1970). Psychosomatic illness: A problem in communication. *Psychotherapy and Psychosomatics, 18,* 154–160.

Oldershaw, A., Treasure, J., Hambrook, D., Tchanturia, K., & Schmidt, U. (2011). Is anorexia nervosa a version of autism spectrum disorders? *European Eating Disorder Review*. DOI: 10.1002/erv/1069.

O'Riordan, M., & Plaisted, K. (2001). Enhanced discrimination in autism. *Quarterly Journal of Experimental Psychology, 54A*, 961–979.

Passi, V. A., Bryson, S. W., & Lock, J. (2003). Assessment of eating disorders in adolescents with anorexia nervosa: Self-report questionnaire versus interview. *International Journal of Eating Disorders, 33*, 45 – 54.

Pawluk, D. E. & Gorey, K. M. (1998). Secular trends in the incidence of anorexia nervosa: Integrative review of population-based studies. *International Journal of Eating Disorders, 23*(4), 347-352

Pearce, J. M. (2004). Richard Morton: Origins of anorexia nervosa. *European Neurology, 52*(4), 191 – 192.

Peterson, C. B., Crosby, R. D., Wonderlich, S. A., Joiner, T., Crow, S. J., Mitchell, J. E., Bardone-Cone, A. M., Klein, M., & Le Grande, D. (2007). Psychometric properties of the Eating Disorder Examination-Questionnaire: Factor structure and internal consistency. *International Journal of Eating Disorders, 40*, 386 – 389.

Preston, S. D., & de Waal, F. B. (2002). Empathy: Its ultimate and proximate bases. *Behavior and Brain Science, 25*(1), 1 – 20.

Raja, M., Azzoni, A., & Giammarco, V. (1998). Diabetes insipidus and polydipsia in a patient with Asperger's disorder and an empty sella: A case report. *Journal of Autism and Developmental Disorders, 28*(3), 235 – 239.

Råstam, M. (1992). Anorexia nervosa in 51 Swedish children and adolescents. Premorbid problems and comorbidity. *Journal of American Academy of Child and Adolescent Psychiatry, 31*, 819 – 829.

Råstam, M. (2008). Eating disturbances in autism spectrum disorders with focus on adolescent

and adult years. *Clinical Neuropsychiatry, 5*(1), 31-42.

Råstam, M., Gillerg, I. C., Gillberg, C., Johansson, M. (1997) Alexithymia in anorexia nervosa: A controlled study using the 20-item Toronto Alexithymia Scale. *Acta Psychiatrica Scandinavica, 95*, 385 – 388.

Råstam, M., Gillberg, C., & Wentz, E. (2003). Outcome of teenage anorexia nervosa in a Swedish community-based sample. *European Child and Adolescent Psychiatry, Suppl 1, 12*, 78-90.

Rizzalatti, G., Fadiga.,L., Gallese, V., & Fogassi, L. (1996). Premotor cortex and the recognition of motor actions. *Brain Research. Cognitive Brain Research, 3*(2), 131-141.

Roberts, M. E., Tchanturia, K., Stahl, D., Southgate, L., & Treasure, J. (2007). A systematic review and meta-analysis of set-shifting ability in eating disorders. *Psychological Medicine, 37*, 1075-1084.

Ruby, P., & Decety, J. (2004). How would you feel versus how do you think she would feel? A neuroimaging study of perspective taking with social emotions. *Journal of Cognitive Neuroscience, 16*, 988 – 999.

Ruffman, T., Perner, J., & Parkin, L. (1999). How parenting style affects false belief understanding. *Social Development, 8*, 395 – 411.

Sachdev, P., Mondraty, N., Wen, W., & Gulliford, K. (2008). Brains of anorexia nervosa patients process self-images differently from non-self-images: An fMRI study. *Neuropsychologia, 46,* 2161-2168.

Salovey, P., & Mayer, J. D. (1990). Emotional intelligence. *Imagination, Cognition, and Personality, 9*, 185 – 211.

Santel, S., Baving, L., Krauel, K., Munte, T., Rotte, M. (2006). Hunger and satiety in anorexia nervosa: fMRI during cognitive processing of food pictures. *Brain Research, 1114*(1), 138-148

Scheck, K. A., Williams, K., & Smith, A. F. (2004). A comparison of eating behaviors between children with and without autism. *Journal of Autism and Developmental Disorders, 24*(4), 433 – 438.

Schmidt, U., & Treasure, J. (2006). Anorexia nervosa: Values and visible. A cognitive-interpersonal maintenance model and its implications for research and practice. *The British Psychological Society, 45*, 343-366.

Schulte-Rüther, M., Greimel, E, Markowwitsch, H. J., Kamp-Becker, I., Remschmidt, H., Fink, G. R., & Piefke, M. (2011). Dysfunctions in brain networks supporting empathy: An fMRI study in adults with autism spectrum disorders. *Social Neuroscience, 6*(1), 1 – 21.

Schulte-Rüther, M., Markowitsch, H. J., Fink, G. R., & Piefke, M. (2007). Mirror neuron and theory of mind mechanisms involved in face-to-face interactions: A functional magnetic resonance imaging approach to empathy. *Journal of Cognitive Neuroscience, 19*(8), 1354 – 1372.

Schutte, N.S., Malouff, J.M., Hall, L.E., Haggerty, D.J., Cooper, J.T., Golden, C.J., et al. (1998). Development and validation of a measure of emotional intelligence. *Personality and Individual Differences, 25,* 167-177.

