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# The Broad Autism Phenotype, Empathy, and Intimate Relationships

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The Broad Autism Phenotype, Empathy, and Intimate Relationships

Rawa (Ruby) Jamil

A Thesis  
Submitted to the Faculty of Graduate Studies  
through the Department of Psychology  
in Partial Fulfillment of the Requirements for  
the Degree of Master of Arts at the  
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Windsor, Ontario, Canada

2016

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The Broad Autism Phenotype, Empathy, and Intimate Relationships

by

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September 16<sup>th</sup>, 2016

## DECLARATION OF ORIGINALITY

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## ABSTRACT

The broad autism phenotype (BAP), or subclinical features of autism spectrum disorder (ASD), has been identified in people both with and without relatives with ASD. Broad autism phenotype features include aloof personality, rigid personality, and pragmatic language deficits. Theoretically, a larger proportion of relatives of people with ASD should exhibit the BAP compared to nonrelatives, but estimated proportions of people with the BAP in each group has varied widely in the literature. Individuals with more features of the BAP exhibit weaker empathy skills and have fewer and shorter duration friendships than those with fewer BAP characteristics. The purpose of the study was to explore the relationship between BAP features, empathy skills, and intimate relationship functioning in emerging adults. Participants ( $N = 235$ , 80% female, mean age = 20) belonged to one of two groups: (1) emerging adults with no known relatives with ASD (No Relative Group;  $n = 115$ ) and (2) emerging adults with relatives with ASD (Relative Group;  $n = 120$ ). Multiple regression analyses revealed that being raised with a relative with ASD was associated with shorter friendship duration. Participants with more BAP features had weaker empathy skills, shorter friendship duration, and less interest in friendships. Self-reported empathy skills mediated the relationship between social BAP features and interest in and pleasure derived from friendships. There was no difference between BAP scores or number of people with the BAP in the No Relative Group and Relative Group. These results may be used to encourage young adults with the BAP to seek out friendships and to screen relatives of people with ASD for the BAP to provide them support about how to maintain friendships through the development of social skill and healthy friendship training programs and support groups.

## DEDICATION

This project is dedicated to all the sweet siblings whom I have had the privilege of getting to know through the Sibling Support Group at the Summit Centre. Your compassion, empathy, and advocacy for your siblings with autism continues to inspire me. You've taught me profoundly more than I could have ever taught you.

## ACKNOWLEDGEMENTS

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To my family and best friends, thanks for always believing in me and reminding me what my long-term goals are. Mom, Dad, Riam – thank you for modeling the importance of a strong work ethic. My work ethic has led me to where I am today, which is one step closer to my dream job!

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## CHAPTER 1

### INTRODUCTION

#### *Overview of Study*

Social relationships (e.g., friendships and romantic relationships) become increasingly important during adolescence and emerging adulthood (Furman & Buhrmester, 1992), as it is during these developmental periods when individuals develop and hone the social skills needed to become adept in initiating and maintaining friendships and romantic relationships (La Greca & Harrison, 2005). As intimate relationships become more physically and emotionally intimate (Barry & Madsen, 2009; Burnett & Blakemore, 2009), adolescents and emerging adults may rely more heavily on their abilities to emotionally connect with others to maintain their intimate relationships.

However, some people are not adept in their ability to emotionally connect with others. It has been well documented that individuals with autism spectrum disorder (ASD; see Appendix A for a list of all acronyms) have deficits in cognitive empathy (Peterson, Garnett, Kelly, & Attwood, 2009; Corden, Childers, & Skuse, 2009), defined as a person's ability to decipher others' intentions, emotions, or beliefs (Vetter, Leipold, Kliegel, Phillips, & Altgassen, 2013).

Deficits in empathy may also be present in a group of individuals who exhibit milder symptoms of ASD that are below the clinical threshold for a diagnosis. These individuals may exhibit what is referred to as the Broad Autism Phenotype (BAP), a set of subclinical social skill and communication deficits similar to those in ASD (Sucksmith, Roth, & Hoekstra, 2011). The symptoms of the BAP are qualitatively similar to, yet milder than, the symptoms of ASD (Hurley, Losh, Parlier, Reznick, & Piven,

2007). Individuals with the BAP exhibit characteristics in three domains: aloof personality (minimal interest in and lack of enjoyment from social interactions), rigid personality (trouble coping with/lack of interest in change), and pragmatic language deficits (deficits in understanding the social features of language, such as turn taking in conversation and changing the conversation topic; Hurley et al., 2007).

Given that approximately 58% of ASD cases in the United States are heritable (i.e., transmitted from parents to children; Hallmayer et al., 2011), researchers first sought evidence for the existence of the BAP by researching autistic traits in family members of people with ASD. Indeed, a plethora of studies have suggested that some relatives of people with ASD do express subclinical symptoms of ASD (Bolton et al., 1994; Sucksmith et al., 2011). More recently, researchers have demonstrated that the symptoms of the BAP are also present in some people who have no known relatives with ASD (Constantino & Todd, 2003; Ingersoll, 2010; Wainer, Ingersoll, & Hopwood, 2011). In addition to the aloof personality, rigid personality, and pragmatic language deficits associated with the BAP, recent studies have suggested that people with symptoms of the BAP may also exhibit weaker empathy skills (Lamport & Turner, 2014), less ability to recognize the emotional states of others (Wallace, Sebastian, Pellicano, Parr, & Bailey, 2010), and deficits in theory of mind (ToM; Losh & Piven, 2007).

Cognitive empathy deficits have been extensively researched in ASD, and findings suggest that those with impaired cognitive empathy tend to have lower quality interpersonal relationships (Bauminger et al., 2008; Dawson, Webb, & McPartland, 2005; Peterson et al., 2009). What remains under-studied is how BAP features, general empathy and cognitive empathy deficits may impact real world functioning, specifically in

intimate relationships such as friendships and romantic relationships. What is known is that people with higher BAP characteristics are more likely to have weaker social skills (Sasson, Nowlin, & Pinkham, 2012), fewer and shorter duration friendships (Jobe & Williams-White, 2007), lower friendship quality (Losh & Piven, 2007), and more feelings of loneliness (Jobe & Williams-White, 2007; Wainer, Block, Donnellan, & Ingersoll, 2013) than those with milder BAP characteristics.

It is important to explore intimate relationships in emerging adults because these relationships become increasingly salient in their lives and help foster a sense of self, solidify an identity, and play a part in overall self-esteem (Furman & Shaffer, 2003). The present study expanded upon the BAP literature by further exploring the functional outcomes (i.e., romantic loneliness, number and duration of serious romantic relationships, perceived importance of and interest in friendships) of emerging adults with varying levels of BAP traits. The purpose of the present study was to explore the relationship between BAP features, empathy skills, and intimate relationship functioning in emerging adults aged 18 to 25 who either did not have a biological relative with ASD or had a biological sibling (full or half sibling), niece, nephew, aunt, uncle, cousin, or grandparent with ASD. The present study also explored whether being raised with a relative with ASD was a risk factor for weaker intimate relationship functioning and whether task-based measures of cognitive empathy (emotion recognition and ToM abilities) or self-report based measures of cognitive empathy were better predictors of intimate relationship functioning. The proportion of emerging adults with the BAP in each group and the average BAP severity of each group were also compared. The findings from the present study may be used to improve the quality of life for individuals

with the BAP by informing the development of mentorship programs, support groups, and social skills or healthy romantic relationship training programs.

## CHAPTER 2

### REVIEW OF LITERATURE

#### *Friendships and Romantic Relationships in Emerging Adulthood*

Friendships play an important role in the lives of emerging adults, which is the developmental period between the ages of 18 to 25 (Arnett, 2000). It is during emerging adulthood when friendships become more emotionally intimate than they were during adolescence (Barry & Madsen, 2009). Given that friendships serve as a protective factor against loneliness (Bowker & Spencer, 2010; Jobe & Williams-White, 2007) and mental health problems (Bagwell & Schmidt, 2013), it follows that having friends is associated with greater life satisfaction (Martin & Huebner, 2007).

Friendships and romantic relationships are closely intertwined in that friendships serve as practice for emotional conversations that inevitably occur in romantic relationships (Connolly et al., 2014). Further, friends provide the social support needed for initiating and maintaining romantic relationships and act as sources of support and advice when emerging adults experience issues in their romantic relationships (Connolly & Goldberg, 1999; Shulman, Levy-Shiff, Kedem, & Alon, 1997). Because being part of healthy interpersonal relationships is thought to be a fundamental human need (Baumeister & Leary, 1995; Gere & MacDonald, 2010), people with weak interpersonal relationships may have more negative mental health outcomes (La Greca & Harrison, 2005; Molcho, Gabhainn, & Kelleher, 2007).

Romantic relationships remain prevalent into emerging adulthood: approximately 70% of American emerging adults aged 18 report having been involved in a romantic relationship (Carver, Joyner, & Udry, 2003). As such, romantic relationships play an

important role in development by helping solidify identity, increasing self-esteem, and exploring sexuality (Furman & Shaffer, 2003). Increased involvement in romantic relationships is associated with romantic and friendship competence and higher social acceptance (Furman, Low, & Ho, 2009) and influences the quality of experiences in subsequent romantic relationships (Furman, Ho, & Low, 2007). As relationships become more complex and physically and emotionally intimate, emerging adults may rely more heavily on their abilities to emotionally connect with others to maintain their intimate relationships (Burnett & Blakemore, 2009), placing more demand on their empathy skills.

Friendships and romantic relationships, although closely intertwined, meet different needs in emerging adulthood (Furman & Buhrmester, 1992). For instance, friendships fulfill the need for companionship and self-worth, whereas romantic relationships fulfill the need for intimacy (Barry et al., 2009). Taken together, it is evident that friendships and romantic relationships play an important role in the social development and mental well-being of emerging adults and that having adequate empathy skills to maintain these relationships may be beneficial. Some people, namely those who exhibit features of the BAP or those diagnosed with ASD, may not be able to fully experience the benefits of friendships and romantic relationships.

### ***Autism Spectrum Disorder and the Broad Autism Phenotype***

People who exhibit features of the BAP and those with ASD may experience difficulty in intimate relationships because of their symptom presentation (Bauminger et al., 2008; Dawson, et al., 2005; Jobe & Williams-White, 2007; Losh & Piven, 2007; Peterson et al., 2009). People with ASD typically have social communication deficits (difficulty carrying a back and forth conversation, expressing emotions, etc.) and

repetitive and rigid behaviours (adhering to fixed routines and specific interests; American Psychiatric Association [APA], 2013). Given that ASD is largely caused by genetic factors (Devlin & Scherer, 2012) and is highly heritable (Colvert et al., 2015), it follows that some relatives of people with ASD may exhibit similar, yet milder features of ASD, a phenomenon termed the broad autism phenotype (BAP; Hurley et al., 2007). These BAP characteristics include aloof personality (minimal interest in and lack of enjoyment from social interactions), rigid personality (trouble coping with/lack of interest in change), and pragmatic language deficits (deficits in understanding the social features of language, such as taking turns in conversation and changing the conversation topic; Hurley et al., 2007), all of which may interfere with fostering healthy intimate relationships.

One of the primary foci of the present study was people with features of the BAP (*not* people with ASD). However, the literature summary that follows will begin by briefly reviewing the characteristics and etiology of ASD, rather than beginning with a review of the BAP literature. This is because understanding the characteristics and etiology of ASD serves as a foundation for understanding the BAP. A more comprehensive review of the BAP will be presented in subsequent sections (see The Broad Autism Phenotype).

### ***What is Autism?***

Autism spectrum disorder is a neurodevelopmental disorder whose symptoms fall into two main categories: (1) social communication deficits; and, (2) repetitive and rigid behaviours (APA, 2013). Social-communication deficits include difficulty carrying a back and forth conversation, expressing emotions, initiating or responding to social

interactions, initiating and maintaining relationships, and maintaining eye contact (APA, 2013). Repetitive and rigid behaviour symptoms include repetitive movements, echolalia, and adherence to fixed routines and specific interests (APA, 2013). Persons with ASD often have varying symptom presentations, with levels of impairment ranging from “requiring little support” to “requiring substantial support” (APA, 2013, p. 52).

### ***Causes of Autism.***

The wealth of evidence suggesting that genetics are implicated in the etiology of ASD is compelling, although debate continues. The etiology of ASD may be largely genetic or due to the interaction between genetic predisposition and environmental risk factors; however, the etiology of ASD cannot be attributed solely to environmental factors (Devlin & Scherer, 2012). A wealth of research has demonstrated a variety of genetic causal and risk factors for ASD such as rare chromosomal abnormalities, de novo copy number variations (see paragraph below for definition), ASD-related syndromes (Fragile X syndrome, Rett syndrome, etc.), and gene mutations (Devlin & Scherer, 2012). Recent etiological estimates for ASD suggest that between 50-95% of ASD cases have an underlying genetic cause (Colvert et al., 2015; Sandin et al., 2014). Less than 30% of the cases of ASD that are genetic have a known genetic cause (e.g., rare chromosomal abnormalities, de novo copy number variations, ASD related syndromes; Schaaf & Zoghbi, 2011).

Some biological relatives of people with ASD do not exhibit characteristics of the BAP (e.g., Losh & Piven, 2007). This is possible because 7-20% of genetic ASD cases are caused by de novo genetic mutations (Schaaf & Zoghbi, 2011), which are new mutations (i.e., the first person in the family to express such a mutation) that occur in

parents' gametes prior to conception or during fetal development (Genetics Home Reference, 2015). De novo genetic mutations occur in aging human cells, which includes the gametes of parents of children with ASD. Following this logic, it is not surprising that older parental age is a risk factor for ASD (Autism Speaks, 2014). Given that de novo genetic mutations are new mutations (i.e., they are not present in parents' genome and are technically not passed down from parent to child), they are not included in heritability estimates of ASD (Wright, 2014).

There are also a number of known environmental risk factors for ASD, such as older maternal or paternal age at time of conception (Parner et al., 2012); prenatal exposure to thalidomide, valproic acid, and insecticides (Landrigan, 2010); and perinatal and neonatal factors like breech position, prematurity, and low APGAR scores (Guinchat et al., 2012). The 'refrigerator mother theory' of ASD (Bettleheim, 1967), whereby mothers of children with ASD were blamed for causing their child to develop ASD by being rigid, cold, and rejecting, has been soundly discredited and is not an empirically supported environmental cause of ASD (Rajendran & Mitchell, 2007).

### ***Heritability of autism.***

The accumulation of research supporting the theory that ASD is a genetic disorder began when early twin and family research demonstrated that there is a strong genetic component to a diagnosis of ASD by studying concordance rates of identical twins (Bailey et al., 1995; Folstein & Rutter, 1977). More recent studies have echoed these initial findings by demonstrating an 87-94% concordance rate in identical twins (Colvert et al., 2015) and a 22-46% concordance rate in fraternal twins (Colvert et al., 2015). There is a 19% recurrence rate in full siblings of children with ASD (Messinger et al.,

2015; Ozonoff et al., 2011), 8.6% recurrence rate in maternal half siblings of children with ASD, 6.8% recurrence rate in paternal half siblings of children with ASD, and 2.6% recurrence rate for cousins of children with ASD (Sandin et al., 2014).

### ***Overview of the BAP.***

Subclinical symptoms of ASD are apparent in 14-33% of parents (Sasson et al., 2012; Wheelwright, Auyung, Allison, & Baron-Cohen, 2010), 20% of siblings (Georgiades et al., 2012; Messinger et al., 2013), and 3.7% of third degree relatives (e.g., cousins and grandparents) of people with ASD (Pickles et al., 2000). According to Sucksmith et al. (2011):

The BAP is a term describing a group of ‘sub-threshold’ social skills and communication traits and unusual personality features that are frequently found in the relatives of people with autism and which are believed to be milder manifestations of traits characteristic for clinically diagnosed autism (p. 360).

### ***Characteristics of the BAP.***

The present study used Hurley et al.’s (2007) conceptualization of the features of the BAP (see ‘Characteristics and Measurement of the BAP’ section below for rationale). As indicated above, this conceptualization of the BAP emphasizes that the core characteristics of people with the BAP are aloof personality, rigid personality, and pragmatic language deficits (Hurley et al., 2007). According to Hurley et al. (2007):

Aloof personality is defined as a lack of interest in or enjoyment of social interaction, rigid personality is defined as little interest in change or difficulty adjusting to change, and pragmatic language problems refer to deficits in the

social aspects of language, resulting in difficulties communicating effectively or in holding a fluid, reciprocal conversation (p. 1681).

Pragmatic language also involves using speech differently with different people, taking turns in conversations, being polite when speaking to others, and can include nonverbal communication such as using appropriate eye contact, body posture, and facial expressions (Prutting & Kirchner, 1987). These three characteristics parallel the core symptoms of ASD. Specifically, the pragmatic language deficits and aloof personality feature coincide with the social-communication domain of ASD and the rigid personality domain coincides with the repetitive and rigid behaviour domain of ASD (APA, 2013).

Although people with the BAP exhibit features that may impair their social functioning, it is important to remember that people with the BAP are not *functionally impaired* as are individuals with ASD (Losh et al., 2009). That is, people with the BAP generally do not experience similar limitations in social and occupational functioning or require substantial support like most people with ASD (Losh et al., 2009; Ustun & Kennedy, 2009). Thus, the BAP is not a diagnosis; rather, it is a research construct to further investigate ASD (Sarris, 2014). Although the BAP is more likely to manifest in first-degree relatives of people with ASD (Bishop et al., 2004; Bolton et al., 1994; Piven, Palmer, Jacobi, Childress, & Arndt, 1997), subclinical features of ASD are present not only in relatives of people with ASD but have also been recognized in people who have no known relatives with ASD (Constantino & Todd, 2003; Ingersoll, 2010).

### ***Theoretical Background.***

Genetic causes and heritability are certainly strong and extensively researched etiological factors of ASD and the BAP (Bolton et al., 1994; Colvert et al., 2015; Devlin

& Scherer, 2012; Georgiades et al., 2013; Sasson et al., 2012; Wheelwright et al., 2010). These mechanisms generally explain how both ASD and characteristics of the BAP can arise, but theories of the etiology have been developed only for ASD (i.e., there does not appear to be a theory specifically addressing the etiology of the BAP). As such, for the present study, two theories addressing the etiology of ASD served as the theoretical basis for the etiology of the characteristics of the BAP because ASD and the BAP are closely related.

It has been theorized that a specific deficit, a deficit in empathy, may help explain some of the symptoms of ASD (e.g., Baron-Cohen, 2009). In order to understand the theoretical basis of ASD (and by extension, the theoretical basis of the BAP), one must understand how ASD and empathy are related. Therefore, a brief overview of empathy, ASD, and the BAP is presented first to orient the reader to the relationship between these variables. However, a more thorough review of empathy, emerging adults, and the BAP is presented in subsequent sections of the introduction (see ‘Empathy, ASD, and the BAP’).

### ***Overview of Empathy, ASD, and the BAP.***

It is well documented that many people with ASD and people with BAP characteristics have weaker empathy skills than controls (Baron-Cohen & Wheelwright, 2004; Bons et al., 2012; Deschamps, Beens, & Matthys, 2014; Grove et al., 2013; Lampion & Turner, 2014). For example, when comparing the parent-reported empathy skills of 27 children with ASD and 29 typically-developing children (aged 6 and 7), results found that, on average, children with ASD had weaker abilities related to understanding others’ mental states and emotions than typically-developing children

(Deschamps et al., 2014). Similarly, many parents of people with ASD report having weaker empathy skills than control parents (Grove, Baillie, Allison, Baron-Cohen, & Hoekstra, 2013), and many emerging adults with higher BAP characteristics report having weaker empathy skills than those with lower BAP characteristics (Lamport & Turner, 2014). Thus, theories have focused on how weaker empathy skills may arise in ASD and how this deficit can explain the symptoms of ASD.

***The Social Motivation Theory of Autism.***

The social motivation theory of autism posits that people with ASD may be psychologically and biologically predisposed to neglect social opportunities, take less pleasure in social interaction, and put forth less effort into maintaining relationships (Chevallier, Kohls, Brodtkin, & Schultz, 2012). According to Chevallier and colleagues (2012):

Social motivation can be described as a set of psychological dispositions and biological mechanisms biasing the individual to preferentially orient to the social world (social orienting), to seek and take pleasure in social interactions (social reward), and to work to foster and maintain social bonds (social maintaining; p. 2).

Social motivation theory posits that individuals with ASD have deficits in social motivation, which in turn hinders these people from developing strong empathy skills because they have not had adequate exposure to situations warranting empathy (Chevallier et al., 2012). People with ASD are known to be impaired in the three aspects of social motivation: social orienting, social reward, and social maintaining (Chevallier et al., 2012).

*Social orienting.* Early in life, infants later diagnosed with ASD have been documented as being disinterested in socially-oriented stimuli. For example, children who are later diagnosed with ASD make less eye contact, reciprocate a smile to a caretaker less often, and infrequently respond to their names (Osterling, Dawson, & Munson, 2002). Furthermore, adolescents with ASD are more likely to focus on the mouths, bodies, and surrounding objects of social scenes rather than on the eyes of people in the scenes (Klin, Jones, Schultz, Volkmar, & Cohen, 2002).

*Social reward.* Approximately 50% of people with ASD report not having friends (Howlin, Goode, Hutton, & Rutter, 2004). Further, people with ASD are significantly lower than controls on the desire for and perceived importance of empathic and close friendships (Baron-Cohen & Wheelwright, 2004). People with ASD reported feeling less pleasure from being in social situations than controls (Chevallier et al., 2012).

*Social maintaining.* People with ASD are less likely to use typical strategies to maintain their social relationships such as verbally or nonverbally greeting or maintaining eye contact with a newcomer (Hobson & Lee, 1998), hiding how they are feeling (Barbaro & Dissanayake, 2007), and using laughter to navigate through social situations (Hudenko, Stone, & Bachorowski, 2009).