Shafritz, K. M., Dichter, G. S., Baranek, G. T., & Belger, A. (2008). The neural circuitry mediating shifts in behavioral response and cognitive set in autism. *Biological Psychiatry, 63*, 974 – 980.

Silberg, J. L., & Bulik, C. M. (2005). The developmental association between eating disorders symptoms and symptoms of depression and anxiety in juvenile twin girls. *Journal of Child Psychology and Psychiatry, 46*(12), 1317-1326.

Simonoff, E., Pickles, A., Charman, T., Chandler, S., Loucas, T., & Baird, G. (2008). Psychiatric disorders in children with autism spectrum disorders: Prevalence, comorbidity, and associated factors in a population-derived sample. *Journal of American Academy of Child and Adolescent Psychiatry, 47*(8), 921-929.

Smith, A. (2009). The empathy imbalance hypothesis of autism: A theoretical approach to cognitive and emotional empathy in autistic development. *The Psychological Record, 59*, 273-294.

Smith, A., & Cook-Cottone, C. P. (2011). A review of family therapy as an effective intervention for

anorexia nervosa in adolescents. *Journal of Clinical Psychology in Medical Settings.* Online First, 14 October 2011, DOI: 10.1007/s10880-011-9262-3.

Southgate, L., Tchanturia, K., & Treasure, J. (2008). Information processing bias in anorexia nervosa. *Psychiatry Research, 160*, 221-227.

Spreng, R. N., McKinnon, M. C., Mar, R. A., & Levine, B. (2009). The Toronto empathy Questionnaire: Scale development and initial validation of a factor-analytic solution to multiple empathy measures. *Journal of Personality Assessment, 91*(1), 62 – 71.

Steinglass, J. & Walsh, B. T. (2006). Habit learning and anorexia nervosa: a cognitive neuroscience hypothesis. *International Journal of Eating Disorders 39*, 267–275.

Steinglass, J. E., Walsh, B. T. & Stern, Y. (2006). Set shifting deficit in anorexia nervosa. *Journal of the International Neuropsychological Society 12*, 431–435.

Stiver, R. L., & Dobbins, J. P. (1980). Treatment of atypical anorexia nervosa in public schools: An autistic girl. *Journal of Autism and Developmental Disorders, 10*, 67-73.

Tchanturia, K., Campbell, I. C., Morris, R., & Treasure, J. (2005). Neuropsycological studies in anorexia nervosa. *International Journal of Eating Disorders, 37*(S1), S72-S76.

Tchanturia, K., Davies, H., & Campbell, I. C., (2007). Cognitive remediation therapy for patients with anorexia nervosa: Preliminary findings. *Annals of General Psychiatry, 6*, 1 – 6.

Tchanturia, K., Morris, R. G., Anderluh, M. B., Collier, D. A., Nikolaou, V., & Treasure, J. (2004). Set shifting in anorexia nervosa: An examination before and after weight gain, in full recovery and relationship to childhood and adult OCPD traits. *Journal of Psychiatric Research, 38*(5), 545-552.

Terai, K., Munesue, T., & Hiratani, M. (1999). Excessive water drinking behavior in autism. *Brain and Development, 21*(2), 103 – 106.

Thomas, J. J., Vartanian, L. R., & Brownell, K. D. (2009). The relationship between eating disorder not otherwise specified (EDNOS) and officially recognized eating disorders: Meta-analysis and implications for DSM. *Psychological Bulletin, 135*(3), 407 – 433.

Tichener, E. B. (1909). *Lectures on the experimental psychology of thought processes*. New York, NY: Macmillan.

Timimi, S., Douglas, J., & Tsiftsopoulou, K. (1997). Selective eaters: A retrospective case note study. *Child: Care, Health, and Development, 23*, 265 – 278.

Troisi A, Massaroni P, Cuzzolaro M. (2005). Early separation anxiety and adult attachment style in women with eating disorders. *British Journal of Clinical Psychology 44*(1):89-97.

Uher, R., Murphy, T., Brammer, M. J., Dalgleish, T., Phillips, M. L., Ng, V. W., Andrew, C., Williams, S., Campbell, I., & Treasure, J. (2004) Medial prefrontal cortex activity associated with symptom provocation in eating disorders. *American Journal of Psychiatry, 161*, 1238 – 1246.

Van der Gaag, C., Minderaa, R. B., & Keysers, C. (2007). Facial expression: What the mirror neuron system can and cannot tell us. *Social Neuroscience, 2*(3-4), 179-222.

Volker, M. A., Thomeer, M. L., & Lopata, C. (2011). Pervasive developmental disorders. In A. Davis (Ed.), *Handbook of Pediatric Neuropsychology* (pp. 501 – 536). New York, NY: Springer.

Wagner A. Aizenstein H. Venkatraman VK. Fudge J. May JC. Mazurkewicz L. Frank GK. Bailer UF. Fischer L. Nguyen V. Carter C. Putnam K. Kaye WH. (2007) Altered reward processing in women recovered from anorexia nervosa *American Journal of Psychiatry. 164*(12):1842-9

Ward, A., Ramsay, R., & Treasure, J. (2000) Attachment research in eating disorders. *British Journal of Medical Psychology, 73*(Pt 1), 35-51.

Ward, A., Ramsay, R., Turnball., S., Steele, M., Steele, H., & Treasure, J. (2001). Attachment in anorexia nervosa: A transgenerational perspective. *British Journal of Medical Psychology, 74*(Pt 4), 497-505.

Wentz, E., Lacey, J. H., Waller, G., Råstam, M., Turk, J., & Gillberg, C. (2005). Childhood onset neuropsychiatric disorders in adult eating disorder patients: A pilot study. *European Child and Adolescent Psychiatry, 14*, 431 – 437.

Williams, E., Thomas, K., Sidebotham, H., & Emond, A. (2008). Prevalence and characteristics of autistic spectrum disorders in the ALSPAC cohort. *Developmental Medicine in Child Neurology, 50*(9), 672 – 677.

Williams, P. G., Darlymple, N., & Neal, J. (2000). Eating habits of children with autism. *Pediatric Nursing, 26*, 259 – 264.

Williams, J. H. G., Whiten, A., Suddendorf, T., & Perrett, D. I. (2001). Imitation, mirror neurons and autism. *Neuroscience and Biobehavioral Reviews, 25*, 287-295.

Wispe, L. (1968). Sympathy and empathy. In D. L. Sills (Ed.), International encyclopedia of the social sciences (Vol. 15, pp. 441 – 447). New York, NY: Free Press.

Wolk, S. L., Loeb K. L., & Walsh, B. T. (2005). Assessment of patients with anorexia nervosa: Interview verse self-report. *International Journal of Eating Disorders, 29*, 401 – 408.

Wood, L., Al-Khairulla, H., & Lask, B. (2011). Group cognitive remediation therapy for adolescents with anorexia nervosa. *Clinical Child Psychology and Psychiatry, 16*(2), 225-231.

Woodbury-Smith, M., Robinson, J., Wheelwright, S., & Baron-Cohen, S. (2005). Screening adults for Asperger syndrome using the AQ: A preliminary study of its diagnostic validity in clinical practice. *Journal of Autism and Developmental Disorders, 35*(3), 331–335.

Yerys, B. E., Wallace, G., Harrison, B., Celano, M., Giedd, J., & Kenworthy, L. E. (2009). Set-shifting in children with autism spectrum disorders: Reversal shifting deficits on the intradimensional/extradimensional shift test correlate with repetitive behaviors. *Autism, 13*(5), 523-539.

Yuan, T., & Hoff, R. (2008). Mirror neuron system based therapy for emotional disorders. *Medical*

Hypothesis, 71, 722-726.

Zahn-Waxler, C., Robinson, J. L., & Emde, R. N. (1992). The development of empathy in twins. *Developmental Psychology, 28*, 1038 – 1047.

Zucker, N. L., Losh, M., Bulik, C. M., LaBar, K. S., Piven, J., & Pelphrey, K. A. (2007). Anorexia nervosa and autism spectrum disorders: Guided investigation of social cognitive endophenotypes. *Psychological Bulletin, 133*(6), 976-1006.

APPENDIX A: ASSESSMENT RESULTS FORM

Are you interested in receiving feedback regarding the results of the present assessment? This report would include information on your interpersonal functioning and tendency to express empathy in relationship to others. Some individuals struggling with eating issues have found this type of information helpful.

YES NO

If, yes please complete the Release of Information on the following page.

Address where you would like the assessment sent:

Name and Address: _____
_____
_____
_____

Phone Number: _____

E-mail Address: _____

Your home address and contact information in case we need to contact you regarding assessment results:

Name and Address: _____
_____
_____
_____

Phone Number: _____

E-mail Address: _____

APPENDIX B: RELEASE OF INFORMATION

Authorization for Disclosure of Protected Health Information

I authorize the use/disclosure of health information about me/my child as described below

Patient Name: _____

Patient's Date of Birth: _____

B. Person(s) or Organizations(s) authorized to receive the information:

Amanda Smith, M.S. and Catherine Cook-Cottone, Ph.D., Licensed Psychologist

and

Name, position, address, and phone of other professional (e.g., Primary Care and/or Treating Physician, Nutritionist, and/or Primary Therapist)

_____
_____
_____
_____

C. Specific description of the information that may be used or disclosed (including dates):

Feedback on Completed Assessment (doesn't include information regarding assessments on diagnostic specific behavior)

D. Specific description of how the information will be used:

Assist in treatment process (at the treatment providers discretion)

1. I understand that this authorization will expire on _____ (date).
2. I understand that I may revoke the authorization (except to the extent that action was already taken in compliance with this signed authorization) at any time by notifying Amanda Smith in writing.
3. I understand that I can refuse to sign this authorization and that my refusal will not affect my ability to obtain treatment, payment, or my eligibility for benefits (if applicable).
4. I may inspect or copy any information used or disclosed under this agreement.
5. I understand that if the person or organization that receives the information is not a health care provider or plan covered by the federal privacy regulations, the information described above may be redisclosed and would no longer be protected by these regulations.

Patient's Signature or Patients representative	Date
Printed Name of Patient or Patient's Representative	Relationship to the Patient

Note: You have the right to know specifically what information you are authorizing for release (e.g., "results of lab tests performed on 1/4/04" or, if your entire medical record is included, "all health information"). You have a right to know the name(s) or other identification of the person(s) or organization(s) authorized to release this information (e.g., the names of your health care provider(s)). You have the right to know who is going to use it and what it is going to be used for (e.g., John Smith, Ph.D./Research).

You have a right to receive a copy of this form.