Many individuals with ASD remain interested in romantic and sexual relationships (Mehzabin & Stokes, 2011), despite their social motivation deficits. The social motivation theory posits that this drive remains strong because of the evolutionary pressure for humans to reproduce (Chevallier et al., 2012). Therefore, the deficits in social, ToM, emotion recognition, and general empathy that characterize ASD are thought to stem from a deficit in social motivation (Chevallier et al., 2012).

***The Empathizing-Systemizing Theory of Autism.***

The empathizing-systemizing theory of ASD (E-S Theory; Baron-Cohen, 2009) was created to explain the social-communication and rigid/repetitive behaviour symptoms in ASD. This theory posits that the degree of discrepancy between a person's empathy skills and systematizing skills determines whether that person is expected to develop ASD. That is, people with ASD are theorized to have a severe deficit in empathy and to have average or higher systematizing abilities; Baron-Cohen, 2009). The E-S theory posits that social and communication difficulties evident in ASD can be attributed to deficits in empathy, whereas the repetitive behaviours, narrow interests, and need for sameness can be attributed to excessive systemizing. It is theorized that people with ASD have difficulties taking on the perspective of another person (e.g., the person's thoughts and feelings) in order to predict the person's actions (Baron-Cohen, Leslie, & Frith, 1985). As such, people with ASD may find the behaviours of others confusing and even frightening (Baron-Cohen, 2009).

Systematizing occurs when a person strives to analyze patterns or construct systems to understand their environment (Baron-Cohen, 2009). In ASD, systematizing is seen when individuals attempt to identify rules and patterns in the environment and subsequently adhere to these rules to ensure that the outcomes of situations remain constant and predictable (Baron-Cohen, 2009). For example, someone who relies on systematizing in social relationships might identify the following rule: “when I use a harsh tone of voice, others will attend to me.” This person would expect that using a harsh tone would yield the same response in different situations because the person has identified the “rule,” which should lead to a predictable outcome.

Much empirical evidence supports the E-S theory of ASD (e.g., Baron-Cohen, Richler, Bisarya, Gurunathan, & Wheelwright, 2003; Baron-Cohen, & Wheelwright, 2004; Grove et al., 2013). Grove and colleagues (2013) suggested that the discrepancy between systemizing and empathizing in ASD may be so marked because individuals with ASD use their systemizing abilities to decipher the mental states and emotions of others and to decide on appropriate reactions. Because it is difficult to determine universal rules that govern all social interactions (i.e., humans are unique and respond differently to different situations), using a systemizing strategy may not be the most effective way to substitute for empathy.

Overall, these two theories complement each other to explain the symptom presentation in ASD. The social motivation theory suggests that an innate deficit in social motivation may hinder people with ASD from developing strong general empathy (Chevallier et al., 2012), and the E-S theory of autism suggests that a deficit in empathy and an excess in systemizing may play an integral role in understanding the social-communication deficits and rigid and repetitive behaviours evident in many people with ASD (Baron-Cohen, 2009). Now that the theoretical basis for ASD and the BAP has been presented, a review of the BAP literature as it pertains to the present study will be summarized.

### ***The Broad Autism Phenotype***

#### ***Characteristics and Measurement of the BAP.***

The present study used Hurley et al.'s (2007) conceptualization of the BAP (aloof personality, rigid personality, and pragmatic language deficits), which is currently the most widely accepted conceptualization of the BAP (Pisula & Ziegart-Sadowska, 2015).

These three defining characteristics consistently emerged as core characteristics among parents of children with ASD based on 200 videotaped interviews (using well-validated personality and pragmatic language measures) conducted with parents of children with ASD over a 20-year period (Hurley et al., 2007). Wainer and colleagues (2011) conducted a conjoint factor analysis using the eleven factors of the Autism Quotient, Social Responsiveness Scale, and Broad Autism Phenotype Questionnaire to identify which constructs underlie the BAP. A total of 680 undergraduate students ( $M = 19$  years) completed the three measures. Three underlying factors of the BAP emerged, all correlating highest with the BAPQ factors (aloof personality, rigid personality, and pragmatic language deficits; Wainer et al., 2011). Taken together, there is evidence to suggest that Hurley et al. (2007) three-factor model addresses the core features of the BAP (Wainer et al., 2011).

Most present day BAP researchers agree that the symptoms of the BAP broadly parallel the behavioural (social-communication and repetitive behaviour) symptoms of ASD, but the research findings about the core features of the BAP have been inconsistent. This inconsistency in the literature is likely due, in part, to the change in the conceptualization of the BAP to a dimensional construct (i.e., quantitatively measuring the severity of BAP features) as opposed to categorical construct (i.e., qualitatively having the BAP vs. not having the BAP), and the change in the methods/measures used to identify the BAP (Sucksmith et al., 2011). This change in thinking shifted the types of measures typically used to assess for BAP to quantitative measures like The Autism Quotient (AQ; Baron-Cohen et al., 2001), Social Responsiveness Scale (SRS; Constantino, 2002), and the Broad Autism Phenotype Questionnaire (BAPQ; Hurley et

al., 2007), from behavioural observations and semi-structured interviews, such as the Family History Interview (Piven et al., 1997; Rutter & Folstein, 1995) and the Modified Personality Assessment Schedule-Revised (M-PAS-R; Piven et al., 1997; Piven et al., 1994). See Table 1 for a brief description of and supplementary information for the aforementioned measures. This table provides information about how different researchers conceptualized the BAP in the studies cited in this document.

The research findings on the core behavioural symptoms of the BAP may differ in part because of differences that exist between the control groups of various studies. There is no ideal control group for this type of research, as many factors need to be controlled for, such as the genetic liability of ASD, the environmental effects of being raised with (i.e., living in the same household) a sibling with ASD, and the unique stressors arising from parenting a child with ASD. Many studies attempt to control for such differences by recruiting control groups that also have a child with a genetic disorder in their family (e.g., parents of children with specific language impairment; Whitehouse, Barry, & Bishop, 2007), or by recruiting control groups consisting of siblings or parents of people with a different developmental disability (e.g., Down Syndrome [DS]; e.g., Losh et al., 2009, Murphy et al., 2000).

Despite these efforts to isolate BAP features by using various control groups, it is difficult to adequately assess BAP features in two different groups without accounting for the unique experiences and stressors of raising a child with ASD or being a sibling of a child with ASD, as children with ASD may be aggressive, self-injurious, or have severe communication impairments (Pilowsky, Yirmiya, Gross-Tsur, & Shalev, 2007). As such, comparing ASD families to families of children with other developmental disabilities

Table 1  
Summary of Broader Autism Phenotype (BAP) Measures

Format	Measure Name	Author(s)	Population	Notes
Questionnaires	Broad Autism Phenotype Questionnaire (BAPQ)	Hurley et al., 2007	Adults	(i) Self-report questionnaire that assesses the core features of the BAP: Pragmatic Language Deficits, Aloof Personality, and Rigid Personality (ii) Created with parents of children with autism specifically to identify and measure BAP features
	Social Responsiveness Scale (SRS)	Constantino, 2000; Constantino, 2005	Children 4-18 Adults (use a different version)	(i) Parent/teacher report questionnaire that measures degree of autism related social impairment (ii) Differentiates those who have autism from those who are typically developing (iii) Adult version of the SRS available (iv) Both child and adult version assess autism related social impairment: Autistic Awareness, Cognition, Communication, Motivation, and Mannerisms
	The Autism Quotient (AQ)	Baron-Cohen, 2001	Adults with average IQ	(i) Self report measure designed to detect autism (ii) 5 subscales (Social Skills, Attention Switching, Attention to Detail, Communication, and Imagination) (iii) Social Skills and Communication consistently emerge as underlying constructs measured by the AQ.
Interviews	Family History Interview (FHI)	Rutter and Folstein, 1995	Children with or without ASD Adults with or without ASD	(i) Semi-structured interview whereby a trained rater assesses the social and communication skills and interests of family members of people with autism. (ii) The family member is categorized as either having or not having the BAP based on scores from the interview
	Modified Personality Assessment Schedule – Revised (MPAS-R)	Piven et al., 1997; Piven et al., 1994	Adults	(i) Semi structured interview that assesses key personality traits commonly implicated in the BAP (rigidity, conscientiousness, aloof personality, undemonstrative, anxious, hypersensitivity to criticism, unresponsive, and untactful) (ii) Trained rater assesses the pragmatic language skills of the interviewee.

likely does not capture the full extent of the environmental factors that come with raising a child with ASD. Additionally, parents of individuals with ASD exhibit differences compared to parents of people with other developmental disabilities, such as higher levels of stress (Dabrowska & Pisula, 2010; McStay, Dissanayake, Sheeran, Koot, & Begeer, 2014; Weiss, 2002), burnout, and depression (Weiss, 2002).

Parents of children with ASD were excluded from the present study because they appear to have unique experiences that may exacerbate existing BAP features. Fairthorne, Fisher, and Whitehouse (2014) conducted a qualitative study in which parents were interviewed about their experiences parenting their child with ASD. Results suggested that having a child be diagnosed with autism may instigate or exacerbate BAP-related behavioural and personality changes in parents. Parents reported having less interest in and avoiding social engagements and feeling socially isolated after their child was diagnosed with ASD (Fairthorne et al., 2014). Therefore, BAP features in parents of people with ASD may be attributed not only to genetic factors as initially thought but may also be the result of environmental stressors from parenting a child with ASD (Fairthorne et al., 2014).

***Behavioural Features of the BAP.***

***Confounds in studying the behavioural features of the BAP.***

Findings of many past studies investigating the behavioural features of the BAP may be confounded because standardized measures of the BAP were not administered to participants. Rather, some past studies based their research on the BAP being a *phenotype* (a group of heritable, measurable characteristics that are more likely to present in relatives of people with the genetic disorder than people without (Gottesman & Gould,

2003). Past studies also based their research on the notion that the BAP is more prevalent in first-degree relatives of people with ASD than people who have no known relatives with ASD (Bishop et al., 2004; Piven et al., 1997). Many studies use this discrepancy as a rationale for their methodology in identifying features of the BAP. Researchers have often compared heterogeneous groups of relatives of people with ASD to groups of people with no known relatives with ASD and report that relatives of people with ASD *as a group* do not differ from controls in specific abilities (e.g., pragmatic language abilities, social-communication deficits, etc.). However, this method is flawed because only *some* (not *all*) relatives of people with ASD exhibit features of the BAP (e.g., Messinger et al., 2013; Sasson et al., 2012; Wheelwright et al., 2010), and those relatives who do not exhibit features of the BAP perform similarly to controls on certain tasks (e.g., theory of mind tasks; e.g., Losh et al., 2009). Studies that found no differences between the BAP-related skills of relatives and controls may have had groups of participants with similar proportions of individuals with the BAP (although it is expected that 14-33% of the Relative group [Hurley et al., 2007; Messinger et al., 2015; Sasson et al., 2012; Wheelwright et al., 2010] and 5-9% of the No Relative group [Sasson et al., 2014] would have the BAP). Studies that found differences in the BAP-related features between relatives and controls may be confounded in a similar way: perhaps a disproportionately large number of the relatives (exceeding the population estimates of 14-33% [Hurley et al., 2007; Messinger et al., 2015; Sasson et al., 2012; Wheelwright et al., 2010]) exhibited characteristics of the BAP, inflating the difference between the groups.

There are reasons that previous studies may not have included standardized measures of the BAP, despite the shortcomings of this decision. For example, a specific

BAP measure had not yet been created or the study's objective was to identify whether a *certain* deficit was characteristic of relatives of people with ASD (i.e., researchers used a measure of a specific characteristic, such as pragmatic language skills, instead of using a BAP measure). Overall, it is important to consider the shortcomings of past research when evaluating the research findings presented next and that future studies should incorporate a measure of the BAP itself.

***Developmental outcomes and prevalence of BAP features in siblings of people with ASD.***

Siblings of children with ASD show various developmental outcomes. Approximately 20% of siblings of children with ASD (27% of brothers and 11% of sisters) are subsequently diagnosed with ASD (Messinger et al., 2015; Ozonoff et al., 2011), 20% of full siblings of children with ASD exhibit subclinical ASD features (Georgiades et al., 2012; Messinger et al., 2013), 20-36% have other psychiatric impairments such as internalizing and externalizing problems (Orsmond & Seltzer, 2010; Smith & Perry, 2005), while the remaining siblings of children with ASD are typically developing (Messinger et al., 2013).

***Behavioural features of siblings of people with ASD.***

Only a small amount of literature currently exists on siblings of people with ASD (Georgiades et al., 2012), as previous BAP literature has largely focused on parents of children with ASD. The sibling literature that does exist is dominated by studies of infant and child-aged siblings of people with ASD, with few studies focusing on the outcomes of adult siblings of people with ASD. There are even fewer studies on the BAP in

second-degree (e.g., aunts, uncles, nieces, nephews) and third-degree relatives (e.g., cousins, grandparents) of people with ASD (e.g., Pickles et al., 2000).

To date, the findings of research on siblings of people with ASD and their BAP features have been inconsistent. Some studies suggest that many child-aged siblings of people with ASD exhibit autistic traits such as social impairment (Robel et al., 2014; Schwichtenberg, Young, Sigman, Hutman, & Ozonoff, 2010), communication deficits (Pickles et al., 2012; Robel et al., 2014), and pragmatic language deficits (Ben-Yizhak et al., 2011), compared to various control groups, such as siblings of typically-developing children (Ben-Yizak et al., 2011; Schwichtenberg et al., 2010; Stone, McMahon, Yoder, & Walden, 2007) and siblings of children with other psychiatric impairments (Constantino et al., 2006). Other studies suggest that most child-age siblings of people with ASD do not exhibit such characteristics compared to controls (Bishop, Maybery, Wong, Maley, & Hallmayer, 2006; De la Marche et al., 2011; Malesa et al., 2012). Results from some of the aforementioned studies (Constantino et al., 2006, De la Marche et al., 2011, Schwitchenberg et al., 2010) are inconsistent despite participants across all studies being from the same age demographic (siblings aged 4-18), despite using the same type of control groups, and despite assessing participants using the Social Responsiveness Scale (SRS), a parent-report measure of autistic social impairment (Constantino, 2002).

One possible explanation for these inconsistent findings is that the proportion of male to female siblings for each study was vastly different. In De la Marche et al.'s (2011) sample, 39 of 117 (33%) siblings were brothers, and results suggested no significant difference in BAP features between siblings of people with ASD and control

siblings. In Constantino et al.'s (2006) sample, 150 of 150 (100%) of the siblings of people with ASD were brothers, and results suggested that more siblings of people with ASD showed BAP features than control siblings. The inconsistency in findings between these two studies may be due to the proportion of male siblings involved, as more brothers of children with ASD typically exhibit autistic features than sisters of children with ASD (Messinger et al., 2013). This finding corresponds with the higher rate of ASD diagnoses in males compared to females (approximately 80% of those diagnosed with ASD are males; Ozonoff et al., 2011).

The findings of studies assessing the BAP and siblings of people with ASD appear to be more consistent when qualitative measures of the BAP were used. For example, Georgiades et al. (2012) assessed 170 siblings of children with ASD and 90 control children at the age of 12 months using a behavioural observation measure of autistic traits. Results suggested that the siblings could be divided into two clusters: those with high and those with low autistic traits. Thirty-seven of 41 children in the high autistic traits group had a sibling with ASD (21% of the original sibling with ASD group), whereas only four (4.5% of the original control group) were from the control group. These results suggested that more infant siblings of children with ASD have significant communication deficits compared to typically developing siblings (Georgiades et al., 2012). A similar result emerged when autistic features were measured in child- and adolescent-age siblings of people with ASD (autistic features were measured by self-report or parent report; Ruzich et al., 2016). A cluster of siblings had an average ASD symptom score that was similar to those of the control group from the general population (low score), whereas another cluster of siblings had average ASD

symptom scores that were more similar to the scores of the group with ASD (high score; Ruzich et al., 2016). Similar results emerged in a comparative study of autistic features in families of children with ASD and families of children with Down Syndrome (Pickles et al., 2000). The study used the Family History Interview (Rutter & Folstein, 1995), a structured interview designed to assess autism symptoms of first- (e.g., parents, siblings), second- (e.g., aunts, uncles, nieces, nephews), and third-degree (e.g., cousins, grandparents) relatives of people with ASD. More family members with a relative with ASD exhibited features of the BAP than family members with a relative with DS, with 17% of all ASD relatives and 2.4% of DS relatives exhibiting at least one feature of the BAP (Pickles et al., 2000). There remains substantial evidence that more young siblings of children with ASD exhibit autistic symptoms compared to siblings of typically-developing people and siblings of people with other disabilities, despite the inconsistent findings from quantitative BAP studies.

Findings of studies of the infant- and child-age siblings of people with ASD are not entirely generalizable to adult siblings, as it is apparent that the core features of BAP may evolve as siblings age. For example, the features of the BAP in children consist of weaker initiation and response to joint attention, lower social smiling and eye contact, and higher repetitive behaviours (Sucksmith et al., 2011). On the other hand, it has been well established that in adults, the core features of the BAP are pragmatic language deficits, aloof personality, and rigid personality (Hurley et al., 2007; Wainer et al., 2011). Thus, it is important to study adult siblings of people with ASD because there is a paucity of research with this age demographic and because the adult features of the BAP differ from those of child siblings.

The few studies of adult siblings suggested that some siblings do exhibit features of the BAP and exhibit unique personality profiles related to the BAP into adulthood (e.g., Howlin, Moss, Savage, Bolton, & Rutter, 2015; Murphy et al., 2000). For instance, Murphy et al. (2000) interviewed 195 parents and 97 adult siblings of people with ASD and 72 parents and 52 adult siblings of people with DS. Interviewees were assessed for BAP traits with a semi-structured interview called the Family History Questionnaire (FHI; Rutter & Folstein, 1995; see Table 1) and for personality features using a semi-structured interview called the Modified Personality Assessment Schedule – Revised (M-PAS-R; Murphy et al., 2000; see Table 1). Murphy et al. (2000) compared the personality profiles within (i.e., ASD parents vs. ASD siblings) and between (i.e., ASD vs. DS) groups rather than categorizing participants as BAP-present or BAP-absent. The relatives of people with ASD scored, on average, twice as high as relatives of people with DS on the Tense, Withdrawn, and Difficult personality factors of the FHI (Murphy et al., 2000). Within the ASD relatives groups, siblings exhibited, on average, higher scores on the Aloof, Shy, Undemonstrative, Impulsive, Sensitive, Self Conscious, and Eccentric personality subscales, whereas parents exhibited, on average, higher scores on the Anxious and Conscientious Personality subscales (Murphy et al., 2000).

Howlin et al. (2015) addressed the adult BAP social and mental health outcomes of siblings of children with ASD not covered by Murphy et al. (2000). Howlin et al. (2015) conducted a follow up study with 18 adult siblings who were initially identified in childhood as exhibiting the BAP, and 69 adult siblings who were initially identified in childhood as unaffected with the BAP. Broad Autism Phenotype symptoms were measured quantitatively with the Social Responsiveness Scale-Adult version

(Constantino, 2002) and the Autism Quotient (Baron-Cohen et al., 2001). At follow up, the siblings initially identified with the BAP had more BAP features than those initially identified as being unaffected by the BAP (Howlin et al., 2015). These findings suggest that some personality features and social-communication and rigid and repetitive behaviours may indeed persist into adulthood (Howlin et al., 2015), but the paucity of adult sibling literature does not allow for a general consensus about whether BAP traits of siblings of people with ASD persist into adulthood. Two previously discussed studies (Howlin et al., 2015; Murphy et al., 2000) were the only studies located that addressed the BAP in older siblings of people with ASD, but both studies did not use a measure of the unique BAP features (e.g., BAPQ; see Table 1 for a summary of BAP measures), but rather used either the AQ (a self report measure of *autistic* features) and SRS-A (a self report measure of *autistic* social impairment) or the FHI (a semi-structured personality interview).

***Being raised with a relative with ASD.***

The main focus of the ASD sibling literature has been on biological and genetic influences on the development of siblings of children with ASD. There are few studies addressing the experience of being raised with (i.e., living in the same household as) a sibling with ASD and how this experience may impact the intimate relationships of typically developing siblings (Smith & Elder, 2010). The research that does exist suggests that being raised with a sibling with ASD can have long-term effects on the friendships of typically developing siblings (Latta et al., 2014). For example, siblings of people with ASD report having fewer friends than siblings of people with other developmental disabilities (Bågenholm & Gillberg, 1991). Siblings of people with ASD

have reported that their friendships are negatively impacted by having a sibling with ASD because siblings may not want to invite their friends over while their sibling with ASD is home and because their parents simply do not have enough time to support and promote the friendships of their typically-developing children (Benderix & Sivberg, 2007).

Overall, there is evidence to suggest that the experience of being raised with a sibling with ASD does impact the number of and potentially the quality of friendships of the typically-developing sibling. No studies were found that addressed how the experience of being raised with a person with ASD affected the initiation and maintenance of romantic relationships. This topic was addressed in the present study.

***BAP features in parents of people with ASD.***

Though parents are not the focus of the present study, the literature on the BAP and parents of children with ASD is briefly summarized, as most of the BAP literature focuses on parents of people with ASD. Current estimates of the prevalence of the BAP in parents of children with ASD range from 14-33% (Sasson et al., 2012; Wheelwright et al., 2010). Similar to people with ASD, parents of people with ASD with the BAP exhibit deficits in social interaction, communication skills, have rigid and repetitive behaviours (see Cruz, Camargos-Júnior, & Rocha, 2013 for review), and have reported less desire to engage socially with others (see Sucksmith et al., Hoekstra, 2011 for review).

***Broad autism phenotype and people with no known relatives with ASD.***

Symptoms of ASD are present not only in relatives of people with ASD, but also in approximately 5-9% of control parents (Sasson et al., 2012) and approximately 18% (Wainer et al., 2013) to 40% of undergraduate participants (Sasson et al., 2014). For example, parent-reported autistic symptoms were measured using the SRS for each child

in 788 non-ASD twin pairs (aged 7-15), and results suggested that the features characteristic of ASD are heritable and are evident in the general population (Constantino & Todd, 2003). These findings have been replicated with an adult population using the AQ to measure self-reported autistic symptoms (Hoekstra, Bartels, Verweij, & Boomsma, 2007; Ingersoll, 2010) and using the BAPQ to measure self-reported BAP features (Sasson et al., 2014; Wainer et al., 2013).