HIPAA Authorization for Release of Information
This form does not constitute legal advice and covers only federal, not state, laws.

APPENDIX C: DEMOGRAPHIC INFORMATION AND FAMILY HISTORY

Please provide the following demographic information:

Age (in years): _____
Biological Sex: _____
Race/Ethnicity: _____
Current Height: _____
Current Weight: _____
Level of Education: _____

Eating Disorder Diagnosis

1. Are you currently diagnosed with an Eating Disorder? Yes No
   If so, please check one of the following:

   ____ Bulimia

   ____ Anorexia

   ____ Binge Eating Disorder

   ____ Eating Disorder Not Otherwise Specified (EDNOS)

2. Have you previously been diagnosed with an eating disorder? Yes No
   If so, please check one of the following:

   ____ Bulimia

   ____ Anorexia

   ____ Binge Eating Disorder

   ____ Eating Disorder Not Otherwise Specified (EDNOS)

Autism Spectrum Diagnosis

3. Are you currently diagnosed with an Autism Spectrum Disorder? Yes No
   If so, please check on of the following

   ____ High Functioning Autism Disorder

   ____ Asperger Syndrome

   ____ PDD-NOS

FAMILY HISTORY: Please indicate any mental health diagnoses within your family along with the family member.

Diagnosis	Family Member

APPENDIX D: CURRICULUM VITA

EDUCATIONAL AND PROFESSIONAL EXPERIENCE

July 2012	-	June 2013	**Psychology Intern, Predoctoral Internship in Clinical Psychology, Child and Adolescent Track,** University of Rochester Medical Center; School of Medicine and Dentistry American Psychological Association Accredited Program Child and Adolescent Track Director: Jennifer West, Ph.D.
August 2008	-	September 2013	**Doctor of Philosophy, Combined Counseling and School Psychology**, University of Buffalo, State University of New York, Buffalo, NY American Psychological Association Accredited Program Dissertation: An Exploration of the Social Neuroscience of Empathy in Anorexia Nervosa and Autism Spectrum Disorders Committee Members: Drs. Catherine Cook-Cottone, Martin Volker, & Michele Shanahan Degree Completion: September 2013
August 2007	-	May 2008	**Doctor of Philosophy, Counseling Psychology**, Gannon University, Erie, PA Transferred: May 2008 *(program closed)*
January 2006	-	March 2008	**Masters of Science, Exercise and Sport Sciences**, Ithaca College, Ithaca, NY Major Concentration: Sport Psychology Masters Thesis: A Qualitative Investigation of the Impact of Mothers, Peers, and Coaches on Eating Disorders in Female Student – Athletes Committee Members: Drs. Greg Shelley, Noah Gentner, & Jeff Ives Graduated: March 2008
August 2002	-	December 2005	**Bachelor of Science, Exercise Science,** Magna cum Laude, Ithaca College, Ithaca, NY Minor Concentration: Nutritional Science Graduated: December 2005

CLINICAL EXPERIENCE

Outpatient/Community Mental Health Clinic

Child and Adolescent Outpatient Clinic: Department of Psychiatry (July 2012 – present)
Population Served: Children, adolescents and their families with mental health concerns
Responsibilities: Doctoral psychology intern with a caseload of 12-18 children/adolescents in an outpatient clinic; Conduct diagnostic evaluations and interviews; participate in diagnostic clinic; implement psychological interventions and treatment; consult with psychiatric staff regarding client care and medication consultation; facilitate psychotherapy groups; participate in Committee on Special Education meetings; engage in parent training and school-based consultation
Clinical Supervisors: Jennifer West, Ph.D. and Kristen Davidson, Ph.D.

Child and Adolescent Outpatient Clinic: Department of Psychiatry (August 2010 – June 2012)
Population Served: Children, adolescents and their families with mental health concerns
Responsibilities: Doctoral psychology extern with a caseload of 10-12 children/adolescents in an outpatient clinic; Conducted diagnostic evaluations and interviews; participated in diagnostic clinic; implemented psychological interventions and treatment; consulted with psychiatric staff regarding client care and medication consultation; facilitated psychotherapy groups; participated in Committee on Special Education meetings; engaged in parent training and school-based consultation
Clinical Supervisors: Linda Alpert-Gillis, Ph.D. and Kenya Malcom Ph.D.

Greater Buffalo Counseling Center, Buffalo, NY (March 2011 – December 2011)
Population Served: Adults with mental health concerns
Responsibilities: Conducted and implemented psychological interventions and treatment though a client-centered model of care; consulted with clinic psychologists and social workers regarding patient treatment; participated in group supervision
Direct Supervisor: Cathy Dollar, Ph.D.

Psychological Services Clinic, Gannon University, Erie, PA (August 2007 – May 2008)
Population Served: Underserved individuals in the Erie community
Responsibilities: Conducted therapy utilizing cognitive-behavioral and interpersonal psychotherapy; participated in live-supervision model; participated in weekly group supervision; assisted with client eligibility for treatment on intake team
Direct Supervisors: Robert Nelsen, Ph.D. and Jesse Owen, Ph.D.