***Cognitive and Affective Features of the BAP (Empathy).***

In addition to the behavioural characteristics of the BAP, many studies have reported various cognitive features of the BAP, such as deficits in executive functioning, language abilities, general cognitive abilities, and social cognitive/cognitive empathy abilities (see Sucksmith et al., 2011 for a review of the cognitive features of the BAP). The present study focused on one specific cognitive feature of the BAP: empathy. Empathy is comprised of two components: cognitive and affective empathy (Baron-Cohen & Wheelwright, 2004).

***Cognitive empathy.***

Cognitive empathy involves a person recognizing the feelings and understanding the mental states of others (Chakrabarti & Baron-Cohen, 2006). Therefore, there are two subdomains of cognitive empathy: emotion recognition and theory of mind (ToM). The first component, emotion recognition, is the ability to decipher the feelings of another person through facial expression, body posture, and vocal intonation (Henry, Cowan, Lee, & Sachdev, 2015). The second component, ToM, refers to “the capacity to understand others’ mental states, and to appreciate that these may differ from our own”

(Henry et al., 2015, p. 135). See Figure 1 for a schematic representation of the various components of empathy.

***Affective empathy.***

Affective empathy is a person's emotional response to another's emotional state (Baron-Cohen & Wheelwright, 2004) with facial expressions, vocal tone, and body postures that match the emotional context of the speaker (Chakrabarti & Baron-Cohen, 2006). Affective empathy is key to social interactions because it allows a person to choose an appropriate response that demonstrates an understanding of the other's feelings (Blakemore, 2011).

**Empathy, ASD, and the BAP.**

As intimate relationships become more salient aspects of emerging adults' lives, they may rely more heavily on their abilities to emotionally connect with others because the context of their intimate relationships becomes increasingly emotional in nature (Barry & Madsen, 2009; Burnett & Blakemore, 2009; Laursen, 1996). This change places a stronger demand on the empathy skills of the emerging adults in order to maintain successful intimate relationships. Some research suggests that having more features of the BAP is associated with weaker empathy skills, which may make it more difficult for emerging adults to maintain successful relationships (Lamport & Turner, 2014).

***Self-reported general empathy skills.***

Previous research suggests that BAP features are associated with self-reported empathy skills. For example, undergraduate students who scored higher on the BAPQ (especially on the aloof personality and pragmatic language subscales) had weaker self-reported empathy skills (Lamport & Turner, 2014) than those who scored lower on the

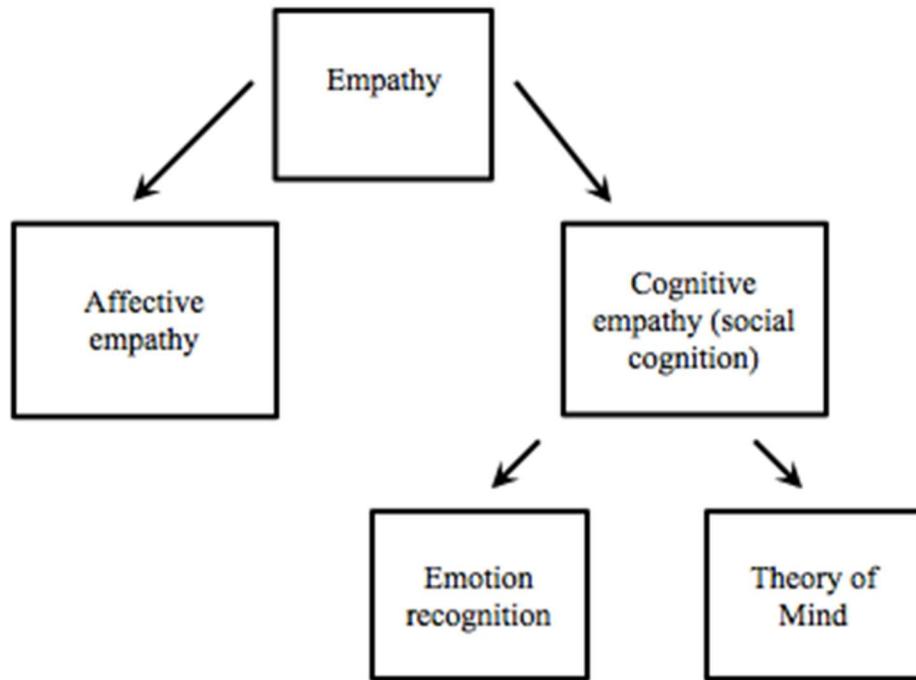


Figure 1. A flowchart displaying the various components of empathy.

BAPQ. Such findings are confounded by self-report bias (i.e., the possibility that those with stronger empathy skills may be overly critical of themselves and may report having weak empathy skills, or people with weaker empathy skills may perceive themselves as being more empathic than they are).

***Task-based cognitive empathy skills.***

Many researchers use task-based cognitive empathy measures to assess real-life cognitive empathy skills and to circumvent self-report bias. A task-based cognitive empathy (e.g., emotion recognition) measure requires participants to view a series of photos of facial expressions and select the emotion word that best represents the facial expression presented (e.g., Ekman-60 Faces; Ekman & Friesen, 1976). A task-based cognitive empathy (e.g., ToM) measure requires participants to identify what another person might be thinking or feeling by viewing a series of photos depicting a storyline, or reading a short story and answering questions about what certain characters might be thinking or feeling (e.g., false belief tasks, second order belief tasks, social faux pas recognition tasks; see Perner & Wimmer, 1985; Stone & Baron-Cohen, 1998). Such tasks support whether or not one is able to understand that others have thoughts that differ from one's own thoughts and beliefs.

Ingersoll (2010) investigated whether scores of ASD symptomatology from people in the general population were correlated with scores of emotion recognition. One hundred and two undergraduate participants completed the AQ (Baron-Cohen et al., 2001) to quantify the degree of autistic symptoms and the Diagnostic Analysis of Nonverbal Accuracy-II (DANVA-II; Nowicki & Duke, 1994, 2001) to assess ability to detect emotions from faces, vocal intonations, and body language. People who had higher

(but subclinical) autistic symptoms made more errors on the DANVA-II faces and vocal intonation subscales (Ingersoll, 2010). The results suggested that higher symptoms of ASD are related to difficulties decoding the nonverbal aspects of language (Ingersoll, 2010).

There is evidence that ToM deficits may differentiate people with high and low social-BAP features in people who have no known relatives with ASD. Sasson et al. (2013) assessed the relationship between social BAP features (pragmatic language and aloof personality), emotion recognition, ToM, and social skills (as rated by research assistants) of 541 undergraduate students. The results of the study suggested that higher social BAP deficits were associated with weaker social skills and weaker cognitive empathy skills (Sasson et al., 2012). Cognitive empathy skills were found to function as a mediator of the relationship between social BAP characteristics and social skills. That is, people with higher social BAP scores may have weaker social skills, possibly because they have difficulty recognizing others' emotions or comprehending others' beliefs or mental states (Sasson et al., 2012).

However, Miu, Pana, and Avram (2012) reported that people with high and low AQ scores had similar ToM ability, contrary to the findings of Sasson et al. (2012). In this study, 295 undergraduate participants were divided into two groups based on their AQ scores: high autism traits (people who scored 1.5 *SD* or higher than the group mean but whose scores were still considered to be in the subclinical range) and low autism traits (people who scored 1.5 *SD* lower than the group mean). On average, the two groups correctly identified approximately the same number of emotions depicted by photographs of eyes (Miu et al., 2012).

Whether the BAP is studied in relatives of people with ASD or the general population, there is not yet a consensus on whether empathy deficits are related to the BAP. This is likely because both *self-report* and *task-based* measures of cognitive empathy (e.g., emotion recognition and real life ToM tasks) have been used to assess these skills. Results from self-report measures may be confounded by self-report bias, and task-based measures may have ceiling effects for subclinical populations (e.g., Bolte & Poustka, 2003; Sucksmith et al., 2013).

The empathizing (emotion recognition, ToM, and affective response) abilities of emerging adults remain understudied (Vetter et al., 2012). The studies that do exist for this age group primarily utilized either ToM *or* emotion recognition measures (Vetter et al., 2012), and some of these measures may not be sensitive enough to detect subtle deficits in nonclinical populations (Thomas, De Bellis, Graham, & LaBar, 2007). Given that emerging adulthood is a developmental period in which friendships and romantic relationships remain prominent and both types of relationships require adequate empathy skills (Vetter et al., 2012), it is important to understand how these abilities develop throughout emerging adulthood.

***Romantic Relationships, Friendships, Loneliness, and the BAP.***

Given the importance of intimate relationships in emerging adulthood, it is of concern that people with higher levels of BAP characteristics appear to have more intimate relationship difficulties than those with lower levels of BAP characteristics, whether or not they have a relative with ASD (Jobe & Williams-White, 2007; Losh & Piven, 2007; Losh et al., 2009; Piven et al., 1997). Piven and colleagues (1997), among the first to study intimate relationship difficulties in relatives of people with ASD, found

that 52% of fathers of people with ASD reported having few to no friends. More recent estimates suggest that approximately 11-23% of parents of children with ASD report having no friends compared to 3% of parents of children with Down Syndrome (Losh et al., 2009). Parents of people with ASD who had higher levels of aloof personality characteristics reported weaker quality friendships than parents of people with ASD with higher levels of rigid personality characteristics and parents of people with ASD with lower levels of BAP-related aloof and rigid personality characteristics (Losh & Piven, 2007).

Wainer et al. (2013) reported similar findings: participants with no known relatives with ASD and higher levels of BAP characteristics had less enjoyment of friendships and fewer and shorter friendships than those with lower levels of BAP characteristics. Similarly, Jobe and Williams-White (2007) reported that, in a sample of 97 undergraduate students, emerging adults with higher autistic features (scores in the top 25<sup>th</sup> percentile) had fewer friendships and friendships that were shorter in duration. Some of the previous studies (Jobe & Williams-White, 2007; Losh & Piven, 2007; Losh et al., 2009; Piven et al., 1997) used measures not specifically designed to assess BAP characteristics, such as the AQ and the M-PAS-R. However, their findings have been corroborated by a study that used a BAP-specific measure (Wainer et al., 2013).

Previously unfamiliar college roommates who had dissimilar levels of aloofness (i.e., one roommate had a high level of aloofness and the other roommate had a low level of aloofness) reported being less satisfied with their relationship, and roommates with similar levels of aloofness (i.e., both highly aloof or both having low levels of aloofness) reported being more satisfied with their relationship (Faso, Corretti, Ackerman, &

Sasson, 2016). These results suggest that it is important to consider the level of aloofness of both partners in a relationship dyad to better understand how it might impact their relationship functioning (e.g., duration of friendship) and satisfaction.

Few studies have assessed the quantity, duration, and quality of romantic relationships, despite evidence of differences in these characteristics between people with different degrees of autistic characteristics. Jobe and Williams-White (2007) found that emerging adults with higher AQ scores had romantic relationships that were of longer duration and began dating at around the same time as those with lower AQ scores. The authors conjectured that the people with higher autistic characteristics may resist change and thus remain in relationships longer than expected (Jobe & Williams-White, 2007). It might also be that people with higher levels of BAP features might be attracted to people with higher levels of BAP features and that the two remain in a romantic relationship because both may resist change. However, it is possible that this is an anomalous finding and requires replication.

Few studies have assessed loneliness in people with various levels of the BAP. The extant research on BAP and loneliness has assessed *general loneliness* as opposed to *romantic loneliness*, which is the lack of meaningful *emotional* relationships (i.e., romantic relationships; DiTomasso & Spinner, 1993). Studies have found that emerging adults with higher autistic traits (Jobe & Williams-White, 2007) and emerging adults with higher BAP scores (Wainer et al., 2013) also reported being more lonely. However, this finding was not consistent with Lamport and Zlomke (2014), who found that degree of BAP characteristics did not predict loneliness in emerging adults.

Overall, it is apparent that having higher levels of BAP features may be associated with weaker intimate relationship functioning (e.g., Jobe & Williams-White, 2007; Losh et al., 2009; Wainer et al., 2013) and may be related to more feelings of loneliness (Jobe & Williams-White, 2007; Wainer et al., 2013). Further investigation of the intimate relationship functioning of relatives of individuals with ASD as well as nonrelatives is needed.

### **The Present Study**

The purpose of the present study was to explore the relationship between BAP features, empathy skills, and intimate relationship functioning in emerging adults aged 18-25 who either (a) did not have a biological relative with ASD or (b) had a biological sibling (full or half sibling), niece, nephew, aunt, uncle, cousin, or grandparent with ASD. The present study also explored whether being raised with (i.e., grew up in the same household as) a relative with ASD was a risk factor for weaker intimate relationship functioning. Further, the present study examined whether task-based measures of cognitive empathy (emotion recognition and ToM abilities) or self-report based measures of cognitive empathy were better predictors of the intimate relationship functioning outcome variables. The proportion of emerging adults with the BAP in each group and the average BAP severity of each group was also compared.

#### **Definition of terms.**

**Relatives.** Only emerging adults with a biological sibling (full or half sibling), niece, nephew, aunt, uncle, cousin, or grandparent with ASD were considered relatives for the purposes of the present study. The biological relationship is necessary because there is a genetic liability to ASD (Devlin & Scherer, 2012; see the ‘Heritability of

autism' section above). Parents of children with ASD were excluded from the present study because parents appear to have unique experiences that may be confounded with BAP features (see the 'Measurement of the BAP' section above).

***Intimate relationship.*** For the purpose of the present study, friendships and romantic relationships were referred to as "intimate relationships," which are relationships characterized by physical or emotional intimacy (Bradbury & Karney, 2010). Whereas emotional intimacy refers to members of a dyad sharing feelings and showing empathy to each other, physical or sexual intimacy refers to physical affection (e.g., hugging, holding hands, kissing) between two people (Tartakovsky, 2014). The specific intimate relationship variables being studied were interest in and pleasure derived from friendships, friendship duration, number of past romantic relationships, duration of romantic relationships, and romantic loneliness.

***Empathy.*** Empathy is "the drive to identify another person's emotions and thoughts, and to respond to these with an appropriate emotion" (Chakrabarti & Baron-Cohen, 2006, p. 2). The definition of empathy includes two components: affective and cognitive empathy (Baron-Cohen & Wheelwright, 2004).

***Affective empathy.*** Affective empathy is one's emotional response to the emotional state of another person (Baron-Cohen & Wheelwright, 2006) with facial expressions, vocal tone, and body postures that match the emotional context of the speaker (Chakrabarti & Baron-Cohen, 2006).

***Cognitive empathy.*** Cognitive empathy involves recognizing the feelings of others and understanding the mental states of others (Chakrabarti & Baron-Cohen, 2006). The first component, emotion recognition, is the ability to decipher the feelings of another

person through facial expression, body posture, and vocal intonation (Henry et al., 2015). The second component, ToM, refers to “the capacity to understand others’ mental states, and to appreciate that these may differ from our own” (Henry et al., 2015, p. 135).

***Participatory action research.***

This study used the participatory action research (PAR) model. Participatory action research is a type of research whereby people from the population of study provide input on the design, the implementation, and the interpretation of results of the research project and ensure that the objectives of the research are important to the target population (Ehrhart, 2012; Whyte, Greenwood, & Lazes, 1989). The Sibling Advisor was involved in the design of the present study, in the ethical clearance process, and in the interpretation of results. The Sibling Advisor is a 24-year-old with an undergraduate degree in Biology. She also has a brother with ASD, making her a valuable contributor to the research process because she is from the target population of the present study. She provided insight about the relevance of the study to the target population, about the wording and sensitivity of the questionnaires and interview questions, and provided suggestions on how to recruit participants.

***Importance.***

Being raised with a sibling or close family member with ASD can affect relatives’ overall functioning if the relatives feel burdened to explain their sibling’s/family member’s behaviour to peers, take on additional family responsibilities, and cope with less parental attention (Rodrigue, Geffken, & Morgan, 1993). Further, these stressors may affect the family’s overall functioning and act as risk factors for later psychological problems (Pickles et al., 2000), such as depression and anxiety, which may be more

frequent in siblings of people with ASD who have elevated BAP features (Petalas et al., 2012).

Emerging adults with the BAP who have difficulty understanding emotional information may struggle to initiate or maintain intimate relationships (Lamport & Turner, 2014). Given the importance of engaging in friendships and romantic relationships in emerging adulthood, it follows that weaker intimate relationships may lead to depression, social withdrawal (Sandstrom & Zakriski, 2004; Seepersad, 2006), and social phobia (Ingersoll et al., 2011). Similarly, emerging adults with the BAP, who may have empathy deficits, may experience greater difficulty initiating and maintaining romantic relationships because of their weaknesses and may not be able to fully benefit from engaging in romantic relationships (Lamport & Turner, 2014). There is little research on the BAP characteristics and cognitive empathy skills of adult siblings and extended relatives of people with ASD past childhood (Blakemore, 2011) and in adult siblings and relatives of people with ASD. Real-world implications (e.g., desire for romantic relationships, duration of romantic relationships, desire for and interest in close friendships) of these BAP features in adult siblings and extended relatives are also understudied. Finally, few studies have incorporated both self-report and task-based measures of empathy. The present study adds to the literature by comparing scores on self-report and task-based empathy measures to determine their relative accuracy in predicting intimate relationship functioning.

***Exploratory research questions.***

***1. Environmental effects.*** The present study sought to identify whether being raised with a close relative with ASD was a risk factor for weaker intimate relationship

functioning. This was investigated quantitatively by determining whether being raised with a close relative with ASD predicted intimate relationship functioning above and beyond the presence of BAP features and empathy skills, and qualitatively through a phone interview.

**2. *Self-report vs. task-based measures.*** A second exploratory research question assessed whether task-based measures of cognitive empathy (emotion recognition and theory of mind abilities) or self-reported cognitive empathy scores better predicted intimate relationship functioning. This question was exploratory because, to the knowledge of the researcher, there have been no such comparisons reported in the literature.

### ***Hypotheses***

The hypotheses for the present study were derived from the empathizing-systemizing theory of ASD and the social motivation theory of ASD and from previous research findings.

#### ***Hypothesis 1: BAP, empathy, and intimate relationships***

***1a: Mediation.*** It was hypothesized that general empathy skills would mediate the relationship between social BAP features and intimate relationship functioning. In other words, the relationship between BAP and intimate relationship functioning can be partially accounted for by empathy skills.

***1b: BAP and empathy.*** It was hypothesized that people with higher social BAP scores would have weaker general empathy skills.

***1c: BAP and intimate relationships.*** It was hypothesized that people with higher social BAP scores would have (a) lower reported interest in and pleasure derived from

friendships, (b) shorter duration of friendships, (c) fewer previous romantic relationships, and (d) longer duration of previous/current romantic relationships, and (e) higher levels of romantic loneliness.

**1d: Empathy and intimate relationships.** It was hypothesized that people with stronger general empathy skills would have (a) higher reported interest in and pleasure derived from friendships, (b), longer duration friendships (c) fewer past romantic relationships, (d) longer duration of previous romantic relationships, and (e) lower levels of romantic loneliness.

***Hypothesis 2: Comparing Relatives to Nonrelatives.***

**2a: Proportion of people with the BAP.** It was hypothesized that a there would be a significantly higher proportion of people with the BAP in the Relative Group than in the No Relative group.

**2b: BAP scores.** It was hypothesized that (a) overall and (b) social BAP group average scores would be higher in the Relative Group than in the No Relative Group.

## CHAPTER 3

## METHOD

***Participants***

Participants ( $N = 235$ ) were emerging adults between the ages of 18-25 with no known relatives with ASD (No Relative Group;  $n = 115$ ) or with a biological sibling, niece/nephew, uncle/aunt, cousin, or grandparent diagnosed with ASD (Relative Group;  $n = 120$ ). Given that the present study, in part, addressed emerging adults' romantic relationships, participants of any sexual orientation and any relationship status were eligible to participate. Participants were excluded from the study if their scores on the Autism Quotient (Baron-Cohen et al., 2001), an ASD screening measure, exceeded the cutoff for ASD, as the results of the study would have been confounded if the sample included participants who may have ASD. Thirty-seven participants were unable to complete the study because their scores on the AQ exceeded the ASD cutoff. Eighteen of the 37 (48.6%) who screened out did not have a relative with ASD, whereas the other 19 (51.4%) who screened out did have a relative with ASD.

Power analyses were computed with G\*Power 3 (Faul, Erdfelder, Lang, & Buchner, 2007) to determine the number of participants needed to detect significant effects. To the researchers' knowledge, the BAP, empathy, and intimate relationships, and how these variables relate to each other, have not been studied together. However, there have been studies conducted on the BAP and empathy and on the BAP and intimate relationships. The majority of these studies have yielded small effect sizes regardless of whether the sample consists of relatives of people with ASD or people with no known relative with ASD (e.g., Ingersoll, 2010, Sasson et al., 2012). In addition, the present

study's hypotheses differ from hypotheses of past research, so a range of small effect sizes (e.g., 0.10, 0.15) were used to estimate a range of sample sizes that would be sufficient to detect significant effects. The power analysis determined that between 68 and 100 participants per group (136 to 200 participants in total) would be needed in order to have adequate power. Thus, 115 participants were recruited for the No Relative group and 120 participants were recruited for the Relative group in order to have sufficient power to detect significant effects. Of the 235 participants, 24 (10%) completed the telephone or Skype interview.

Descriptive statistics for the demographics of the sample are shown in Table 2. Participants were around 20 years old, on average. Participants were mostly female, Caucasian, single, working part-time with some university education. The majority of participants from the Relative group were cousins and siblings of a person with ASD, with the majority of their relatives having both lower academic and language skills compared to others their age.

### ***Recruiting participants.***

Emerging adults in the No Relative Group ( $n = 115$ ) were all recruited through the Psychology Participant Pool at the University of Windsor. The Psychology Participant Pool is a pool of undergraduate volunteers who sign up to participate in research studies for course credit. Emerging adults in the Relative Group were recruited in a variety of ways: through the Psychology Participant Pool ( $n = 50$ ), posting informational flyers on relevant websites, blogs, Facebook pages, and snowball sampling ( $n = 70$ ). Facebook has been shown to be a more effective recruitment strategy for hard to reach populations (Baltar & Brunet, 2011) than the snowball sampling technique, whereby participants are

Table 2  
*Descriptive Statistics for Demographic Variables*

Variable	All Participants (n = 235)	No Relative (n = 115)	Relative (n = 120)	Interview Participants (n = 24)
Participant age (Standard Deviation)	20.38 (1.82) years	20.06 (1.42) years	20.69 (2.1) years	21.3 (2.10)
Min.	18	18	18	18
Max.	25	25	25	25
Do you have a relative with ASD?				
Yes	120 (51.0%)	0	120 (100%)	17 (70%)
No	115 (49%)	115 (100%)	0	7 (30%)
Gender				
Female	187 (79.6%)	92 (80%)	95 (79.2%)	22 (92.0%)
Male	47 (20%)	23 (20%)	24 (20%)	2 (8.0%)
Other	1 (0.4%)	--	1 (0.8%)	--
Race				
Caucasian	159 (67.7%)	78 (67.8%)	81 (67.5%)	12 (52.2%)
Arab	22 (9.4%)	13 (11.3%)	9 (7.5%)	4 (17.4%)
Black	12 (5.1%)	7 (6.1%)	5 (4.2%)	1 (4.3%)
South Asian	10 (4.3%)	4 (3.5%)	6 (5.0%)	1 (4.3%)
Mixed Race	7 (3.0%)	2 (1.7%)	5 (4.2%)	2 (8.7%)
Chinese	5 (2.1%)	3 (2.6%)	2 (1.7%)	--
Filipino	5 (2.1%)	2 (1.7%)	3 (2.5%)	1 (4.3%)
Southeast Asian	3 (1.3%)	4 (3.5%)	2 (1.7%)	1 (4.3%)
Latin American	2 (0.9%)	--	2 (1.7%)	1 (4.3%)
West Asian	2 (0.9%)	1 (0.9%)	1 (0.8%)	--
No Answer	2 (0.9%)	--	2 (1.7%)	1 (4.3%)
Aboriginal	1 (0.4%)	--	1 (0.8%)	--
Japanese	1 (0.4%)	1 (0.9%)	--	--
Korean	1 (0.4%)	1 (0.9%)	--	--
Other	1 (0.4%)	1 (0.9%)	--	--
Marital Status				
Single	218 (92.8%)	110 (95.7%)	108 (90%)	21 (91.3%)
Common-Law	6 (2.6%)	--	6 (5.0%)	--
No answer	3 (1.3%)	3 (1.3%)	3 (2.5%)	2 (8.6%)
Married	2 (0.9%)	1 (0.9%)	1 (0.8%)	--

Separated	1 (0.4%)	1 (0.9%)	--	1 (4.3%)
Dating Status				
Dating	120 (51.1%)	58 (50.4%)	62 (50.6%)	8 (34.7%)
Single	108 (46.4%)	55 (47.8%)	53 (44.2%)	15 (65.2%)
Engaged/Married	5 (2.1%)	1 (0.9%)	4 (3.3%)	1 (4.3%)
No answer	1 (0.4%)	1 (0.9%)	1 (0.8%)	3 (13%)
Country of Residence				
Canada	209 (88.9%)	115 (100%)	94 (78.3%)	14 (60.9%)
USA	16 (6.8%)	--	16 (33.3%)	7 (30.4%)
Other	5 (2.1%)	--	5 (4.2%)	2 (8.6)
Highest level of education achieved				
Some university	139 (59.1%)	82 (71.3%)	57 (47.5%)	8 (34.8%)
High school diploma	49 (20.9%)	23 (20%)	26 (21.7%)	2 (8.7%)
Undergraduate degree	31 (13.2%)	8 (7%)	23 (19.2%)	11 (47.8%)
Some college	5 (2.1%)	--	5 (4.2%)	2 (8.7%)
College diploma	3 (1.3%)	2 (1.7%)	1 (0.8%)	--
Master's degree	6 (2.6%)	--	6 (5.0%)	--
Doctorate degree	1 (0.4%)	--	1 (0.8%)	--
Employment status				
Part time	148 (63%)	72 (62.6%)	76 (63.3%)	12 (52.2%)
Unemployed	62 (26.4%)	41 (35.7%)	21 (17.5%)	6 (26.1%)
Full time	20 (8.5%)	2 (1.7%)	18 (15%)	5 (21.7%)
No answer	3 (1.3%)	--	5 (4.2%)	--
Yearly income				
<25,000	187 (79.6%)	89 (77.4%)	98 (81.7%)	16 (69.6%)
\$25,000-\$49,999	10 (4.3%)	3 (2.6%)	7 (5.8%)	2 (8.7%)
\$50,000-\$74,999	4 (1.7%)	--	4 (3.3%)	1 (4.3%)
>\$100,000	4 (1.7%)	2 (1.7%)	2 (1.7%)	1 (4.3%)
Prefer not to answer	30 (12.7%)	21 (18.3%)	9 (7.5%)	3 (13.0%)
Relative with ASD is my				
Cousin	--	--	57 (48.0%)	1 (4.0%)
Sibling	--	--	49 (41.0%)	16 (66%)
Nephew	--	--	7 (6.0%)	--
Niece	--	--	2 (2.0%)	--

Uncle	--	--	2 (2.0%)	--
Grandparent	--	--	2 (2.0%)	--
Aunt	--	--	1 (1.0%)	--
Previously lived with Relative with autism?				
No	--	--	66 (55.0%)	8 (33%)
Yes	--	--	55 (45.0%)	16 (66%)
Gender of biological relative with autism				
Male	--	--	83 (70.0%)	9 (38%)
Female	--	--	34 (30.0%)	8 (33%)
No Relative	--	--	--	7 (30%)
Academic skills of relative compared to age expectations				
Lower	--	--	80 (67.0%)	13 (54.0%)
Similar	--	--	23 (20.0%)	1 (4.1%)
Higher	--	--	14 (12.0%)	3 (12.5%)
No Relative	--	--	--	7 (30%)
Language skills of relative compared to age expectations				
Lower	--	--	77 (65.0)	13 (54%)
Similar	--	--	29 (25.0)	2 (8.3%)
Higher	--	--	11 (9.0)	2 (8.3%)
No Relative	--	--	--	7 (30%)

asked to pass along information about the study to other possible participants (Emerson, 2015; Goodman, 1961). Many participants from the Relative Group were recruited through Facebook, specifically from the Sibling Leadership Network and a Facebook group called SibNet (both are geared to young adult siblings of people with disabilities).

### ***Measures***

All participants answered 314 items (184 *self-report* questions and approximately 130 *task-based* questions). The following are the *self-report* measures that were used: Autism Quotient-Shortened, demographic questionnaire, Broad Autism Phenotype Questionnaire, Questionnaire of Cognitive and Affective Empathy, Dating and Friendship Questionnaire, Relationship Satisfaction Scale, Cambridge Friendship Questionnaire, Social and Emotional Loneliness Scale Adults-Shortened, Dating Goals Questionnaire. The following are the *task-based measures* that were used: Faux-Pas Detection Test and Reading the Mind in the Eyes Test.

#### ***Screening questionnaire.***

*The Autism Spectrum Quotient-Shortened Version* (AQ-S; Baron-Cohen et al., 2001; Hoekstra et al., 2011) was used to screen for ASD. It is a publicly accessible 29-item self-report questionnaire used to screen for ASD in adults with average intelligence. It is composed of two factors: (a) Social Behaviour (subscales: Social Skills, Routine, Switching, Imagination) and (b) Numbers and Patterns. The Social Skills subscale measures a person's interest and enjoyment in social situations and meeting new people. A sample item from the Social Skills subscale is "I would rather go to a library than to a party." The Routine subscale measures a person's preference with respect to routines and flexibility in changing routines. A sample item from the Routine subscale is "New

situations make me anxious.” The Switching subscale measures the ability to do more than one thing at a time (e.g., listen to multiple conversations). A sample item from the Switching subscale is “If there is an interruption, I can switch back very quickly.” The Imagination subscale measures the ability to envision oneself as another person or to understand others' intentions. A sample item from the Imagination subscale is “I find it difficult to imagine what it would be like to be someone else.” The Numbers and Patterns factor measures a person's interest in numbers and patterns (e.g., dates). A sample item from the Numbers and Patterns factor is “I notice patterns in things all the time.” Items are rated on a 4-point Likert scale ranging from 1 (*definitely agree*) to 4 (*definitely disagree*), with higher scores indicating more autistic symptoms. The cutoff score for ASD is 70, and 94% of people who score above the cutoff are diagnosed with ASD (i.e., sensitivity) and 91% of people who score below the cutoff do not have ASD (i.e., specificity). Individual scores are calculated by summing the responses to the 29 items.

Despite its high sensitivity and specificity, the AQ-S was not designed for ASD diagnosis but was designed to quickly screen for ASD in research contexts. (Hoekstra et al., 2011). The AQ-S has acceptable to good internal consistency reliability ( $.77 < \text{Cronbach's } \alpha < .86$ ), and the full version (the AQ) is has adequate construct validity, as items within subscales have moderate alpha coefficients (Baron-Cohen et al., 2001). There is a high correlation (.93-.95) between scores on the AQ (50 items) and the scores on the AQ-S (29 items; Hoekstra et al., 2011). For the present study, internal consistency reliability for the AQ was .73.

The demographic questionnaire was designed by the primary researcher and consisted of 23 questions about the participant's age, ethnicity, marital status, country of

residence, living arrangement, education, employment status, and income (see Appendix B). There were nine items in total for participants in the No Relative Group. There were an additional 14 items for participants in the Relative Group, which ask about the participant's biological relationship to the relative, birth order (if the relative with ASD was a sibling), past and current living arrangements, and some basic demographic questions about the relative with ASD (e.g., age, gender, current functioning level).

*The Broad Autism Phenotype Questionnaire* (BAPQ; Hurley, et al., 2007) is a publicly accessible 36-item self-report questionnaire used to screen for the severity of BAP features in adults. It is composed of three subscales: Aloof Personality, Rigid Personality, and Pragmatic Language Problems. The Aloof Personality subscale measures interest in and enjoyment from social interactions. A sample item from the Aloof Personality subscale is "I like being around other people." The Rigid Personality subscale measures ability to cope with change and interest in change. A sample item from the Rigid Personality subscale is "I am comfortable with unexpected changes in plans." The Pragmatic Language subscale measures one's ability to understand the social features of language, such as turn taking in conversation and changing the conversation topic. A sample item from the Pragmatic Language subscale is "I am 'in tune' with the other person during conversation." Items are rated on a 6-point Likert scale ranging from 1 (*very rarely*) to 6 (*very often*), with higher scores suggesting more traits of the BAP. Individual scores are calculated by summing the responses (1-6) of the 36 questions (minimum = 36, maximum = 216) and dividing by 36 (i.e., taking the average).

A recent study by Sasson et al. (2014) sought to replicate the psychometric properties of and establish new cutoff scores for the BAPQ using a larger sample. A man

who scores in the BAP range would have a mean score greater than 3.55, and a woman who scores in the BAP range would have a mean score greater than 3.17 (Sasson et al., 2014). Sasson et al. (2014) also determined that the BAPQ has an 80% sensitivity rate and an 80% specificity rate, which suggests that it is an effective screening measure for the BAP. The BAPQ has excellent internal consistency reliability (Cronbach's alpha = .95). Ingersoll, Hopwood, Wainer, and Donnellan (2011) compared three commonly used BAP measures and recommended that researchers use the BAPQ because its internal consistency reliability values exceed those of the other measures and its factor structure was consistent between studies. Moreover, it is shorter than the other measures, and it demonstrates acceptable criterion and incremental validity (Ingersoll et al., 2011). For the present study, internal consistency reliability for the BAPQ was .90.

*The Questionnaire of Cognitive and Affective Empathy* (QCAE; Reniers et al., 2011) is a publicly accessible, 31-item self-report questionnaire used to measure cognitive and affective empathy. The QCAE is composed of five factors: Perspective Taking and Online Simulation and Emotional Contagion, Proximal Responsivity, and Peripheral Responsivity. The Perspective Taking subscale measures one's ability to take on another person's perspective. A sample item from the Perspective Taking subscale is "I can easily work out what another person might want to talk about." The Online Simulation subscale measures one's ability to take on the perspective of another person and to specifically identify how he or she would feel in another person's position. A sample item from the Online Simulation subscale is "Before criticizing somebody, I try to imagine how I would feel if I was in their place." The Emotion Contagion subscale measures the degree to which one takes on the feelings of others. A sample item from the

Emotion Contagion subscale is “I am happy when I am with a cheerful group and sad when the others are glum.” The Proximal Responsivity subscale assesses one’s affective response in response to others’ situations. A sample item from the Proximal Responsivity subscale is “It pains me to see young people in wheelchairs.” The Peripheral Responsivity subscale assesses the degree to which one attempts to feel emotionally detached in response to another’s mood. A sample item from the Peripheral Responsivity subscale is “I usually stay emotionally detached when watching a film.” Items are rated on a 4-point Likert scale from 1 (*strongly agree*) to 4 (*strongly disagree*), with higher scores indicating stronger cognitive and affective empathy. Individual scores are calculated by summing the responses of the 31 questions.

Its subscales demonstrate adequate internal consistency reliability, with Cronbach’s alpha for the various subscales ranging from .65 to .85. There is evidence for adequate convergent validity, as the Affective and Cognitive Empathy scales demonstrate strong and positive correlations ( $r = .76$  and  $r = .62$ , respectively) with the Basic Empathy Scale (Jolliffe & Farrington, 2006), a questionnaire that also assesses affective and cognitive empathy. Reniers et al. (2011) argued that commonly used empathy questionnaires do not adequately operationalize empathy into cognitive and affective empathy, which are both presently part of the widely accepted definition of empathy. As such, the QCAE was developed by choosing items addressing both the cognitive and affective aspects of empathy from four well-validated empathy measures and subsequently factor analyzing these items to create the QCAE (Reniers et al., 2011). For the present study, internal consistency reliability for the QCAE was .90.

*The Faux Pas Test Detection Test* (FPDT; Stone, Baron-Cohen, & Knight, 1998) is a publicly accessible, 90-question task-based measure which involves reading and answering questions about short vignettes with character(s) who may (or may not) have said or done something socially inappropriate. The test consists of 20 vignettes, of which 10 contain social blunders and 10 do not (control tasks). After reading each vignette, participants answer up to eight questions in written format. The first question assesses whether the reader was able to detect a social blunder. If the participant responds 'no' to the first question, the remaining seven questions are not administered. The second question asks which character committed the social blunder. The third question assesses whether the participant understands why the comment or gesture was inappropriate. The fourth question asks the participant to identify the intention of the speaker. The fifth question asks about the beliefs of the characters in the story. The sixth question assesses empathy and whether the participant understands how a certain character might feel. The seventh and eighth questions are control questions that ask about the story.

The FPDT is scored based on the scoring key written by Stone and Baron-Cohen (1998) in which the individual scores for each type of question (e.g., control question, empathy question) are summed across the stories. One study determined that the FPDT has a .98 inter-rater reliability (Gregory et al., 2002). No other studies were found investigating validity or reliability for the FPDT.

The FPDT was chosen for the present study because it appeared to be more ecologically valid than other measures of ToM. A recent review of ToM measures recommended that researchers use the FPDT to assess ToM (Henry et al., 2015). The FPDT is said to assess ToM because detecting a faux-pas requires an understanding of

others' mental states (Gregory et al., 2002). For example, the participant must understand the mental state of the 'offender,' that the offender is unaware of the offence, and understand the mental state of the 'offended,' who is upset or angry with the person who committed the social blunder (Gregory et al., 2002). Whereas other measures of empathy and ToM ask participants to self-report their own understanding of others' mental states (e.g., the EQ; Baron-Cohen & Wheelwright, 2004), the FPDT is a task-based measure of whether a person understands the mental states and thoughts of others in stories that emulate real-life scenarios. For the present study, internal consistency reliability for the FPDT was .89.

*The Reading the Mind in the Eyes Test* (RMET; Baron-Cohen et al., 2001) is a publicly accessible, 36-item task-based measure that assesses the ability to detect complex mental states. The RMET is a popular emotion recognition measure (Henry et al., 2015) and is sensitive enough to detect subclinical differences in emotion recognition abilities (Losh & Piven, 2007). Thus, it was an appropriate emotion recognition measure for the present study.

Test takers must evaluate a photograph of a person's eye region and choose one of four descriptors that best matches the mental state or emotion depicted by the photo. Participants have access to a glossary of the vocabulary used in the responses, as some of the vocabulary may be complex (Henry et al., 2015). Individual scores are calculated by summing the responses of the 36 questions. The RMET has adequate internal consistency reliability (Cronbach's alpha = .72) and good test-retest reliability ( $r = .83$ ; Vellante et al., 2013). There is evidence for convergent validity, as the RMET is positively correlated with empathy measures (Baron-Cohen & Wheelwright, 2004; Vellante et al., 2013). The

RMET has a 91% sensitivity in detecting emotion recognition deficits (Losh & Piven, 2007) and has previously been used to successfully detect differences in emotion recognition abilities in people with the BAP (e.g., Gokcen et al., 2009; Losh et al., 2009). Further, the RMET's high sensitivity rate overcomes the major criticism of the potential ceiling effects of other emotion recognition measures (i.e., other measures may not be sensitive enough to detect subclinical emotion recognition deficits) used in the BAP literature (e.g., Bolte & Poustka, 2003; Sucksmith et al., 2013). For the present study, internal consistency reliability for the RMET was .64.

*The Dating and Friendship Questionnaire* (DFQ; Jobe & Williams-White, 2007) is a 13-item self-report questionnaire that assesses the number, commitment level, and length of past friendships and romantic relationships, and the age of first friendship and first romantic relationship. The author of this measure granted the primary researcher permission to use this measure for this study (see Appendix C).

*The Relationship Satisfaction Scale* (RSS; McKibben et al., 2010) is a 4-item scale created to measure how generally satisfied, emotionally satisfied, sexually satisfied, and committed a person is in his or her romantic relationship. Items are scored on a 10-point Likert scale ranging from 0 (*Not at all*) to 9 (*Extremely*). The author gave the primary researcher permission to add "not applicable" as one of the response options. Individual scores are calculated by taking the average of the item responses. A sample item is "How satisfied are you, overall, with your partner? The RSS has high internal consistency reliability (Cronbach's alpha = .89) and demonstrates face validity by outwardly asking participants about relationship, emotional, and sexual satisfaction and

level of commitment to the relationship. For the present study, internal consistency reliability for the RSQ was .94.

*The Cambridge Friendship Questionnaire* (FQ; Baron-Cohen et al., 2003) is a publicly accessible, 35-item self-report questionnaire measuring enjoyment of close friendships and social interactions, and beliefs about the importance of friendships. There are three different styles of questions in the FQ. First, there are 15 questions akin to multiple-choice questions where participants must choose the response with which they most agree. For example, the participant must choose between (a) “The most important thing about a friendship is having somebody to confide in” and (b) “The most important thing about a friendship is having somebody to have fun with.” Second, there are 13 questions that are rated on various 5-point Likert scales ranging from 1 (*very easy, very similar, of no importance, completely disinterested*) to 5 (*very difficult, very dissimilar, of utmost importance, very interested*). A sample item is “How important is it to you what your friends think of you?” Finally, the remaining seven questions ask participants to respond in multiple-choice format about the subjects of their conversations with others, the minimum amount of social contact they need in a week, and their preferred means of communication. Scoring of the FQ is outlined in Baron-Cohen et al. (2003). A high score on the FQ suggests that the participant enjoys having close, caring, and understanding friends, enjoys social interactions, and perceives friendships as being important. The FQ has high internal consistency reliability (Cronbach’s alpha = .75) and demonstrates construct validity by being negatively correlated with the AQ (Baron-Cohen et al., 2001) and positively correlated with the EQ (Baron-Cohen & Wheelwright, 2004). For the present study, internal consistency reliability for the FQ was .72.

*The Social and Emotional Loneliness Scale for Adults – Shortened Version*

(SELSA-S; DiTomasso & Spinner, 1993; DiTomasso, Brannen, & Best, 2004) is a publicly accessible, 15-question scale measuring social and emotional loneliness in adult populations. The SELSA-S is composed of three subscales: Romantic Loneliness, Family Loneliness, and Social Loneliness. However, only the Romantic subscale (5 items) was used because this scale is most relevant to the objectives of present study. The SELSA-S items are rated on a 7-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*), with higher scores suggesting more feelings of loneliness. Individual scores are calculated by summing the responses of the 5 items. A sample item from the romantic loneliness subscale is “I have an unmet need for a close romantic relationship.” The SELSA-S has excellent internal consistency reliability for the Romantic subscale (Cronbach’s alpha = .93). There is evidence for concurrent validity, as all three subscales correlate with the UCLA Loneliness Scale ( $r_s = .37 - .79$ ). For the present study, internal consistency reliability for the SELSA-S was .88.

*Dating Goals Questionnaire* (DGQ; Schindler, Fagundes, & Murdock, 2010) is a 4-item scale created to measure a person’s goals in regards to romantic relationships. The author of this measure granted permission for it to be used in the present study. Only participants who reported that they were not presently in a romantic relationship completed this measure, as it measures the desire to be in a committed relationship. The DGQ items are rated on a 6-point Likert scale ranging from 1 (*not true of me*) to 6 (*exactly true of me*). Individual scores are calculated by summing the responses of the 4 items. A sample item is “I want to find someone with whom I can have a serious and committed relationship.” Someone who has a high score on DGQ has a strong desire to

be in a committed relationship. The DGQ demonstrates adequate internal consistency reliability (Cronbach's alpha = .68). The authors did not report any validity indicators, and no studies that report validity indicators of the DGQ were located. For the present study, internal consistency reliability for the DGQ was .76.