Family Solution Center, Cheektowaga – Sloan School District, Sloan, NY (January 2010 – May 2010)
Population Served: Children and families in the Cheektowaga – Sloan School District
Responsibilities: Worked to serve children and families through a brief, solution-focused model; participated in live-supervision model; completed case notes and provided feedback to team members
Direct Supervisor: Mr. Bob Williams

Inpatient Experience

Strong Inpatient Unit: Golisano Children's Hospital (January 2013 – Present)
Population Served: Children and adolescents ages hospitalized for severe behavioral, psychological, and mental health concerns
Responsibilities: Doctoral psychology intern who provides clinical services on the Child and Adolescent Psychiatric Inpatient Service; implement process-group therapy; design and implement mindfulness group for adolescents; conduct family movie nights to improve family communication skills; provide brief, individual interventions for patients with severe psychopathology; conduct psychodiagnostic testing and assessments for patients in the partial hospitalization and inpatient settings
Clinical Supervisor: Deanna Sams, Ph.D.

Pediatric Hospital Experience

Strong Pediatric Clinic: Golisano Children's Hospital (July 2012 – December 2012)
Population Served: Children and adolescents ages birth to 21 years old in a primary care setting
Responsibilities: Doctoral psychology intern provided psychological and behavior health consultation, diagnostic assessment, and treatment to children and adolescents referred through the Pediatric Clinic at the Golisano Children's Hospital; consulted with pediatricians, pediatric psychiatrists, and nursing staff regarding patient care and medication regimens
Clinical Supervisor: Sarah Jonovich, Ph.D.

Group Experience

Social Skills Group Leader: Child and Adolescent Outpatient Clinic (August 2010 – Present)
Population Served: Children with social skills deficits and co-occurring mental health concerns at the Child and Adolescent Outpatient Clinic
Responsibilities: As a doctoral psychology intern prepares and facilitates social skills group for children diagnosed with a variety of mental health concerns
Clinical Supervisor: Christine Brent, LMSW-R

Eating Disorder Support Group, Buffalo Centre Eating Disorder Program, Amherst, NY (June 2010 – June 2012)
Population Served: Adolescents, young adults, adults diagnosed with eating disorders

Responsibilities: Co-led a support group for individuals with a history of eating disordered behavior s or current diagnoses of eating disorders
Direct Supervisor: Catherine Cook-Cottone, Ph.D.

School-Based Group Leader, Williamsville School District, Williamsville, NY (January 2009 – May 2009)
Population Served: 5th grade females
Responsibilities: Facilitated a school-based prevention group designed within a positive psychology framework to enhance emotional, cognitive, and behavioral wellness in fifth grade girls; led activities based from an integration of dialectical behavioral therapy techniques, cognitive behavioral strategies, and media literacy; worked to develop a strong mind-body connection and prevent the occurrence of internalizing disorders
Direct Supervisor: Catherine Cook-Cottone, Ph.D.

Treatment Focused Research Interventions

STEER Psychosocial Intervention, Buffalo, NY (January 2010 – September 2011)
Population Served: Adolescents diagnosed with Attention Deficit Hyperactivity Disorder and their families
Responsibilities: Served as a clinician on the *Supporting a Teen's Effective Entry to the Roadway* (STEER) research project, a driving program to support teenagers with Attention Deficit Hyperactivity Disorder; conducted parent training and worked with families to build communication, trust, and safety as their teenager learned to drive
Direct Supervisor: Greg Fabiano, Ph.D.

Relationship Education Workshops, Gannon University, Erie, PA *(*January 2008 – May 2008)
Population Served: Undergraduate students at Gannon University
Responsibilities: Facilitated six psychoeducational groups utilizing the *Within My Reach Program*, a manualized program designed to educate individuals on how to make health decisions in relationships; collected data on control and treatment subjects to evaluate the effectiveness of the program
Direct Supervisor: Jesse Owen, Ph.D.

Working Together Program, Gannon University, Erie, PA (August 2007 – May 2008)
Population Served: Divorced parents, court mandated through the Erie County Court
Responsibilities: Facilitated 10-week long groups to compare the effectiveness of the *Working Together Program* (co-parenting program) with two different components (*Fatherhood Program* versus *Within My Reach Program*); conducted interviews with participants to assess effectiveness of each program
Direct Supervisor: Jesse Owen, Ph.D.

Assessment Experience

Neuropsychological Testing, Jacobs Neurological Center, Buffalo General Hospital, Buffalo, NY (May 2011 – May 2012)
Population Served: Children and adolescents with cognitive and learning disabilities
Responsibilities: Conducted neuropsychological testing and assessment for children and adolescents with cognitive, neuropsychological, and learning disabilities and in some cases, comorbid medical diagnoses; tested and assessed children diagnosed with pediatric multiple sclerosis, scored all measures administered and assisted in the construction of reports
Direct Supervisor: Joy Parrish, Ph.D.

Baker Victory Services, Lackawana, NY (June 2010 – September 2010)
Population Served: Children and adolescents in a residential treatment facility
Responsibilities: Participated in diagnostic treatment team meetings; conducted pscyhoeducational assessments for children placed in residential care settings; conducted psychological intakes; administered and scored trauma screens; wrote psychological reports
Direct Supervisor: Lisa Dekeon, Ph.D.