Participants were asked if they would agree to participate in a phone interview to elaborate on some key aspects of the study (see Appendix D). The qualitative questions asked participants about how they respond to their friends' or their romantic partner's distress, why past friendships or romantic relationships have ended, and how their ability to understand others impacts their intimate relationships. Interviewees from the Relative Group were also asked about what it was like being raised with a relative with ASD and how having a relative with ASD has affected the interviewee's social life.

### ***Procedure***

The primary researcher obtained research ethics clearance from the University of Windsor's Research Ethics Board, after which participants were recruited to participate in the study. Measures were administered online, as part of the target population (relatives of people with ASD) was a hard-to-reach population. King et al. (2014) recommended using online data collection because it is an effective method to access hard to reach populations. First, all participants read and electronically signed a consent form to participate in research and answered screening questions to verify whether they met the inclusion criteria for the study (whether the participant was between the ages of 18-25 and that their scores on the AQ-S were below the ASD cut-off score). If the participants did not meet the inclusion criteria, they were directed to a web page where they were thanked and informed that their answers to the screening questions indicated that they did

not meet the criteria to participate in the study. Participants who met the inclusion criteria were directed to a series of web pages where they completed all self-report and task-based measures. All participants who met the inclusion criteria completed the demographic questionnaire first, but the remaining questionnaires were administered in random order. Validity check questions were dispersed between questionnaires (e.g., “circle 2 if you are reading this statement”) to ensure participants were reading questions fully and responding thoughtfully to questionnaire items.

All participants were asked whether they agreed to participate in an optional telephone interview after completing the online survey. Fifty-nine participants (25%) indicated an interest in participating in the interview and were contacted by the primary researcher. Twenty-four of the 59 participants who indicated an interest in the interviews completed the telephone interview. Thirty-four of the remaining 35 participants who indicated an interest in the telephone interview (but did not complete the telephone interview) did not respond to up to two emails to schedule the interview. One person scheduled a telephone interview with the primary researcher but did not answer the telephone call at the scheduled time and did not schedule another time for the telephone interview.

Participants recruited through the Psychology Participant Pool were compensated with 1 bonus point for completing the online portion of the study and with 0.5 bonus points for participating in the telephone interview. Participants recruited through means other than the Psychology Participant Pool were compensated with a \$5 electronic gift card for completing the online portion of the study and with an additional \$5 electronic gift card for participating in the telephone interview.

## CHAPTER 4

## Results

***Quantitative Analyses******Data validity.***

Data were analyzed using Statistical Package in Social Sciences. Data were first inspected to determine whether participant responses were valid for inclusion in the final dataset. Data validity was ascertained by inspecting participant responses to validity questions (e.g., ‘If you are paying attention, select strongly agree’) and survey completion time. Twenty-eight participants were excluded from the final sample because their data were invalid (i.e., these participants failed both validity questions). Eighteen of the 235 participants included in the final sample failed one validity question but were included in the final sample because they spent at least 35 minutes completing the study.

***Missing data.***

The quantitative data were analyzed to determine the proportion of missing data in the dataset prior to statistical analysis. There was a small amount of missing data, with 1,208 of the 75,905 (1.59%) quantitative responses missing. This amount of missing data is acceptable in terms of data analysis, as it amounts to less than 5% of the total dataset (Tabachnick & Fidell, 2007). Further, results of Little’s Missing Completely at Random (MCAR) test suggest that these data were missing completely at random,  $\chi^2(43233) = 30742.35, p = 1.00$ . Patterns of missing data, which were only analyzed for variables with three or more participants who left a certain question blank, were also inspected. Four participants left question four on the Friendship Questionnaire blank, but no other patterns of missing data were found. Missing data were imputed using the expectation

maximization (EM) technique because less than 5% of the data were missing and because the data were missing completely at random. Tabachnick and Fidell (2007) indicate that the EM technique may be used to estimate missing values when the aforementioned criteria have been met. The data were imputed at the subscale level to ensure the most accurate estimates of the missing values.

***Testing assumptions.***

The assumptions of linear regression were assessed prior to data analysis using Cohen and colleagues (2003) guidelines. The first assumption tested was the absence of outliers and influential observations. Outliers on the outcome variables were assessed by identifying values with a standardized residual value greater than 3 or less than -3 (Cohen et al., 2003). Twelve outliers on number of romantic relationships ( $M$  outliers = 14.4,  $R$  outliers = 15) and two outliers on length of romantic relationship ( $M$  outliers = 7.71 years,  $R$  outliers = 0.58 years) were identified and subsequently removed from their respective analyses. Participants whose scores *were* included in the analyses had on average 2.2 ( $R = 8$ ) relationships and had been in a relationship for an average of 1.78 years ( $R = 7.25$ ). The researcher further explored the outliers to determine whether these individuals differed from the non-outliers. The outliers were most often single, White females with some university education, which is similar to the remainder of the sample. The outliers also had similar BAP scores to the non-outliers. Thus, these outliers appear to be a random group of participants based on their demographic characteristics, despite differences in the number and length of romantic relationships of the outliers from the majority of participants. In addition, these outliers were excluded from the analysis

because the skewness of the data and results of the regression (e.g.,  $F$  value,  $R^2$  value, number of significant predictors) improved when these outliers were excluded.

No outliers on the predictor variables were identified. Outliers on the predictor variables were assessed by identifying participants whose Mahalanobis distance value on the predictor variables exceeded the cutoff chi score (i.e.,  $\chi^2 = 13.28$ ) at the  $p < .01$  level (Cohen et al., 2003). The data were also free of influential observations. None of the participant's Cook's distance values exceeded 1, none of their DFBeta values exceeded 1, and none of their DFFit scores exceeded 2 (Cohen et al., 2003). These results suggest that the outliers on the outcome variables were having a small but negligible impact on the results of the regression. Thus, the assumption of absence of outliers and influential observations has been satisfied.

The second assumption that was tested was the assumption of linearity. The scatterplot of dependent and independent variables and the scatterplot of residuals were used to assess linearity (Cohen et al., 2003). There was a linear trend between the BAPQ and empathy and the intimate relationship functioning outcome variables. In addition, the scatterplot of the residuals were symmetrical about the 0 line. These results suggest that the data were linear and that the assumption of linearity has been met.

The third assumption tested was the assumption of normality. Overall, one predictor was normally distributed, but a second predictor and the majority of outcome variables were not normally distributed. Normality was assessed by reviewing the histogram of residuals and by using the Shapiro-Wilk test of normality (Cohen et al., 2003). The histogram of residuals for the BAPQ was bell curved, with the majority of residuals clustering around 0. The histogram of residuals for empathy, duration of

friendship, number of romantic relationships, and romantic loneliness all appeared to have a positive skew. The Shapiro-Wilk test for normality was not significant for the broad autism phenotype,  $\omega(233) = .996, p = .794, ns$ , suggesting that this variable was normally distributed. The Shapiro-Wilk test for normality was significant for self-reported empathy,  $\omega(233) = .986, p = .019$ , task-based empathy  $\omega(148) = .955, p < .001$ , duration of friendship,  $\omega(235) = .941, p < .001$ , interest in and pleasure derived from friendships,  $\omega(235) = .984, p < .001$ , number of relationships,  $\omega(233) = .906, p < .001$ , duration of romantic relationship,  $\omega(120) = .870, p < .001$ , and romantic loneliness  $\omega(171) = .889, p < .001$ , suggesting that these variables were not normally distributed. Despite these results, the assumption of normality has been satisfied because the regression can be considered robust to violations of normality when the sample size is large (i.e., more than 15 cases per predictor) and because all skewness and kurtosis values for predictor values and the outcome variable were within normal limits (e.g., between -2 and +2 and -3 and +3 respectively; Cohen et al., 2003).

The fourth assumption that was tested was the absence of multicollinearity. Overall, there was no concern of multicollinearity in the present study. Multicollinearity occurs when predictor variables are highly correlated (e.g.,  $> .8$ ), which affects the regression results (Cohen et al., 2003). The correlation between predictor variables for the present study ranged from  $-.38$  to  $+.27$ , and was thus not a concern in terms of multicollinearity. In addition, the tolerance and VIF values were within normal limits and did not exceed the suggested cutoffs (i.e., less than 0.2 and greater than 10, respectively; Cohen et al., 2003).

The fifth assumption that was tested was the assumption of homoscedasticity. The homoscedasticity (error in predicting all values) was relatively similar, suggesting that the assumption had been met. This assumption was tested using the residuals plot (Cohen et al., 2003). The residuals were relatively symmetrical about the 0 line (i.e., the residuals appear to be independent and are not clustered together).

The sixth assumption that was tested was the independence of observations assumption. The independence of observations assumption had been met by evaluating the study design (Cohen et al., 2003). The study was conducted online, so it is unlikely that participants had the opportunity to influence each other's scores on the dependent variable.

### **Descriptive Statistics.**

Descriptive statistics for the predictor variables (i.e., BAP/Social BAP, empathy) are presented for the sample as a whole and separated into the No Relative and Relative groups in Table 3.

### **Exploratory Research Questions.**

#### ***1. Environmental effects.***

Six hierarchical multiple regression analyses were used to analyze whether being raised with a relative with ASD could predict various intimate relationship functioning variables above and beyond the presence of social BAP features and empathy skills. These analyses were conducted only with participants from the Relative group to emphasize the effect of the shared environment for participants who were raised with a relative with ASD. See Table 4 for a summary of results from the six analyses. For all regression analyses, social BAP and empathy were entered into block 1 of the

Table 3  
*Descriptive Statistics for Predictor Variables*

Variable	Mean	Standard Deviation	Min. Value	Max. Value
Overall BAP	2.84	0.57	1.31	4.56
Social BAP	2.71	0.61	1.21	4.46
Empathy	95.65	12.15	54.00	121.0 0
No Relative Group				
BAP	2.87	0.56	1.42	4.56
Social BAP	2.75	0.60	1.21	4.33
Empathy	95.65	11.44	54.00	120.0 0
Relative Group				
BAP	2.81	0.56	1.31	3.94
Social BAP	2.55	0.62	1.33	4.46
Empathy	95.65	12.85	64.00	121.0 0

\*Note. BAPQ = Broad Autism Phenotype Questionnaire.

Table 4

*B Weights for Regression Analyses with Various Outcome Variables.*

	Outcome Variables				
	Number of romantic relationships	Length of romantic relationship	Romantic loneliness	Interest in/ pleasure derived from friendships (FQ)	Duration of friendship
Step 1					
Social BAP (BAPQ)	-0.874*	-0.565	1.754	-8.357**	-1.96*
Empathy (QCAE)	-0.020	-0.022	-0.011	0.562**	-0.116*
Gender	0.110	-0.062	-2.381	9.418**	-0.633
Step 2					
Raised with relative with ASD	0.012	0.505	-3.448	-3.170	-2.097*

*Note.* \* Significant at the .05 level. \*\* Significant at the .01 level. BAPQ = Broad Autism Phenotype Questionnaire. QCAE = Questionnaire for Cognitive and Affective Empathy.

hierarchical MRA to control for their effects on the respective outcome variable. Gender was added as a predictor variable in the first block of the MRA because there was a significant correlation between gender and the predictor and outcome variables (see Table 5). Next, the categorical variable ‘raised with a relative with ASD’ was entered in step 2 of the hierarchical MRA to determine whether this variable could significantly predict scores on each outcome variable.

Each of the intimate relationship variables (e.g., length of relationship, romantic loneliness) was analyzed as the single outcome variable for five separate regression analyses, as opposed to analyzing one regression with the ‘intimate relationship functioning’ composite variable as the outcome variable as was initially proposed. The exploratory research question was tested this way because correlation analyses between various intimate relationship variables showed weak correlations between the friendship (interest in and pleasure derived from friendships and duration of friendship) and romantic relationship (duration of romantic relationship, number of romantic relationships, romantic loneliness) variables (see Table 5). These results suggested that friendships and romantic relationships are different from each other and were not best analyzed as one ‘intimate relationship functioning’ variable. However, there were stronger relationships between the friendship variables (i.e., between interest in and pleasure derived from friendships and friendship duration), and among the romantic relationship variables (e.g., between duration of romantic relationship, number of romantic relationships, romantic loneliness; see Table 5). Each intimate relationship functioning variable was analyzed separately as an outcome variable, despite stronger

Table 5

*Correlations Among Predictor Variables and Outcome Variables.*

	1	2	3	4	5	6	7	8	
1. Social BAP	--								
2. Empathy	-.376**	--							
3. Live/lived with relative	-.021	.044	--						
4. Gender	-.203**	.273**	.001	--					
5. Interest in/pleasure from friendships	-.538**	.506**	-.037	.346**	--				
6. Romantic loneliness	.086	-.065	-.014	.027	-.066	--			
7. Duration of relationship	.046	-.066	.119	-.041	-.118	-.236*	--		
8. Number of relationships	-.049	-.071	.055	-.060	-.029	-.182*	-.125	--	
9. Duration of friendship	-.190**	-.046	-.070	.061	.183**	-.061	-.047	.050	--

*Note.* \* Significant at the .05 level. \*\* Significant at the .01 level.

correlations between the friendship variables and between the romantic relationship variables. This decision was made because the correlations within the friendship functioning domain and the variables within the romantic functioning domain, although significant, were relatively small and still suggest that the variables were distinct.

The first regression analyzed whether social BAP characteristics, empathy skills, gender, and being raised with a relative with ASD could significantly predict participants' interest in and pleasure derived from friendship score. Social BAP characteristics, empathy skills, and gender accounted for a significant proportion of variance in participant's interest in and pleasure derived from friendship score,  $R^2 = .48$ ,  $F(3, 113) = 33.83$ ,  $p < .001$ . Higher levels of social BAP characteristics were found to be associated with lower levels of pleasure derived from friendships,  $b = -8.36$ ,  $t(116) = -3.96$ ,  $p < .001$ . For every one-unit increase in social BAP characteristics, there was a 8.36 unit decrease in interest in and pleasure derived from friendships. Higher levels of empathy were found to be associated with less interest in and pleasure derived from friendships,  $b = 0.562$ ,  $t(116) = 5.25$ ,  $p < .001$ . For every one-unit increase in empathy skills, there was a 0.562 unit increase in interest in and pleasure derived from friendships. Gender was also found to significantly predict interest in and pleasure derived from friendships,  $b = 9.42$ ,  $t(116) = 3.05$ ,  $p = .003$ . Being female increased a participant's interest in and pleasure derived from friendships by 9.42 units. Being raised with a relative with ASD was not associated with interest in and pleasure derived from friendships,  $b = -3.17$ , *ns*. Thus, the data suggested that social BAP characteristics and empathy skills significantly predicted interest in and pleasure derived from friendships, whereas being raised with a relative with ASD did not.

The second regression analysis tested whether social BAP characteristics, empathy skills, gender, and being raised with a relative with ASD could significantly predict participants' duration of friendships. Social BAP characteristics, empathy skills, and being raised with a relative with ASD accounted for a significant proportion of variance in participant's duration friendships,  $R^2 = .11$ ,  $F(3, 113) = 3.38$ ,  $p = .012$ . Higher social BAP characteristics were associated with shorter duration of friendship,  $b = -1.96$ ,  $t(116) = -2.08$ ,  $p = .04$ . For every one-unit increase in social BAP characteristics, there was a 1.96 year decrease in duration of friendship. Higher empathy skills were found to be associated with shorter duration of friendship,  $b = -0.12$ ,  $t(116) = -2.52$ ,  $p = .013$ . For every one-unit increase in empathy skills, there was a 0.12 year decrease in duration of friendship. Gender was not associated with duration of friendship,  $b = .63$ , *ns*. Being raised with a relative with ASD was associated with shorter duration of friendships,  $b = -2.10$ ,  $t(116) = 2.01$ ,  $p = .047$ . Being a relative who was raised with a relative with ASD was associated with having shorter duration friendships, an average of 2 years shorter, than relatives who were not raised with their relative with ASD. Thus, the data suggested that social BAP characteristics, empathy skills, and being raised with a relative with ASD significantly predicted duration of friendships.

The third regression analysis tested whether social BAP characteristics, empathy skills, gender, and being raised with a relative with ASD could significantly predict participants' number of past romantic relationships. The first block of the regression was not significant in predicting number of past romantic relationships,  $F(3, 106) = 2.57$ ,  $p = .058$ ,  $R^2 = .070$ . Higher social BAP characteristics were associated with fewer romantic relationships,  $b = -0.87$ ,  $t(106) = -2.75$ ,  $p = .007$ . For every one-unit increase in Social

BAP characteristics, there was a 0.87 unit decrease in number of romantic relationships. However, empathy skills, gender, and being raised with a relative with ASD were not associated with participant's number of past relationships. Thus, the data suggest that social BAP characteristics significantly predicted number of romantic relationships, whereas empathy skills, gender, and being raised with a relative with ASD did not.

The fourth regression analyzed whether social BAP characteristics, empathy skills, gender, and being raised with a relative with ASD could significantly predict participants' duration of romantic relationship. The first block of the regression was not significant in predicting length of current romantic relationships,  $F(3,59) = 0.78, ns$ . Social BAP characteristics, empathy skills, gender, and being raised with a relative with ASD were not associated with duration of romantic relationships.

The fifth regression analyzed whether social BAP characteristics, empathy skills, gender, and being raised with a relative with ASD could significantly predict participants' romantic loneliness. The first block of the regression was not significant in predicting romantic loneliness,  $F(3,82) = 1.37, ns$ . Social BAP characteristics, empathy skills, gender, and being raised with a relative with ASD were not associated with romantic loneliness.

## ***2. Self-report vs. task based empathy measures.***

The second exploratory research question assessed whether task-based measures of cognitive empathy (emotion recognition and theory of mind abilities) or self-reported cognitive empathy scores better predict intimate relationship functioning. This exploratory research question was tested by computing two separate MRAs (one with the cognitive empathy subscale of the self-report measure and the other with the average of

the  $z$  scores of the task-based cognitive empathy measures as the predictor variable) and comparing their associated semi-partial correlations using a technique called ‘testing correlated correlations’ (Kenny, 1987). According to Howell (2012), this method is commonly used to test the difference between correlations that are correlated themselves (i.e., the *same* participants completed both the self-report and the task based measures; Howell, 2010).

There was no significant difference between the semi-partial correlations of self-reported and task-based cognitive empathy in predicting duration of friendships, interest in and pleasure derived from friendships, number of relationships, duration of romantic relationships, or romantic loneliness. Although the difference was not significant, self-report based measures of cognitive empathy were slightly better predictors of duration of friendships and interest in and pleasure derived from friendships compared to task-based cognitive empathy measures. See Table 6 for the semi-partial correlations of both self-report and task-based measures.

***Hypothesis 1: BAP, empathy, and romantic relationships.***

***Hypothesis 1a: Mediation.***

The mediation hypothesis was tested using Preacher and Hayes’ (2008) mediation analysis macro for Statistical Package in Social Sciences (SPSS). The bootstrapping option was used to assess this hypothesis. Bootstrapping works by repeatedly sampling from the data and repeatedly calculating the indirect effect (Preacher & Hayes, 2008). Bootstrapping is a useful technique because it does not require that the data be normally distributed or that there be a large sample (Preacher & Hayes, 2008).

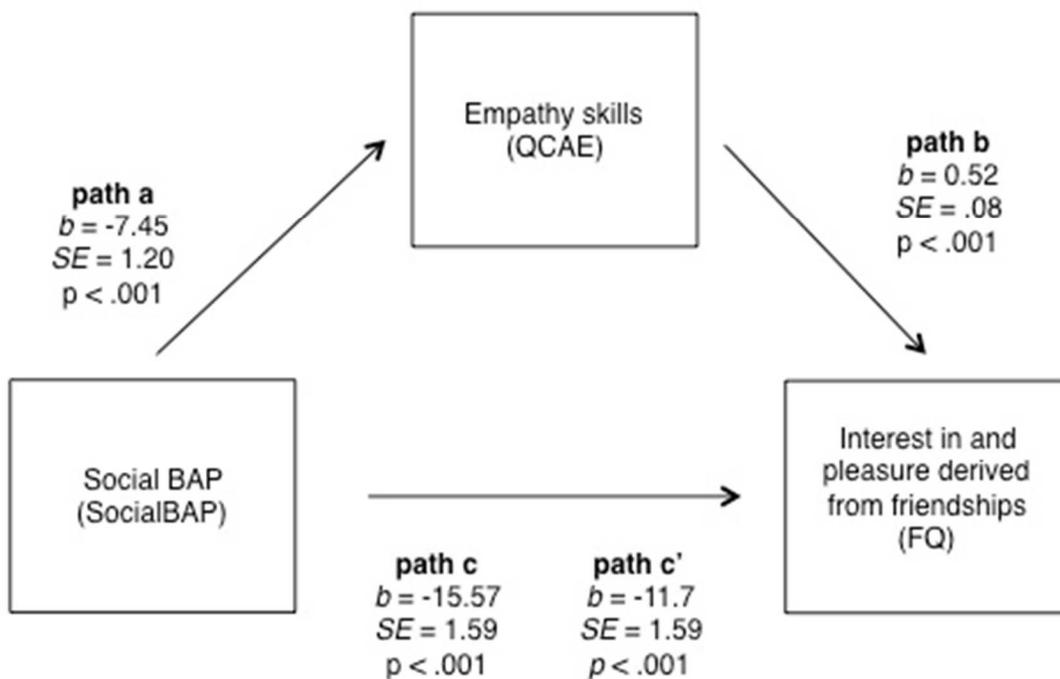
Table 6

*Semi-Partial Correlations for Self-Report and Task-Based Empathy Measures.*

	Self-Report semi-partial correlation	Task-Based semi partial correlation	<i>t</i>	<i>p</i>
Duration of friendship	-0.17	.018	1.68	.096
Interest in/ pleasure from friendships	0.20	.006	-1.77	.079
Number of romantic relationships	0.01	.057	0.39	.701
Duration of romantic relationship	-0.06	.091	0.98	.332
Romantic loneliness	-0.14	-.011	0.97	.336

It was hypothesized that general empathy skills would mediate the relationship between social BAP features and intimate relationship functioning. Recall that the friendship variables and the romantic relationship variables were weakly correlated with each other. Thus, they are separate constructs and are best analyzed separately. Two separate mediation analyses were computed for the friendship variables (i.e., interest in and pleasure derived from friendships, duration of friendship) because each of these variables was significantly correlated to both social BAP and empathy scores (see Table 5). However, mediations were not computed for the romantic relationship variables because no significant correlations existed between the romantic relationship variables (e.g., number of relationships, duration of relationships, romantic loneliness) and social BAP and empathy scores (Table 5). If the paths that make up a mediation model are not significant, it is unlikely that the mediation itself would be significant (Baron & Kenny, 1986).