School Psychology Practicum Student, Sweet Home School District, Amherst NY (January 2010 – May 2010)
Population Served: Kindergarten through fourth grade children
Responsibilities: Assisted school psychologist in the implementation of *Response to Intervention* procedures specific to reading interventions; responsibilities included assessment, benchmarking, progress monitoring, and intervention planning; utilized the AIMSweb program for data management and curriculum based assessments; conducted classroom observations and a psychoeducational evaluation for a child with a specific reading disability; wrote a psychological report and made specific recommendations to teacher regarding child's strengthens and weaknesses in reading
Licensed Supervisor: Catherine Cook-Cottone, Ph.D.
Direct Supervisor: Beth Cornwell-Crawford, M.A. (Certified School Psychologist)

School Psychology Practicum Student, Williamsville School District, Williamsville, NY (August 2009 – December 2009)
Population Served: Kindergarten through fourth grade children
Responsibilities: Conducted psychoeducation assessments, individual and group counseling; implemented primary and secondary interventions programs; presented test results to parents prior to a Committee on Special Education meeting; presented at Committee on Special Education meetings; consulted with teachers; conducted functional behavior assessments and implemented behavioral intervention plans
Licensed Supervisor: Erin L. Steck Silvstri, Ph.D.
Direct Supervisor: Jennifer Griffin, M.A. (Certified School Psychologist)

Consultation Experience

Behavioral Health Consultant, Head Start, Rochester, NY (August – June 2012)
Population Served: Infants, toddlers, and preschool children at Head Start
Responsibilities: Consulted with teachers and parents regarding children enrolled in Head Start Program; conducted classroom observations for children referred for behavioral health consultation; worked with teachers to provide intervention strategies and consulted with parents regarding behavioral issues at home; assisted in providing referral information for outside services when applicable
Direct Supervisors: Sarah Jonovich, Ph.D. and Kenya Malcolm, Ph.D.

School Psychology Consultant, Williamsville School District, Williamsville, NY (January 2010 – May 2010)
Population Served: Second grade student
Responsibilities: Consulted with teacher regarding student with academic difficulties; utilized Instructional Consultation model to assist in the remediation of teacher's concerns of child's poor achievement in reading and math
Direct Supervisor: Erin L. Steck Silvestri, Ph.D.

Relevant Work Experience

Learning Strategist, University at Buffalo Athletics Department, Buffalo, NY **(**August 2008 – May 2010)
Population Served: Division I athletes at-risk for academic failure
Responsibilities: Worked with at-risk Division I athletes on a weekly basis to assist and teach effective study skills, organizational strategies, and time management skills
Direct Supervisor: Courtney Bell, M.A.

Direct Care Staff, Sarah Reed Residential Center**,** Erie, PA (May 2008 – August 2008)
Population Served: Children and adolescents at a residential treatment facility
Responsibilities: Worked with children ages 6 to 16 years old placed in a residential therapeutic setting for severe emotional, social, and behavioral disturbances; engaged children by assisting with tasks of daily living, monitoring safety of children, and implementing after school activities
Direct Supervisor: Adrienne Dixon, Ph.D.

Within My Reach Program, St. Benedicts Educational Center, Erie, PA (January 2008 – May 2008)
Population Served: Adults receiving services through the TANF program
Responsibilities: Facilitated a relationship education group through the Temporary Assistance for Needy Families (TANF) program at the St. Benedicts Educational Center
Direct Supervisor: Jesse Owen, Ph.D.

Intern at Ithaca Community Treatment Court, Ithaca, NY (May 2003 – December 2003)

Population Served: Participants in the drug and family treatment court
Responsibilities: Assisted the treatment court coordinator; entered drug screen data for the Tompkins County Felony Drug Treatment Court and Family Treatment Court
Direct Supervisor: Mrs. Desiree Rogers

CERTIFICATIONS AND WORKSHOPS

Trauma-Focused Cognitive Behavioral Therapy
Online Course
January 2013

Commitment to Living: Understanding and Responding to Suicide Risk
Instructor: Anthony Pisani
November 2012

Integrative Treatment of Complex Trauma for Children, Adolescents & Their Families
Instructor: Dr. Cheryl Lanktree
June 2011

The Coping Cat Program: Evidence-Based CBT Therapy for Anxiety in Youth
Instructor: Dr. Sandra Pimentel
June 2011

Rorschach Training and Workshop – The Exner System
Instructor: Dr. Robert Kamman
May 2011

American Heart Association Certified Health Care Provider
January 2010

Child Abuse and Maltreatment Identification and Reporting
January 2009

Save Schools Against Violence in Education Act (S.A.V.E.)
January 2009

PUBLICATIONS

Journal Articles

Lackner, J. M., Raby, T., **Smith, A**., Lauterbach, D., Brasel, A., Radziwon, C., Krasner, S., & Katz, L. (under review). Perceived severity of trauma not exposure is associated with psychosocial and physical complaints of severely affected IBS patients. *Journal of Psychosomatic Research.*

Smith, A., & Cook-Cottone, C. P. (2011). A review of family therapy as an effective intervention for anorexia nervosa in adolescents. *Journal of Clinical Psychology in Medical Settings.* Online First, 14 October 2011, DOI: 10.1007/s10880-011-9262-3.

Lackner, J., Jaccard, J., Baum, C., **Smith, A**., Krasner, S., Katz, L., Firth, R., Raby, T., & Powell, C. (2011). Patient-reported outcomes for irritable bowel syndrome are associated with patients' severity rating of gastrointestinal symptoms and psychological factors *Clinical Gastroenterology and Hepatology, 9*(11), 957-964 e1.

Owen, J., Imel, Z., Tao, K., Wampold, B., **Smith, A**., & Rodolfa, E. (2010). Cultural ruptures in short-term therapy: Working alliance as a mediator between clients' perceptions of microagressions and therapy outcomes. *Counseling and Psychotherapy Research, 11*(3), 204-212.