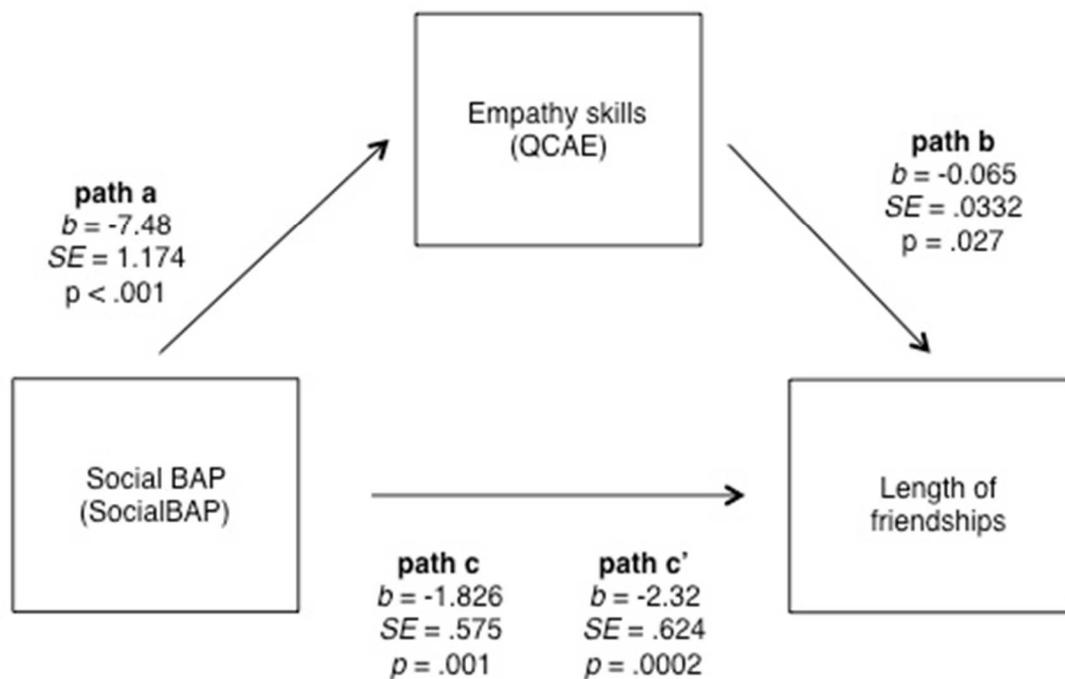
*Interest in and pleasure derived from friendships.* There was a significant indirect effect of social BAP characteristics and interest in and pleasure derived from friendships through empathy skills,  $b = -3.85$ , 95% CI [-5.94, -2.19]. Because zero is not part of the confidence interval, there is a 95% chance that the indirect effect of social BAP characteristics on interest in and pleasure derived from friendships through empathy is significantly different than zero. All paths were significant, including the direct path, which suggests a significant partial mediation (i.e., direct effect is still significant with the inclusion of the mediator). Figure 2 depicts that the direct effect of social BAP characteristics on interest in and pleasure derived from friendships is weaker when empathy is used as a mediator variable (i.e., the  $b$  coefficient decreases from  $c$  to  $c'$ ).



*Figure 2.* This figure depicts the associations between (a) social BAP characteristics and empathy skills, (b) empathy skills and interest in and pleasure derived from friendships, (c) social BAP characteristics and interest in and pleasure derived from friendships, and (c') social BAP characteristics and interest in and pleasure derived from friendships when empathy is factored in as the mediating variable.

Initially, a one-unit increase in social BAP characteristics was associated with a 15.57-unit decrease in interest in and pleasure derived from friendships. However, when empathy was used as a mediator variable, a one-unit increase in social BAP characteristics was associated with an 11.70-unit decrease in interest in and pleasure derived from friendships. The direct path became weaker with the inclusion of the mediator, which is characteristic of mediation. Overall, people with higher social BAP features reported less interest in and pleasure derived from friendships, in part because of their weaker empathy skills.

*Duration of friendships.* There was a significant indirect effect of social BAP characteristics and duration of friendships through empathy skills,  $b = 0.50$ , 95% CI [0.041, 1.09]. Because zero is not part of the confidence interval, there is a 95% chance that the indirect effect of social BAP characteristics on duration of friendships is significantly different than zero. All paths were significant, including the direct path, which suggests a significant partial mediation (i.e., direct effect is still significant with the inclusion of the mediator). Figure 3 depicts that the total direct effect of social BAP characteristics on duration of friendships is stronger when empathy is used as a mediator variable (i.e., the  $b$  coefficient *increases* from  $c$  to  $c'$ ). Initially, a one-unit increase in social BAP characteristics was associated with a 1.83-year decrease in duration of friendship (path  $c$ , see Figure 3). However, when empathy was used as a mediator variable, a one-unit increase in social BAP characteristics was associated with a 2.32-year decrease in duration of friendship (path  $c'$ , see Figure 3). The direct path became stronger with the inclusion of the mediator, which suggests a suppressor effect (Lancaster, 1999). Suppressor variables “suppress irrelevant variance in the other predictor variable(s), thus



*Figure 3.* This figure depicts the associations between (a) social BAP characteristics and empathy skills, (b) empathy skills duration of friendships, (c) social BAP characteristics and duration of friendships, and (c') social BAP characteristics and duration of friendships when empathy skills is factored in as the mediating variable.

indirectly allowing for a more concise estimate of the predictor-outcome relationship, even though the suppressor variable directly predicts none or almost none of the outcome variable's variance" (Lancaster, 1999, p. 5). In this case, the empathy mediator is acting as a suppressor by suppressing irrelevant variance in social BAP. As a result, the relationship between social BAP and duration of friendship was strengthened. Overall, people with higher social BAP features reported shorter duration friendships, in part because of their weaker empathy skills.

Little and colleagues (2007) outline various threats to mediation models, including alternative and plausibly equivalent mediation models, in which the mediation model remains significant either when (a) the mediator remains the same but the independent and dependent variables are reversed in the model or (b) the dependent variable remains the same but the independent variable and mediator variable are reversed in the model.

These alternative mediation models were tested to explore the degree to which causality can be inferred from the significant mediations (see Table 7 for results of alternative mediations). However, because the models only had three variables, the partial correlations involved in the mediation analysis were symmetrical (K. Soucie, personal communication, Aug 19, 2016). That is, as the variables within the model were rotated, the overall significance of the model remained the same and the various path coefficients were simply rearranged depending on where the variables were rotated. Thus, the indirect effects of the models were different, but the total effects were not. Therefore, in this case, the mediation that best aligns with past theory is likely to be the most plausible mediation

Table 7  
Results of Alternative Mediations.

Model	Path A – b(SE)	Path B - b(SE)	Path C - b(SE)	Path C' - b(SE)	Indirect Effect
<b>Model A: Interest in/pleasure from friendships</b>					
X = Social BAP Y = Interest in/pleasure from friendships M = Empathy	-7.45 (1.20) **	-11.72(1.59)**	-15.57(1.59)**	-11.72(1.59)**	-3.84(0.96) <i>p</i> = .0001
X = Empathy Y = Interest in/pleasure from friendships M = Social BAP	-.019(.003)**	-11.72(1.59)**	0.74(.83)**	0.52(0.08)**	0.22(0.05) <i>p</i> = .4119
X = Interest in/pleasure from friendships Y = Social BAP M = Empathy	0.35(0.04)**	-0.007(0.003)*	-0.02(0.002)**	-0.016(0.002)**	-0.002(0.001) <i>p</i> = .490
<b>Model B: Duration of friendship</b>					
X = Social BAP Y = Duration of friendship M = empathy	-7.45(1.20)**	-0.066(0.033)*	-1.82(0.62)**	-2.32(0.66)**	0.50(0.28) <i>p</i> = .3102
X = empathy Y = Duration of friendship M = Social BAP	-0.019(0.003)**	-2.32(0.66)**	-0.022(0.031)	0.067(0.033)*	0.044(0.015) <i>p</i> = .4824
X = Duration of friendship Y = Social BAP M = QCAE	-0.096(0.14)	-0.02(0.003)**	-0.02(0.007)**	-0.022(0.006)**	0.002(0.002) <i>p</i> = .5008

(K. Soucie, personal communication, Aug. 19, 2016). Previous theory and how it aligns with the alternative mediation models are further explored in the Discussion section.

***Hypothesis 1b, 1c, 1d - Correlations.***

Correlational hypotheses 1b, 1c, and 1d were all analyzed by computing the Pearson product-moment correlations between variables hypothesized to be associated with each other. See Table 6 for the correlation matrix of predictor variables and outcome variables.

***Hypothesis 1b: BAP and empathy.*** It was hypothesized that people with higher social BAP scores would show weaker general empathy skills. This hypothesis was supported, as people with higher social BAP scores tended to have significantly weaker general empathy skills (see Table 6).

***Hypothesis 1c: BAP and intimate relationships.*** It was hypothesized that people with higher social BAP scores would show (a) lower reported interest in and pleasure derived from friendships, (b) shorter duration of friendships, (c) fewer previous romantic relationships, (d) longer duration of previous romantic relationships, and (e) higher levels of romantic loneliness. This hypothesis was partially supported, as people with higher social BAP scores reported significantly lower interest and pleasure derived from friendships and significantly shorter duration friendships (see Table 6). However, there were no significant relationships between social BAP scores and number of current romantic relationships, duration of previous romantic relationships, and levels of romantic loneliness (see Table 6).

***Hypothesis 1d: Empathy and intimate relationships.*** It was hypothesized that people with stronger general empathy skills would have (a) higher reported interest in

and pleasure derived from friendships, (b), longer duration friendships, (c) fewer past romantic relationships (d) longer duration of current romantic relationships, and (e) lower levels of romantic loneliness. This hypothesis was partially supported, as people with stronger empathy skills reported significantly more interest in and pleasure derived from friendships (see Table 6). However, there were no significant relationships between empathy and duration of friendships, number of past romantic relationships, duration of previous and current romantic relationships, and levels of romantic loneliness.

**Hypothesis 2: Comparing emerging adult relatives of people with ASD to emerging adults without a relative with ASD.**

**2a: Proportion of people with the BAP.** It was hypothesized that a there would be a significantly higher proportion of people with the BAP in the Relative Group than in the No Relative Group. Hypothesis 2a was tested using a Chi-square test to compare the number of people with the BAP (whose scores exceeded the BAP cutoff) in the Relatives Group and in the No Relatives Group. This hypothesis was not supported, as there was no significant difference between the number of people with the BAP in the No Relative Group ( $n = 28$ ) and the Relative Group ( $n = 32$ ),  $\chi^2(1, N = 235) = .17, ns$  (see Table 8).

**2b: BAP scores.** It was hypothesized that average (a) overall and (b) social BAP scores would be higher in the Relative Group than in the Non Relative Group. Hypothesis 2b was analyzed using independent  $t$ -tests to identify whether overall BAP and social BAP scores were significantly higher in the Relatives Group than in the No Relative Group. This hypothesis was not supported, as there was no significant difference in overall BAP scores between the No Relative ( $M = 2.87, SD = 0.57$ ) and Relative Group ( $M = 2.81, SD = 0.56$ ),  $t(233) = .85, ns$  (see Table 2). In addition, there was no significant

Table 8  
*Number of Participants With and Without the BAP By Group.*

BAP status	No relative group	Relative group	Total
No BAP	87 (76%)	88 (73%)	175 (75%)
BAP	28 (24%)	32 (27%)	60 (25%)
Total	115	120	235

difference in social BAP scores between the No Relative ( $M = 2.76$ ,  $SD = 0.61$ ) and Relative Group ( $M = 2.67$ ,  $SD = 0.62$ ),  $t(233) = 1.10$ ,  $ns$  (see Table 2).

### **Post Hoc Analyses.**

***BAP vs. No BAP Post Hoc Analyses.*** Given that 60 participants (25%) of the overall sample scored above the BAP cutoff, post-hoc analyses were warranted to further explore this unexpectedly large group of participants.

*Proportion of people with the BAP by group.* The proportion of people in each group with the BAP was as follows: No Relative (24.6%), Relative (27%). Within the Relative group, 26.5% siblings/first degree relatives exceeded the cutoff for the BAP, 33% of nieces, nephews, aunt, uncle/second degree relatives exceeded the cutoff for the BAP, and 28.5% of cousins/third degree relatives exceeded the cutoff for the BAP. See Table 9 for specific information on the number of participants in each group.

*People with the BAP and best friend and dating status.* Chi square tests were used to compare the number of people with or without the BAP who endorsed currently having a best friend or currently being in a romantic relationship. People with the BAP were significantly less likely to have a best friend,  $\chi^2(1, N = 234) = 7.12$ ,  $p = .008$ , compared to those without the BAP. However, there was no difference in current romantic relationship status between people with and without the BAP,  $\chi^2(1, N = 235) = .67$ ,  $ns$ . See Table 10 for the proportion of individuals in the various categories.

*Comparing people with the BAP vs. no BAP on measures of cognitive vs. affective empathy.* There was a strong negative relationship between social BAP scores and empathy, such that people with higher BAP scores had weaker empathy ( $r = -.38$ ,  $p < .01$ ). As such, independent sample t-tests were computed to test whether people with the

Table 9  
*Participants With and Without the BAP By Relative Type.*

Group	Number with BAP	Total in Group	Percentage
Relative	32	120	27.0
Siblings/1 <sup>st</sup> degree relative	13	49	26.5
Nieces, nephews, aunt, uncle/ 2 <sup>nd</sup> degree relative	3	9	33.0
Cousins, 3 <sup>rd</sup> degree relatives	16	56	28.5

Table 10  
*Best Friend and Dating Status in People With and Without the BAP.*

	No BAP	BAP	Total
Do you currently have a best friend?			
No	19 (11%)	15 (25%)	34 (15%)
Yes	155 (89%)	45 (75%)	200 (85%)
Total	175	60	234
What is your current dating status?			
Single	79 (45%)	29 (48%)	108 (46%)
Relationship (e.g., dating, engaged, married)	96 (55%)	31 (51%)	127 (54%)
Total	175	60	235

BAP differed significantly from people without the BAP on either the cognitive or affective aspects of empathy. This was explored by comparing scores of people with and without the BAP on the cognitive subscale and affective subscales of the self-report questionnaire called The Questionnaire for Cognitive and Affective Empathy (QCAE). People with the BAP scored significantly lower ( $M = 56.70$ ,  $SD = 9.19$ ) than people without the BAP ( $M = 60.80$ ,  $SD = 8.59$ ) on the cognitive empathy subscale,  $t(233) = -3.09$ ,  $p = .002$ . However, people with the BAP ( $M = 36.0$ ,  $SD = 5.24$ ) and without the BAP ( $M = 35.8$ ,  $SD = 5.60$ ) did not differ significantly on the affective empathy subscale,  $t(233) = 0.23$ , *ns*.

The two task-based measures were measures of the subcomponents of cognitive empathy: emotion recognition abilities (Reading the Mind in the Eyes Test; RMET) and theory of mind (Faux Pas Detection Test; FPDT) People with the BAP ( $M = 25.27$ ,  $SD = 5.7$ ) did not differ significantly on their task-based scores of emotion recognition abilities compared to people without the BAP ( $M = 26.36$ ,  $SD = 3.70$ ),  $t(232) = -1.67$ ,  $p = .176$ , *ns*. Similarly, people with the BAP ( $M = .928$ ,  $SD = .048$ ) and without the BAP ( $M = .917$ ,  $SD = 0.054$ ) did not differ significantly on their task-based scores of theory of mind skills (FPDT),  $t(147) = 0.97$ ,  $p = .336$ , *ns*. These results suggest that people with the BAP report struggling more with the cognitive aspect of empathy, but that people with the BAP performed similarly to people without the BAP when task-based measures of cognitive empathy were used to assess the subcomponents of cognitive empathy.

### **Interview Responses**

Participants ( $n = 24$ ) from the No Relative ( $n = 7$ ) and Relative ( $n = 17$ ) groups participated in the telephone or Skype interview. The interview questions explored topics

such as how participants respond to their friends' or romantic partner's distress, how the participant's friends or romantic partner would describe them, why past friendships or romantic relationships have ended, and how the participant's ability to understand others impacts their friendships and romantic relationships. Interviewees from the Relative Group were also asked about what it was like being raised with a relative with ASD and how having a relative with ASD has affected the interviewee's social life (see Appendix D for the complete list of interview questions). Interviews were 14.5 minutes on average (range: 8.5 – 26.5 minutes).

It is important to consider how the identity of the primary researcher might have impacted the interview process prior to reporting the interview analyses. First, the researcher might have made assumptions about what an interviewee meant to say instead of clarifying with the interviewee because the primary researcher was the same sex as and in the same age and cultural demographics as the majority of interview participants. In addition, the primary researcher's objective for conducting the telephone interviews was to learn how interviewee's empathy skills impacted their intimate relationships. As a result, she may have inadvertently led the participants to talk about their empathy skills, without explicitly saying 'empathy.' There is a possibility that participants deduced the interview was about empathy, given that the top two themes from the participant's interview responses both addressed empathy skills.

**Data analysis.** Interviews were transcribed and checked by the primary researcher. The primary researcher then identified unique codes within each transcript (e.g., it makes me a more patient person) and organized participant codes by question. The primary researcher and research advisor used thematic analysis to identify general

themes that emerged from answers to each question (Braun & Clarke, 2012). As response patterns from each question emerged, the themes were named to describe the responses subsumed within them (see Appendix E for a list of themes by question). These themes were further analyzed into broader, overarching themes, which are reported in Table 9 (see Appendix F for list of overarching themes and subthemes). The overarching themes are reported in decreasing order, such that the theme with the most individual responses appears first, and the theme with the fewest responses appears last.

Nine overarching themes emerged from participants' responses to the seven interview questions (see Table 11). The first five themes that emerged were based on the following questions that all participants were asked:

1. Briefly describe a situation where a friend or romantic partner felt distressed and how you responded to his or her distress.
2. What do you hope your life looks like in the next 10-15 years in terms of friendships and romantic relationships?
3. What have you heard close friends or romantic partner(s) say about you?
4. Have you ever had a friendship or romantic relationship end? What about you do you believe may have added to the end of this relationship?
5. How does your ability to understand others impact your friendships and romantic relationships?

***Overarching theme #1: Positive traits.***

The theme "Positive traits" represents responses where participants described themselves as exhibiting various positive traits, including strong empathy and having more interest in friendships and romantic relationships. Friends and romantic partners

were reported to have described participants as “calm” (Participant 1273), “happy” (Participant 18), “outgoing” (Participant 19), “honest” (Participant 7), and “loyal” (Participant 20).

The theme “Empathic” emerged as a type of positive trait. Many participants described themselves as empathic, or described situations in which their behaviour was empathic. For example, some participants believed they were “good at understanding others” (Participant 1263) and “able to read people emotionally” (Participant 13). One participant described, “I will always put myself in their position and think about what their reaction is, how I would react to the situation, and if it’s generally healthy how they are feeling right now” (Participant 19). Participants described their empathy skills as being “a real asset with friendships” (Participant 13). Further, one participant described that her ability to understand others has allowed her to “pick up on other people’s emotions even though it’s not incredibly obvious” and that it has “allowed me to develop close relationships very quickly only because I can pick up on those things” (Participant 21).

***Overarching theme #2: No empathy.***

The theme “No empathy” represents responses that suggest some participants believe they have weak empathy skills. For example, some participants acknowledged that they “don’t really know why others [might be] upset or how to respond ... emotionally” (Participant 45) and that they “have a hard time seeing things in [others’] point of view” (Participant 23). Many participants reported that friends and romantic partners would describe them as abrasive and work (as opposed to relationship-

*Table 11*  
*Overarching Themes Identified From Interview*

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Overarching Themes

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**All Participants**

1. Positive traits
2. No empathy
3. Interest in relationships
4. Non empathic/practical help
5. Consequences of relationships

**Relative Group Only**

1. Negative impacts of being raised with a relative with autism
  2. Personal growth and special considerations as result of having a relative with autism
  3. Positive impacts of having a relative with autism
  4. Unaware of different family dynamics
- 

*\*Note.* The overarching themes are reported in decreasing order, such that the theme with the most individual responses appears first, and the theme with the fewest responses appears last.

oriented). For example, friends and romantic partners described them as “stubborn” (Participant 1282), “bossy” (Participant 23), “pushy” (Participant 20), “loud” (Participant 17), “driven to succeed” (Participant 20), “anal” (Participant 27), and “closed off” (Participant 21). Further, relationships tended to end because participants were “not very comfortable being close to people” (Participant 30), “not good at communicating” (Participant 17), and for being “too nonchalant and laid back” (Participant 18).

***Overarching theme #3: Interest in relationships.***

The theme “Interest in relationships” represents responses where participants described an interest in initiating or maintaining their friendships and romantic relationships in the future. For example, participants stated “As far as friendships go, I suppose I would like to have some more friends. I hope to expand my social circle a little bit” (Participant 20) and “I really value the ‘strong connection’ kind of relationships. Relationships of convenience don’t matter much and I want someone I can trust and talk to about my feelings” (Participant 21). Another participant stated, “I would prefer to be with someone who I can have a lifetime relationship with. I don’t want to be dating. It’s more about commitment to one man who I’m going to stick with for the rest of my life” (Participant 1277). Others hoped to be “settled down and married with kids” (Participant 1263) and to “be married to someone whom I consider my best friend” (Participant 43).