Owen, J., **Smith, A**., & Rodolfa, E. (2009). Clients' expected number of counseling sessions, treatment effectiveness, and termination status: Using empirical evidence to inform session limit policies. *Journal of College Student Psychopathology, 23*, 118-134.

Book Chapters

Cook-Cottone, C. P., **Smith, A**., & Grella, S., (in press). Training issues in health psychology. In W. O'Donohue, L. Benuto, & L. Woodward (Eds). *Handbook of Adolescent Health Psychology*, New York, NY: Springer Publishing Company.

Cook-Cottone, C. P., & **Smith, A**. (2011). Neuropsychological components of eating disorders. In C. A. Noggle, & R. S. Dean (Eds). *Neuropsychological Impact of Psychopathology*, New York, NY: Springer Publishing Company.

Invited Book Reviews

Robert, S., & **Smith, A**. (2009). Review of Tatto, Maria Teresa (Ed.) *Reforming Teaching Globally*. Oxford, United Kingdom: Symposium Books.

Program Evaluation

Meier, S. T., Grella, S., Mack, J., Sapaleva, T., **Smith, A**. (June 2010). Early Childhood Connections Pilot Program, Unpublished Program Evaluation Report.

PROFESSIONAL PRESENTATIONS

National Conferences

Keddie, E., Cook-Cottone, C., **Smith, A**., Serwacki, M., & Klein, J. (2011, February). *Yoga and wellness in schools: Preventing anxiety and eating disorders*. Poster session to be presented at the National Association of School Psychology, Philadelphia, PA.

Smith, A., Raby, T., Wurl, A., Booth, A., Radziwon, C., & Lackner, L. (2011, August). *Psychosomatic symptoms and perceived severity of trauma in patients with irritable bowel syndrome.* Poster session presented at the American Psychological Association Convention, Washington, DC.

Dewanwala, A., **Smith, A**., Wurl, A., Lackner, J., & Sitrin, S. (2011, May). *Accuracy of physician's assessment of IBS disease severity.* Poster session presented at Digestive Disease Week, Chicago, IL.

Haroon, M., **Smith, A**., Sapaleva, T., Gudleski, G., Krasner, S., Katz, L., Wurl, A., Powell, C., Booth, A., Radziwon, C., Sampath, P., & Lackner, J. (2011, May). *Do Rome foundation psychosocial alarm factors predict IBS symptom severity?: A validation study from an NIH clinical trial.* Poster session presented at Digestive Disease Week, Chicago, IL.

Lackner, J., Raby, T., **Smith, A**., Lauterbach, D., Brasel, A., Radziwon, C., Krasner, S., & Katz, L. (2010, August). *Perceived severity of trauma not exposure is associated with psychosocial and physical complaints of severely affected IBS patients*. Poster session presented at Neurogastroenterology and Motility Meeting, Boston, MA.

Sapaleva, T., Quigley, B., Brasel, A., **Smith, A**., Krasner, S., Katz, L., & Lackner, J. (2010, May). *Stress buffering role of social support on pain severity in severely affected IBS patients.* Poster session presented at Digestive Disease Week, New Orleans, LA.

Lackner, J. M., Ma, C., Baum, C., Brasel, A., **Smith, A**., Sapaleva, T., Radziwon, C., Krasner, S., Katz, L., Powell, C., Sampath, P., & Sitrin, D. (2010, May). *What do IBS symptom severity scales measure?: GI symptoms, emotions, cognitions – or something else?* Oral presentation at Digestive Disease Week, New Orleans, LA.

Owen, J. Madura, T., Troutner, S. & **Smith, A**. (2008, March). *Attitudes toward cohabitation and relationship decision making*. Poster session presented at the International Counseling Psychology Conference, Chicago, IL.

Smith, A., Englund, J., Brisson, J., Sweeney, K., & Bajracharya, S. (2007, March). *A community assessment on nutritional health: A service-learning project*. Poster session presented at the American Alliance for Health, Physical Education, Recreation and Dance, Baltimore, MD.

State and Local Conferences

Keddie, E., Cook-Cottone, C., **Smith, A**., Serwacki, M., & Klein, J. (2011, October). *Girls growing through yoga and wellness: Preventing anxiety and eating disorders in the schools.* Poster session presented at the New York Association of School Psychology, Verona, NY.

Smith, A. (2010, April). *Understanding the neurological underpinnings of anorexia nervosa*. Poster session presented at the Graduate School of Education Student Research Symposium. Knowledge in Global Transition: Multiple Perspectives and Contexts, Buffalo, NY.

Smith, A. & Grella, S. (2009, September). *Review and critique of the children's depression inventory*. Poster session presented at Eric F. Gardner Measurement Conference. Sponsored by the University at Buffalo, Auburn, NY.

Smith, A. (2009, March). *A qualitative investigation of the impact of mothers, peers, and coaches on eating disorders in female student – athletes*. Poster session presented at the Graduate School of Education Graduate Student Research Symposium. Embracing the 21st Century: Facilitating Change through Education, Buffalo, NY.

Smith, A., Englund, J., Brisson, J., Sweeney, K., & Bajracharya, S. (2005, April). *A community assessment on nutritional health: A service-learning project*. Poster session presented at the James J. Whalen Academic Symposium, Ithaca, NY.