***Overarching theme #4: Non-empathic/practical help.***

The theme “Non-empathic/practical help” represents actions of participants who are helpful and accommodating in relationships, but whose actions are non-empathic. For example, participants reported that when intimate partners were faced with hardship, they

would give the person “time to process” (Participant 21), “let them vent” (Participant 27), “give advice” (Participant 14), and “keep [the person] distracted” (Participant 23).

***Overarching theme #5: Consequences to relationships.***

The theme “Consequences to relationships” represents responses that describe the personal and relational changes that occur as a result of being a friend or a romantic partner. Responses suggest that friendships and romantic relationships can have personal implications, such as becoming “emotionally overwhelmed” (Participant 21), and having “no desire to pursue a romantic relationship” (Participant 43). Participants explained that intimate relationships ended because sometimes, partners “change a hell of a lot” (Participant 18), have “different priorities” (Participant 23), and “grow apart” (Participant 1275) over time. Another reason that relationships ended was because partners did not meet “minimal expectations” (Participant 1234).

The last four overarching themes emerged from responses to the following two questions asked to those who grew up with a relative with ASD:

1. Briefly describe what it was like being raised with a sibling with ASD.
2. How has having a relative with ASD affected your social life (e.g., in terms of friendships and romantic relationships)?

***Overarching theme #1: Negative impacts of being raised with a relative with autism.***

The theme “Negative impacts of being raised with a relative with autism” represents responses that suggest that some participants experienced various difficulties as a result of being raised with a relative with ASD. For example, one sibling stated that she “knew what stress was at a young age” and that “it was very chaotic because my

schedule was always dependent on his and what we did that day was dependent on his mood or how he was feeling or what he was doing” (Participant 7). Other siblings reported getting “less attention” (Participant 25) and “taking the back burner” (Participant 18). Many siblings reported negative social impacts as a result of being raised with a relative with ASD. For example, siblings reported “it can make relationships tough because I have to keep canceling on my friends because something’s come up... so it impacts both relationships and friendships” (Participant 18) and avoiding “having friends over to my house because it was really difficult to introduce new people to the house” (Participant 43).

***Overarching theme #2: Personal growth and special considerations as a result of having a relative with autism.***

The theme “Personal growth and special considerations as a result of having a relative with autism” represents responses from participants who had experiences of personal growth and considered their sibling when choosing romantic partners. For example, many siblings reported growing up quickly and feeling a sense of responsibility for their sibling with ASD. Siblings reported that they were “asked to be more grown up than most kids usually are” (Participant 18). Another sibling described, “I’m more like a third parent to him than a sister even though we’re only 18 months apart... I feel more on my parent’s team than I am on my brother’s team” (Participant 7). Many siblings believe that they are responsible for their sibling with ASD. One sibling described “when my parents are no longer here, I feel like he is my responsibility, even though my parents try to make it seem like he isn’t and that they’re going to get him a house and do all those things. I still feel like I am obligated to be his caregiver at all times. So it’s like just very

involved ...it's basically like having my own child" (Participant 1263). In addition, many siblings considered their sibling with ASD when choosing a romantic partner. For example, one sibling explained, "when it came to finding a romantic partner and settling down...my sister was a huge part of that decision making process. I needed somebody who could really understand her and be committed to me and to my sister and her needs" (Participant 20).

***Overarching theme #3: Positive impacts of being raised with a relative with autism.***

The theme "Positive impacts of being raised with a relative with autism" represents responses from some participants that reported experiencing various positive impacts as a result of being raised with someone with ASD. For example, some participants reported positive family relationships, such as having the relative with ASD be "the only thing that made us feel like a family at one point (Participant 17)." Other siblings reported that their siblings with ASD had a global positive impact on them. For example, a number of siblings were inspired to pursue careers where they could help others because of their experiences growing up with their siblings with ASD. For example, one sibling stated, "I'm an occupational therapy major and my goal is to work with kids with special needs and emotional challenges. I'm happy that other people have been able to do it for [my sibling] that I want to be able to do it for someone else's sibling" (Participant 14). Another sibling explained, "he's the reason I do everything that I do...I feel like I am ambitious and I get to make decisions and I get to be an adult who has a purpose...because of him. I feel like if it wasn't for him, I wouldn't know what to do" (Participant 17). Many siblings also identified several positive personal traits that

they have as a result of being raised with a sibling with ASD. Siblings reported being “more accepting of people” (Participant 24), “more independent” (Participant 43), “patient” (Participant 18), “empathic,” and “compassionate” (Participant 20).

***Overarching theme # 4: Unaware of different family dynamics.***

The theme “Unaware of different family dynamics” represents responses that suggest that some participants were unaware that their lifestyle with their sibling was atypical or different than others’ experience with their siblings. For example, one sibling only realized the differences in her teen years, because “she was my only sibling, and I didn’t realize that sibling relationships are usually different” (Participant 25). Another sibling described her experience as “normal, because that’s the only reality I’ve lived with” (Participant 43).

## CHAPTER 5

### DISCUSSION

The purpose of the present study was to explore the relationship between BAP features, empathy skills, and intimate relationship functioning in emerging adults who either did not have a biological relative with ASD, or had a biological sibling (full or half sibling), niece, nephew, aunt, uncle, cousin, or grandparent with ASD. The present study also explored whether being raised with a relative with ASD was a risk factor for weaker intimate relationship functioning and whether task-based measures of cognitive empathy or self-report based measures of cognitive empathy were more strongly associated with intimate relationship functioning.

#### ***Exploratory Research Questions.***

##### ***1. Environmental effects.***

The first exploratory research question investigated whether growing up with a relative with ASD was a risk factor for various intimate relationship functioning outcomes. Overall, being raised with a relative with ASD was associated with shorter duration of friendships. However, being raised with a relative with ASD was not associated with interest in and pleasure derived from friendships, number of romantic relationships, duration of romantic relationships, or romantic loneliness.

The effect of being raised with a relative with ASD was isolated by controlling for (in a limited way) the greater theoretical likelihood of inheriting the BAP in relatives of people with ASD by including only participants in the Relative group in this analysis. Although a greater percentage of siblings have previously been shown to have more BAP features compared to other relatives (e.g., cousins, aunts; Pickles et al., 2000), for

the purposes of the present study, the degree of BAP features (i.e., BAP scores) between siblings (i.e., first degree relatives) and other relatives (i.e., second and third degree relatives) were not a confound because siblings and other relatives' scores on the BAPQ were not found to differ. That is, a similarly high proportion of first, second, and third relatives exceeded the BAP cutoff in the present study. This was unexpected because past research demonstrated that first-degree relatives (i.e., siblings) exhibited more BAP features than second and third degree relatives of people with ASD (Pickles et al., 2000). These results can be explained through a suspected selection bias, that people with more BAP characteristics were interested in participating in this study.

Being raised with a relative with ASD was associated with shorter duration of friendships, when social BAP features and empathy had been accounted for. It is possible that participants who grew up with relatives with ASD had shorter duration friendships in part because they were raised with a relative with ASD. This is possible because BAP scores were similar between relatives who were or were not raised with their relative with ASD and because the effect of empathy skills had been accounted for in this analysis. Past research also found that being raised with a sibling with ASD can have long-term effects on the friendships of typically-developing siblings (Latta et al., 2014). For example, siblings of people with ASD reported having fewer friends than siblings of people with other developmental disabilities (Bågenholm & Gillberg, 1991). Siblings of people with ASD have reported that their friendships were negatively impacted by having a sibling with ASD because siblings may not want to invite their friends over while their sibling with ASD was home and because their parents simply did

not have enough time to support and promote the friendships of their typically developing children (Benderix & Sivberg, 2007).

Results from the qualitative interview are used throughout the discussion to illustrate the quantitative findings. The unique environmental effects of being raised with a relative with ASD on friendship duration were echoed in the qualitative responses of siblings who were raised with their relative with ASD. Many siblings reported negative impacts on their friendships as a result of being raised with a relative with ASD, which were subsumed within the overarching theme “Negative impacts of being raised with a relative with ASD.” For example, one sibling explained “he [the brother with ASD] would hit or have a meltdown...as his sister I dealt with that and suffered social repercussions” (Participant 21). Another sibling described that “ I would never invite people over my house because I was a little apprehensive about how they would react to him” (Participant 7). Another example of how being raised with a relative with ASD might affect friendships was exemplified by a participant who explained, “I did not really hang out with peers. I would hang out with my family and my brother because we had to go to another city for his speech therapy” (Participant 17).

However, being raised with a relative with ASD was not associated with interest in and pleasure derived from friendships. Although no difference was found between relatives who were or were not raised with a relative with ASD on their interest in and pleasure derived from friendships, some siblings reported having an interest in intimate relationships during the telephone interview. These responses were subsumed within the theme “More Friendships/More Relationships.” For example, siblings stated “I would

want to have more friends [in the future] than I have now” (Participant 21), and another stated “I want to expand my social circle” (Participant 20).

Being raised with a relative with ASD was not associated with number of past romantic relationships, duration of past romantic relationships, or romantic loneliness. In the qualitative responses, some siblings of people with ASD reported choosing romantic partners who would make good long-term partners or with whom they are highly compatible. The siblings of people with ASD described being selective in choosing a romantic partner, specifically selecting partners who were willing to care for their sibling with ASD in the future. For example, one sibling explained that she plans to be the caregiver for her siblings and that “if I do have a partner, I want him to clearly understand that when we have our own home, I want to have two extra rooms for my siblings” (Participant 19). Another sibling described how her sister played a role in her choosing a romantic partner: “my sister was a huge part of that process...I needed somebody who could really understand her and be committed not only to me, but to her and her needs” (Participant 20). Another described “I know I will be responsible for my sister, so finding a romantic relationship is hard because I am not thinking about a short-term fling boyfriend. I need a long-term person” (Participant 27). Thus, participants say that romantic partners are screened more carefully than are friends because long-term romantic partners are expected to be involved in caring for the relative with ASD. This pattern illustrates why no association was found between being raised with a relative with ASD and number of past romantic relationships, duration of past romantic relationships, or romantic loneliness. That most predictors (e.g., social BAP, empathy,

being raised with a relative with ASD) were not associated with the romantic relationship outcome variables will be further discussed later in the discussion.

The qualitative results suggest that there are additional unique environmental effects of being raised with someone with ASD, which can have both positive and negative impacts on the sibling of the person with ASD. Participants described some positive effects of being raised with a person with ASD as “being less judgmental of people” (Participant 45), bringing forth “my passion and advocacy for understanding others and fighting for them” (Participant 43), and that it has “...impacted my relationships. I’ve got so much patience. I let people vent and I’ve learned skills from living with her because I know she needs longer to deal with things” (Participant 18). Many siblings described finding their career as a result of growing up with their sibling with ASD. For example, one sibling explained how having a relative with ASD has impacted her career choice: “My career, I employ people with disabilities...I started a business to employ people with ASD” (Participant 20).

The negative effects of being raised with a person with ASD included feeling isolated because “you very rarely find someone who has a sibling who has ASD and Down Syndrome like my brother does, so you can’t really talk to anyone about it, which is difficult” (Participant 30), having the “family dynamics revolve around my brother” (Participant 21), and being “given less attention and less sense of normalcy about how you are supposed to interact with a sibling” (Participant 25). Despite the negative impacts of having a relative with ASD, many participants expressed a profound love for their sibling. One participant stated, “it’s also very rewarding and I’ve learned so much from my sister that I wouldn’t want her without ASD” (Participant 27).

## ***2. Self-report vs. task-based empathy measures.***

The second exploratory research question assessed whether self-report or task-based cognitive empathy measures (emotion recognition and theory of mind abilities) were more strongly associated with each intimate relationship functioning variable. No differences were found between the self-reported and task-based cognitive empathy scores in determining duration of friendships, interest in and pleasure derived from friendships, number of relationships, length of romantic relationships, or romantic loneliness. These results suggest that either self-report and task-based cognitive empathy measures can be used in BAP and intimate relationship research.

Although the difference was not significant, the self-report based cognitive empathy measure was more strongly related to interest in and pleasure derived from friendships compared to the task-based cognitive empathy measures. These results may be understood using a phenomenon called “common-method variance”, or variance that results from similar measurement methods (Podsakoff, MacKenzie, & Lee, 2003). In this case, the self-report measure of empathy may have predicted variance in a self-report measure of interest in and pleasure derived from friendships. Thus, it follows that self-reported cognitive empathy was more strongly associated with a self-report outcome variable than with task-based cognitive empathy measures.

### ***Hypothesis 1: BAP, empathy, and romantic relationships.***

#### ***Correlations.***

*BAP and empathy.* It was hypothesized that people with more social BAP features would have weaker self-reported general empathy skills. This hypothesis was supported, which supports the empathizing-systemizing theory of ASD (which may be

extrapolated, in a weaker sense, to the BAP) that people with ASD are theorized to have a deficit in empathy (Baron-Cohen, 2009). These findings also support the social motivation theory, which posits that individuals with ASD (which may be extrapolated, in a weaker sense, to the BAP) have deficits in social motivation (i.e., aloof personalities), which in turn hinders these individuals from developing strong empathy skills because they have not had adequate exposure to situations warranting empathy (Chevallier et al., 2012). These results are also consistent with previous findings. For example, undergraduate students (non-relatives) who scored higher on the BAPQ reported having weaker empathy skills than those who scored lower on the BAPQ (Lampton & Turner, 2014). It is apparent from the present study that participants with more BAP features reported being less empathic than those with fewer BAP features.

There were a number of qualitative themes in the present study that focused on empathy skills, even though the quantitative survey questions and qualitative interview questions did not explicitly state the word ‘empathy’. First, the subtheme “Empathic” emerged from responses to a number of interview questions. Some participants reported responding in empathic ways to friends or romantic partners faced with adversity, such as “trying to talk to them about their feelings” (Participant 13), and “calling her to check up on her because I know it would be a hard day” (Participant 1273).

Next, the subtheme “Weak Empathy” emerged from responses of participants who reported having weak empathy skills and described feeling “unsure about what to say to someone who is distressed other than ‘it’s okay’ ” (Participant 30) and finding it “quite difficult to figure out the right thing to say to people who are sad or distressed” (Participant 17). Some participants reported responding in non-empathic ways to friends

or romantic partners faced with adversity, such as providing “tough love” by saying things like “get over it” (Participant 7), or by giving the other person “time to process” (Participant 21). That some participants reported strong empathy skills and others reported weak empathy skills is contradictory but can be expected, given that the participants self-reported a range (e.g., strong, weak) of empathy skills. Overall, the qualitative responses help illustrate participant’s quantitative responses about empathy skills.

*BAP and intimate relationship functioning.* It was hypothesized that people with higher overall and social BAP scores would have reported lower interest in and pleasure derived from friendships, shorter duration of friendships, fewer previous romantic relationships, longer duration of previous/current romantic relationships, and higher levels of romantic loneliness. This hypothesis was partially supported in that people with higher social BAP scores reported less interest in and pleasure derived from friendships and shorter duration of friendships. These results support the social motivation theory of ASD, which posits that people with ASD (which may be extrapolated, in a weaker sense, to the BAP) may be predisposed to neglect social opportunities, take less pleasure in social interaction, and put forth less effort into maintaining relationships (Chevallier et al., 2012). Indeed, in the present study, participants with higher social BAP characteristics reported less interest in friendships and experienced shorter duration friendships, possibly because they are predisposed to neglect social opportunities or because they are less likely to use typical strategies to maintain their social relationships.

These results are similar to those of Wainer et al. (2013) in that participants with no known relatives with ASD and higher levels of BAP characteristics reported less

enjoyment of friendships and shorter friendships than those with lower levels of BAP characteristics. Further, Jobe and Williams-White (2007) reported that emerging adults with higher autistic features (which the researchers conceptualized as the BAP) had friendships that were shorter in duration. Thus, these results suggest that social BAP characteristics have a meaningful effect on emerging adults' interest in friendships and duration of friendships.

However, there was no association between people's higher social BAP scores and their number or duration of past romantic relationships. Previous research in this field found that emerging adults with more BAP features reported having longer duration romantic relationships (Lamport & Turner, 2014), which is inconsistent with findings from the present study. Age was not a factor in these differing results, as participants from both Lamport and Turner's (2014) study and the present study were emerging adults who were 20 years old, on average. It is possible, in the present study, that some people with higher BAP features had recently entered romantic relationships at the time they completed the study and thus reported short duration romantic relationships, whereas other people with higher BAP features reported long duration relationships. These differences in relationship length in people with higher BAP features might explain why there was no correlation between BAP features and length of romantic relationship.

Post-hoc analyses of current dating status (single or dating/engaged/married) and BAP status (BAP present or BAP absent) were conducted to clarify these findings. The results suggest that people with and without the BAP did not differ in their current dating

status. These results are thought to be a more accurate estimate of the relationship between the BAP and current romantic relationship functioning.

The fact that there was no association between social BAP and the romantic relationship outcome variables and that there were modest associations between social BAP and the friendship variables suggests that social BAP characteristics play a more prominent role in friendships than in romantic relationships in this sample of 20-year-old university students. These results can be partially explained through the Dyadic Withdrawal Hypothesis, which suggests that emerging adults often withdraw from their friendships when they become involved in a romantic relationship (Leslie, 1982).

There are a number of explanations for this theorized trend. First, in emerging adulthood (participant mean age = 20), there is a need for intimacy, and this need can often be fulfilled in a romantic relationship (Feldman et al., 2000). Next, romantic relationships are an important aspect of Western culture. For example, Western culture emphasizes the importance of finding “one true love” or a “soul mate” (Johnson & Leslie, 1982). As a result, as romantic relationships become more serious (e.g., exclusively dating [51% of present sample], engaged/married [2% of present sample]), emerging adults report having fewer friends (Johnson & Leslie, 1982). For these reasons, emerging adults might decide to spend more time and effort maintaining romantic relationships and less time maintaining friendships. Thus, participants with more BAP features who were in a romantic relationship at the time of the study might have reported shorter friendship duration for this reason. As well, having high BAP characteristics may be more detrimental to friendships than to romantic relationships. This finding should be

considered in light of how romantic relationships satisfy intimacy needs and how romantic relationships are emphasized and valued in Western culture.

The Dyadic Withdrawal Hypothesis also outlines that mature emerging adults are family-focused (Barry, Madsen, Nelson, & Carroll, 2009). Having a mature personality is related to the BAP, as previous findings suggest that relatives with higher BAP symptoms were more conscientious than controls (Murphy et al., 2000). Thus, people with more BAP features may be more family-focused and less friend-focused, and emphasize romantic relationships over friendships. The qualitative responses from the present study also demonstrate that some participants were mature, as they reported being described by friends or romantic partners as “someone who takes work and school very seriously” (Participant 43), “driven to succeed” (Participant 20), and forward thinking (i.e., “I’m not just thinking about what will happen in a year, I’m thinking about 10, 20 years from now” [Participant 27]). Further, many relatives of people with ASD often reported feeling “more mature and more grown up than I would have potentially been without [relative with ASD]” (Participant 18), and reported having “more responsibility than my peers did” (Participant 33).

An additional explanation for the relation between BAP and friendships and no relation between BAP and romantic relationships is that people with the BAP who are in a romantic relationship are having their social needs met through a romantic relationship. It might be that people with moderately high BAP features require less social interaction than people with fewer BAP features and choose to have their romantic partner (as opposed to friends) fulfill their social and emotional needs.

Finally, there was no association between social BAP scores and feelings of romantic loneliness. These results differ from previous findings that people with higher BAP scores reported feeling more lonely (Jobe & Williams-White, 2007; Lamport & Zlomke, 2014). The results from the present study suggest that people with longer relationships or more romantic relationships reported feeling less romantically lonely. However, the present study focused on *romantic loneliness*, whereas past studies have focused on *general loneliness*, which might account for the difference between the findings.

*Empathy and intimate relationship functioning.* It was hypothesized that people with stronger general empathy skills would have higher reported interest in and pleasure derived from friendships, longer duration friendships, fewer past romantic relationships, longer duration of previous romantic relationships, and lower levels of romantic loneliness. This hypothesis was partially supported in that people with stronger general empathy skills reported feeling more interested in and receiving more pleasure from friendships. It has been suggested that people who have strong empathy skills have more fulfilling relationships (Chow, Ruhl, & Buhrmester, 2013). It might be that people who have stronger empathy skills seek out experiences where they can be empathic and reap the benefits of their strong empathy skills, which allows them to experience more gratifying friendships.

However, no association was found between general empathy skills and duration of friendships, number of past romantic relationships, duration of past romantic relationships, and romantic loneliness. These results align with previous research, which has also suggested that there was no association between empathy and length of romantic

relationship (Haugen, Welsh, & McNulty, 2008), or loneliness (Brewer & Kerslake, 2015). Thus, these results suggest that having strong empathy skills is not necessary to maintain long-term relationships and that romantic loneliness is not predicated on empathy skills.

Although empathy may not be necessary to maintain intimate relationships, a subtheme from the interview responses illustrates how having strong empathy skills can “Strengthen Relationships.” For instance, when asked how the ability to understand others impacts their friendships and romantic relationships, one participant explained, “the fact that I pick up on people’s emotions even though it might not be incredibly obvious has allowed me to develop close relationships very quickly” (Participant 21). Another participant stated, “I feel like people trust me a lot because I can empathize with people really well” (Participant 30).

### ***Mediations.***

It was hypothesized that general empathy skills would mediate the relationship between social BAP features and intimate relationship functioning. However, because the outcome variables did not strongly correlate with each other, the mediation analyses were conducted using each outcome variable in separate mediations.

Mediation results suggest that self-reported empathy skills mediated the relationship between social BAP characteristics and duration of friendships. People with more social BAP characteristics reported shorter duration friendships, and even shorter duration friendships when their weaker empathy skills were taken into consideration. This mediation was different from typical mediations because the relationship between social BAP and duration of friendships became stronger (as opposed to weaker) with the

inclusion of empathy as a mediator. These results are evidence for empathy acting as a suppressor variable. That is, when empathy was included as the mediator variable between social BAP and friendship duration, participant friendship duration became even shorter. Therefore, people with more social BAP features had shorter friendship duration. Overall, people with higher social BAP scores also had weaker empathy skills and reported even shorter friendship duration when their empathy skills are taken into account. These results suggest that weaker empathy skills are an important factor in why friendships tend to be shorter when social BAP features are considered.