Community and In-Service Presentations

Smith, A., & Grella, S. (2011, May). *Eating disorders and body image.* Invited Presentation at Cleveland-Hill High School, Cheektowaga, NY.

Smith, A., & Read, M. (2010, March). *Eating Disorders: A look across the spectrum of eating disorders*. Invited Presentation at D'Youville College, Buffalo, NY.

Smith, A., & Read, M. (2009, February). *Eating Disorders*. Invited Presentation at D'Youville College, Buffalo, NY.

RESEARCH FOCUSED PROJECTS

New York State Child Welfare/Child Protective Services Training Institute, Buffalo, NY (August 2011 – May 2012)
Population Served: Children placed in Kinship homes
Responsibilities: Collaborated with the Research Foundation of SUNY- Center for Development of Human Services Trainer/Partnership Liaison on a grant project to examine the strengths and weaknesses of kinship placements for children in the foster care system; created a curriculum/manual to assist child care workers with the unique challenges of kinship families
Direct Supervisor: Catherine Cook-Cottone, Ph.D.

Neuropsychological Testing, Jacobs Neurological Center, Buffalo General Hospital, Buffalo, NY (May 2011 – May 2012)
Population Served: Normal developing children and adolescents
Responsibilities: Conducted98ioku neuropsychological testing and assessment with healthy controls for a comparison study of children diagnosed with pediatrics Multiple Sclerosis and normal children ages 5 years old to 18 years old
Direct Supervisor: Joy Parrish, Ph.D.

Graduate Research Assistant, Behavioral Medicine Clinic, Buffalo, NY (June 2009 – August 2011)
Population Served: Adults diagnosed with Irritable Bowel Syndrome
Responsibilities: Worked on a multi-million grant sponsored by the NIH and managed data entry, conducted phone screens, administered assessment measures, consulted with health psychological and gastroenterologist, and assisted with the writing of manuscripts
Direct Supervisor: Jeffrey Lackner, Psy.D.

Program Evaluation of Pediatric Screening Tool, University at Buffalo, Buffalo, NY (Jan 2010 – May 2010)
Population Served: Infants, toddlers, and preschoolers
Responsibilities: Compiled and analyzed data to evaluate the utility and effectiveness of a pediatric screening tool in order to identify children with behavioral, language, motor, or emotional difficulties at their pediatric wellness visit
Direct Supervisor: Scott Meier, Ph.D.

JOURNAL EDITORIAL EXPERIENCE AND GRANT EXPERIENCE

***Ad Hoc* Editor on the New School Psychology Bulletin,** June 2011 – May 2012
Reviewed manuscripts for publication in the *New School Psychology Bulletin*

Editor on the New School Psychology Bulletin, August 2010 – June 2011
Reviewed manuscripts for publication in the *New School Psychology Bulletin*

Mark Diamond Review Committee, Summer 2010
Reviewed grant proposals for University at Buffalo Graduate Student Association

National Institute of Health Grant Submission, June 2010
Submitted grant application, unfunded

TEACHING EXPERIENCE

Teaching Assistant, Sarah Reed Early Childhood Partial Hospitalization Program, Erie, PA (May 2008 – August 2008)
Population Served: Preschool children in an early intervention program
Responsibilities: Taught in a therapeutic preschool that served children with emotional, behavioral, and developmental difficulties; implemented behavioral plans; consulted with therapists and psychiatrist about child's progress; wrote daily report cards to parents; worked on building social and academic skills along with providing structure to assist children in developing appropriate behaviors within the classroom
Direct Supervisor: Mrs. Patty Esposito

Graduate Teaching Assistant, Exercise Science Department, Ithaca College, Ithaca, NY (January 2006 – December 2006)
Population Served: Undergraduate students
Responsibilities: Assisted undergraduate students in anatomy and physiology lab; provided supplemental instruction when required; graded and administered practical exams
Direct Supervisor: Tom Swensen, Ph.D.

PROFESSIONAL AFFILIATIONS

American Psychological Association: Member

National Association of School Psychology: Member and Past Student Leader

ACADEMIC AWARDS AND HONORS

Counseling School and Educational Psychology Student Scholar Award: Selected as the 2012 awardee for demonstrating a clear track record of active involvement in departmental research

Doctoral Comprehensive Examination: Passed with Distinction - August 2009

University at Buffalo, SUNY: Awarded a full tuition remission and stipend (Fall 2008 – Spring of 2012)

National Honor Society of Phi Kappa Phi: Inducted through the Ithaca College Chapter

Philip James Butterfield Scholarship: A merit based scholarship, Ithaca College

Robert Caliel '54 Endowed Scholarship: A merit based scholarship, Ithaca College

Friend's Scholarship: A merit based scholarship, Ithaca College

Oracle Honor Society: An honor society at Ithaca College limited to students who, at the end of their spring semester, were ranked academically in the top five percent of the freshman class

VOLUNTEER EXPERIENCE

Big Brother, Big Sister Program, Buffalo, NY (July 2011 – Present)
Develops a one-on-one relationship with an at risk child in the Buffalo area; meets and plans activities

International Student Mentor, University at Buffalo, Buffalo, NY (February 2011 – May 2011)
Met on an individually basis with two international students studying at the University at Buffalo; helped to increase social support and reduce isolation; worked to promote meaningful cultural exchanges.

Therapeutic Riding Equestrian Center, Erie, PA (February 2008 – May 2008)
Assisted children with mental, emotional, and social disabilities participate in equine therapy.