Results of another mediation analysis suggested that self-reported empathy skills mediated the relationship between social BAP features and interest in and pleasure derived from friendships. Participants with more social BAP characteristics had weaker empathy skills, and participants with weaker empathy skills reported less interest in and pleasure derived from friendships.

It is a best practice when interpreting the causal order of variables in mediation models to rearrange the variables in the mediation to see if the results are more clear when the variables in the model are rearranged (Little et al., 2007). As previously described, many of the alternative mediation models for the present study were significant because as the variables within the model were rotated, the overall significance of the model remained the same, while the indirect effects of the models changed slightly (K. Soucie, personal communication, August 19, 2016). Thus, it is important to consider theory in interpreting the results of the mediation (K. Soucie, personal communication, August 19, 2016).

The social motivation theory posits that individuals with ASD (which may be extrapolated, in a weaker sense, to the BAP) have lower social motivation (i.e., aloof personalities), which in turn hinders them from developing strong empathy skills because they have not had adequate exposure to situations warranting empathy (Chevallier et al., 2012). Thus, the social motivation theory provides a rationale to support the temporal order of more BAP features (independent variable) preceding a weakness in empathy skills (mediator variable).

***Hypothesis 2: Comparing Relatives to Nonrelatives.***

It was hypothesized that there would be a higher proportion of people with the BAP in the Relative Group compared to the No Relative group. It was also hypothesized that overall and social BAP group average scores would be higher in Relative Group than in the No Relative Group. These hypotheses were not supported, as the Relative and No Relative groups had similarly high proportions of people with the BAP and had similar overall and social BAP scores.

***Proportion of people with the BAP in Relative vs. No Relative group.***

The proportion of people with the BAP in the No Relative Group for the present study was 24.6%. Approximately 18% (Wainer et al., 2013) to 40% (Sasson et al., 2012) of undergraduate participants exceeded the BAP cutoff in two other studies that used the BAPQ. Thus, the results of the present study align with those of Sasson et al. (2012) who also reported that a large proportion of their undergraduate sample exceeded the BAP cutoff. Given that the majority of participants from the present study were recruited using the Psychology Participant Pool and that Wainer et al. (2013) and Sasson et al. (2012) also recruited undergraduates, it follows that all three studies report similarly

high proportions of people with the BAP. It is important to consider the ways in which undergraduate emerging adults differ from emerging adults in the general population to understand the extent to which these findings are generalizable to the general population of emerging adults. That is, undergraduates have generally stronger cognitive abilities, stronger reading and verbal skills, and higher socio-economic status compared to people in the general population (Wintre, North, & Sugar, 2001). Therefore, results of past studies and the present study must be interpreted with caution.

Another study that estimated the proportion of people with the BAP using parents of typically developing children found that approximately 5-9% of parents of typically developing children exceeded the BAPQ cutoff (Sasson et al., 2013). That the results of the present study do not align with those of Sasson et al. (2013) can be interpreted by considering the differences between a largely undergraduate emerging adult sample in the present study and parents of typically-developing children (i.e., Sasson et al., 2013). It was previously described how a largely undergraduate emerging adult sample differs from the general population. In addition, emerging adults in the present study differed from parents of typically-developing children in Sasson et al. (2013) because on average, emerging adults were younger ( $M$  age = 20) than parents of typically-developing children ( $M$  age = 35; Sasson et al., 2013). Overall, the results from emerging adult research cannot be validly compared to results from studies of parents of typically-developing children, as people in different life stages may have different values and goals (e.g., educational goals vs. family goals).

The proportion of people in the Relative Group was 27%. The only other study located whose participants included first, second, and third degree relatives of people

with ASD found that approximately 17% of all ASD relatives exhibits at least one feature of the BAP (Pickles et al., 2000). The results from the present study differ from those of Pickles et al. (2000) for a variety of reasons. First, Pickles et al. (2000) used the Family History Interview (Rutter & Folstein, 1995), which is a structured interview to assess BAP features of relatives of people with ASD, whereas the present study used the BAPQ self-report questionnaire to assess BAP features. The differences between these assessment modalities likely underlie the inconsistent findings. Whereas parent interviews serve as a more objective means of assessing the behavioural features of the BAP in children, self-report measures are often biased by self-report bias (i.e., the possibility that those with more BAP features may be overly critical of themselves and may report having more severe features of the BAP). However, it is important to note that Pickles et al. (2000) required participants to have BAP features in only one domain to be classified with the BAP. Pickles et al.'s (2000) results are likely inflated, given that the BAP includes features in two to three domains (e.g., pragmatic language deficits, aloof personality, and rigid personality).

In the present study, the large proportion of people with the BAP in the No Relative and Relative group may have arisen in a variety of ways. First, there is a possibility of selection bias in that people with higher BAP features were attracted to the study because the study's recruitment title contained 'autism' in it (i.e., Social Skills and Close Relationships in People With and Without Relatives with Autism). Given that 165 out of 235 participants were recruited from the Psychology Participant Pool, it is likely that many of these students have learned about ASD in psychology classes. As a result, these students may be subject to the psychological equivalent of medical school

syndrome, which occurs when students believe they have the diseases or psychopathologies that they learn about (Collier, 2008). Thus, having learned about ASD symptoms and potentially suspecting the study was about ASD may have led to participants to over-report BAP features. Another potential source of selection bias might stem from the study's online design. Perhaps people with higher BAP features were more drawn to complete the study because it did not require the human interaction of in-person studies. Next, it has recently become more acceptable in mainstream media to be socially awkward and nerdy (Friedrichs, 2012). There are a number of television shows whose characters are socially awkward, but are incredibly endearing and popular (e.g., Sheldon Cooper from *The Big Bang Theory*, Jessica Day from *New Girl*). Thus, it might be that some participants are more honestly reporting their aloof personalities or difficulties with pragmatic language skills than they might have in the past because there is less of a stigma associated with having such characteristics.

***Overall and social BAP group average scores in Relative vs. No Relative Group.***

It remains unclear whether relatives and nonrelatives differ in their group average score of BAP characteristics. Findings from previous research on the BAP in siblings of people with ASD compared to controls have been inconsistent and most studies have used different measures to measure the BAP. One study demonstrated that family members (siblings and cousins included) with a relative with ASD were more likely to exhibit features of the BAP than family members without a relative with ASD, with 17% of all ASD relatives and 2.4% of people with no known relatives with ASD exhibiting at least one feature of the BAP (Pickles et al., 2000). Other studies suggest that many child-aged siblings of people with ASD exhibit more autistic traits (which the researchers

conceptualized as the BAP) compared to various control groups, such as siblings of typically-developing children (Ben-Yizak et al., 2011; Schwichtenberg et al., 2010; Stone, McMahon, Yoder, & Walden, 2007). However, other studies suggest that many child-aged siblings of people with ASD do not exhibit such characteristics compared to controls (Bishop, Maybery, Wong, Maley, & Hallmayer, 2006; De la Marche et al., 2011; Malesa et al., 2012). It is important to remember that most previous research on the BAP and siblings of people with ASD has focused on child-age siblings and thus, results are based on parent-report of BAP features, whereas the present study focused on adult relatives and their self-reported BAP features. Parents of children with ASD may report fewer BAP features in their typically-developing children because the parents themselves might exhibit features of the BAP, and might be comparing their typically-developing children to their children with ASD, causing them to underreport their typically-developing child's BAP features. On the other hand, emerging adults may have over-reported their BAP features for reasons that have previously been discussed.

#### ***Post-Hoc Analyses.***

***Proportion of relatives with the BAP by relative type.*** Within the Relative group, the BAP cutoff was exceeded by 26.5% of siblings/first degree relatives, 33% of nieces, nephews, aunt, uncle/second degree relatives scores, and 28.5% of cousins/third degree relatives. The only other study located, in which participants included first, second, and third degree relatives of people with ASD, found approximately 8% of first-degree relatives (parents and siblings), 5% of second-degree relatives (aunt/uncle, niece/nephew), and 3.4% of third-degree relatives (cousins) exhibited at least one feature of the BAP (Pickles et al., 2000). Other studies of child-age siblings estimated that

approximately 20% of siblings of people with ASD exhibit subclinical symptoms of ASD (Georgiades et al., 2012; Messinger et al., 2013).

***People with the BAP and best friend and dating status.*** People with the BAP were less likely to currently have a best friend compared to those without the BAP. However, there was no difference in current romantic relationship status between people with and without the BAP. These results suggest that people with higher BAP features may exhibit difficulty initiating and maintaining friendships, but not romantic relationships. No other studies of people with the BAP and their best friend and dating status were found. However, people with higher BAP scores have been found to have shorter duration of friendships (Jobe & Williams-White, 2007) and longer duration of romantic relationships (Lamport & Turner, 2014). These results align with previous results of the present study that people with higher social BAP scores reported less interest in and pleasure derived from friendships. Less interest in friendship may result in many people with higher social BAP features not currently having a best friend.

The number of people with and without the BAP who were in romantic relationships did not differ, suggesting that people with the BAP engage in romantic relationships at similar rates to people without the BAP. The results from the present study support the social motivation theory of ASD. Specifically, many individuals with ASD (which, to a lesser extent may be extrapolated to the BAP) remain interested in romantic and sexual relationships (Mehzabin & Stokes, 2011), despite their social motivation deficits because of the evolutionary pressure for humans to reproduce (Chevallier et al., 2012). In addition, emerging adulthood is a time during which the need

for intimacy emerges (Barry et al., 2009), which might motivate people with the BAP to seek out romantic relationships.

***Comparing people with the BAP vs. No BAP on measures of cognitive vs. affective empathy.***

Post-hoc analyses suggested that people with the BAP struggle more with the cognitive aspect of empathy than with the affective aspect of empathy. The self-report questionnaire used in the present study defined cognitive empathy as “a comprehension of other people’s experience” and affective empathy as “the ability to vicariously experience the emotional experience of others” (Reniers et al., 2011, p. 85). Thus, people with the BAP *reported* struggling to understand others’ experiences, whereas they *reported* experiencing others’ emotions with them. It appears that people with the BAP are unsure why another person feels a certain way, but recognize that the person is experiencing an emotion and experience that emotion with them.

Post-hoc analyses were conducted to determine whether people with the BAP experience more difficulty with the emotion recognition or theory of mind aspects of cognitive empathy using the scores on the two task-based cognitive empathy measures. These results do not support previous study’s findings that people with the BAP struggle more with the cognitive aspect of empathy (Sasson et al., 2012), as people with the BAP performed similarly to people without the BAP on both the emotion recognition and theory of mind tasks. It might be that people with the BAP are subject to self-report bias in that they perceive their cognitive empathy skills to be weaker than they truly are, considering that their task-based cognitive empathy scores do not suggest a weakness in this area. On the other hand, it might be that people with the BAP do have weaker

cognitive empathy skills and that the task-based cognitive empathy measures are not sensitive enough to detect differences in subclinical populations (e.g., people with or without the BAP), as has been previously suggested (Bolte & Poustka, 2003; Sucksmith et al., 2013).

***Implications.***

Results from the present study found that the BAP is present in both emerging adults with no known relatives with ASD and in emerging adults with relatives with ASD, and that having more BAP features has a negative impact on initiating and maintaining friendships. It is important to encourage young adults with BAP features to seek out friendships, given that friendships serve as a protective factor against loneliness (Bowker & Spencer, 2010; Jobe & Williams-White, 2007) and mental health problems (Bagwell & Schmidt, 2013) in non-BAP samples. It is also apparent that friendships are negatively impacted by the combination of BAP features and weak empathy skills. As such, it is important for parents without the BAP to model strong empathy skills (e.g., how to respond appropriately when someone is experiencing different emotions) for young adults who exhibit features of the BAP in order to promote healthy friendships. It is also important to inform undergraduate professors, counselors, and the like of the prevalence of the BAP in the undergraduate population, to encourage professionals in higher education to be more aware of the possible implications the BAP may have on students' educational experience.

The BAP was also common in siblings and extended relatives of people with ASD in the present sample. Further, these relatives with the BAP (although the present study likely has an inflated proportion of relatives with the BAP) experience difficulties

with initiating and maintaining friendships. Thus, it is important to screen family members, especially siblings of people with ASD, for BAP features, given that psychological problems, such as depression and anxiety, may be more frequent in siblings of people with ASD who have elevated BAP features (Petalas et al., 2012; Pickles et al., 2000). Screening for the BAP in relatives is the first step to providing them support about how to maintain friendships (Jobe & Williams-White, 2007) through the development of social skills and healthy friendship training programs, mentorship programs, and support groups. It is important to inform family members of people with ASD about the BAP so that parents who exhibit more BAP features may recognize these features in themselves and their typically developing children. As a result, parents and typically developing children with more BAP features can experience the benefits of friendships and romantic relationships by seeking help and resources. By improving the quality of life of relatives of people with ASD, these individuals will be empowered to provide better care and advocacy for their relatives with ASD.

***Strengths.***

The present study has a number of strengths, making it a meaningful addition to the BAP literature. First, the interpersonal implications (e.g., desire for romantic relationships, duration of romantic relationships, desire for and interest in close friendships) of people with features of the BAP have been under-studied, and the present study extends understanding of the relational implications of the BAP. Another strength is that adult siblings and extended relatives of people with ASD, who are an under-studied population, were the focus of the present study. The present study gave an opportunity for participants to voice their perspectives. Further, this study considered the

environmental effects of being raised with a relative with ASD above and beyond the effects of the BAP. Genetic studies about relatives of people with ASD often do not consider the environmental effects of being raised with a person with ASD, which is a point of criticism for these studies (Pickles et al., 2000). Further, the present study incorporated both self-report and task-based measures of empathy, which, to the researcher's knowledge, have not been used together in past BAP research. The results from the present study add to the literature by comparing the relative accuracy of self-report and task-based empathy measure associations with intimate relationship functioning and thus will help future researchers choose empathy measures for their research studies.

The present study is one of the first BAP studies to screen participants for ASD using a screening questionnaire. Including an ASD screening questionnaire is considered a strength of the study because having people with ASD (who often have weaker empathy skills and intimate relationships) in the sample would have confounded the results. The results of the present study are unlikely to be confounded by participants with ASD, given that 37 participants screened in the ASD range on the ASD screening questionnaire and were thus excluded from participating in the study. Thus, the screening measure increased the validity of the results. Further, because a large proportion of the sample exceeded the cutoff for the BAP, the researcher was able to compare people with the BAP (as opposed to comparing participants with varying BAP *severity*) to people without the BAP in their empathy skills and intimate relationship functioning. Finally, the use of qualitative research methodology enriched the understanding of empathy and its impact on intimate relationship functioning.

Participants' quantitative responses were complemented through the use of qualitative research, giving a forum for the participants' voices. Many participants expressed gratitude and that they felt they were contributing to the research because they shared their stories.

***Limitations.***

The findings from the present study are limited in that the study was correlational in nature, which makes it difficult to confidently infer causality between variables. The results are also limited in that the most of the quantitative responses were self-report, and thus subject to self-report bias. The results of self-report questionnaires might also be driven in part by shared-method variance. Thus, the correlations between variables might be inflated in part because of the similar data collection methodology rather than true association between variables.

Selection bias is likely in this sample. As previously discussed, people with higher BAP and ASD features may have been drawn to participate in this study. Participants with more BAP characteristics may have been drawn to the study because it was an online study that did not involve human interaction. Further, the study recruitment title contained the acronym "ASD", so participants who had relatives with ASD might have been responding to the ASD screening questionnaire or the BAPQ by comparing themselves to their relative with ASD, making their symptoms potentially more severe than they actually are. In addition, the participants from the No Relative Group (and many from the Relative Group) were recruited using the Psychology Participant Pool. The Participant Pool consists of mostly female undergraduate students at the University of Windsor. Thus, the participants were mostly females, whereas the

BAP is disproportionately prominent in males (Baron-Cohen et al., 2001). Additional differences between undergraduates and the general population were discussed previously in “Proportion of people with the BAP in Relative vs. No Relative group.” As such, the findings of the present study may not be strongly generalizable to the general population or to siblings and extended relatives of people with ASD.

***Future Directions.***

It will be important to further explore the environmental effects of being raised with a relative with ASD because few studies have investigated this effect. Further, it will be important for genetic studies comparing relatives to non-relatives to consider the effects of being raised with a relative with ASD before drawing conclusions. Next, it is unclear whether relatives with the BAP exhibited features of the BAP as children or beginning later in adulthood because of the time-limited and correlational nature of the present study. Thus, it is important to conduct longitudinal research with relatives of people with ASD to map the developmental trajectory of the BAP.

Self-report bias limited the results of the present study. Thus, it would be beneficial to conduct research with dyads and have participants report on their partners’ BAP features, empathy skills, etc. Future research may consider comparing ratings from different informants, such as romantic partners or friends. Given that the majority of participants in the present study were Caucasian female undergraduates, future research should specifically recruit an equal number of males and females from diverse ethnic and educational backgrounds to explore the effects of gender and ethnicity on BAP, empathy, and intimate relationship functioning, as these demographic variables may moderate the relationship between BAP, empathy, and intimate relationship functioning.

***Conclusions.***

Overall, the BAP has interpersonal implications and appears to play a more important role in friendships than in romantic relationships. Specifically, emerging adults from the Relative and No Relative group who reported more BAP features had less interest in friendships and shorter duration friendships, in part because people with more BAP features had weaker empathy skills. Relatives who were raised with their relative with ASD experienced unique environmental effects of having a relative with ASD, which are thought to influence their reporting shorter duration friendships.

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APPENDIX A  
Acronyms Used in the Study

*List of all acronyms used in the study*

List of acronyms	List of explanations
ASD	Autism Spectrum Disorder
BAP	Broad Autism Phenotype
ToM	Theory of Mind
E-S Theory	Empathizing-Systemizing Theory
SRS	Social Responsiveness Scale
SRS-A	Social Responsiveness Scale – Adult Version
BAPQ	Broad Autism Phenotype Questionnaire
AQ	Autism Quotient
SD	Standard Deviation
DS	Down Syndrome
FHI	Family History Questionnaire
M-PAS	Modified Personality Assessment Schedule
M-PAS-R	Modified Personality Assessment Schedule-Revised
EQ	Empathy Quotient
RMET	Reading the Mind With the Eyes Task
UOT	Unexpected Outcomes Test
DANVA-II	Diagnostic Analysis of Nonverbal Accuracy-II
PAR	Participatory Action Research
AQ-S	Autism Quotient – Shortened Version
QCAE	Questionnaire of Cognitive and Affective Empathy
FPDT	Faux Pas Test Detection Test
DFQ	Dating and Friendship Questionnaire
FQ	Cambridge Friendship Questionnaire
SELSA-S	The Social and Emotional Loneliness Scale for Adults – Short Version
DGQ	Dating Goals Questionnaire
MRA	Multiple Regression Analysis
SPSS	Statistical Package in Social Science

APPENDIX B  
Demographic Questionnaire

1. How old are you (in years)?: \_\_\_\_
2. What is your gender? \_\_\_\_
3. Which race or ethnicity do you identify with the most?
 

<input type="checkbox"/> Aboriginal	<input type="checkbox"/> Latin American
<input type="checkbox"/> Arab	<input type="checkbox"/> South Asian (East Indian, Pakistani, etc)
<input type="checkbox"/> Black	<input type="checkbox"/> Southeast Asian (Cambodian, Indonesian, etc.)
<input type="checkbox"/> Chinese	<input type="checkbox"/> West Asian (Afghan, Iranian, etc.)
<input type="checkbox"/> Filipino	<input type="checkbox"/> White
<input type="checkbox"/> Japanese	<input type="checkbox"/> Other (please specify) _____
<input type="checkbox"/> Korean	
4. What is your marital status: Married, Common-Law, Separated, Divorced, Single, Other \_\_\_\_
5. What is your current country of residence: \_\_\_\_
6. What is the highest level of education you've achieved? High school diploma, some college, college diploma, some university, university undergraduate degree, Master's degree, doctorate degree
7. Employment status: Indicate your employment status: full time, part time, unemployed
8. Yearly income: What is your current yearly income (in USD\$ or CAD\$): \_\_\_\_
9. Do you have a biological sibling, niece, nephew, aunt, uncle, cousin, or grandparent diagnosed with autism? Yes or No
  - a. If yes, what is your relative with autism's biological relationship to you (sibling, niece, etc.): My biological relative with autism is my \_\_\_\_.
  - i. If your biological relative with autism is your **sibling**, how many biological siblings total (not including you) do you have? \_\_\_\_
  - ii. First born in family is 1st, second born is 2nd, etc.,  
What is your position in the birth order? \_\_\_\_  
What is your sibling with autism's position in birth order? \_\_\_\_
10. Are you currently living with your relative with autism? \_\_ Yes or No
  - a. If Yes, did you live with your relative with autism before you turned 18?
  - b. If Yes, for how many years have you been living with your relative with autism?
11. Have you previously lived with your relative with autism? Yes or No
  - a. If Yes, for how many years did you live with your relative with autism? \_\_\_\_
  - b. If No, how much contact did you/do you have with your relative with autism (hrs/wk)?
12. About your relative with autism
  - a. In what year was your relative with autism born? \_\_ OR How old is your relative with autism? \_\_\_\_
  - b. What is the gender of your biological relative with autism? \_\_\_\_
  - c. Are your relative's academic skills (e.g., reading and writing) higher, lower, or similar to the academic skills of people their age?
  - d. Are your relative's language skills higher, lower, or similar to people their age?

Ruby Jamil designed the demographic questionnaire for the present study.

APPENDIX C  
Permission to Use Measures

*List of measures and permission to use measures*

Measure	Author(s)	Publicly available?	Permission to use?
Autism Quotient-Shortened Version	Hoekstra et al. (2011)	Yes	N/A
Broad Autism Phenotype Questionnaire	Hurley et al. (2007)	Yes	N/A
Questionnaire of Cognitive and Affective Empathy	Reniers et al. (2011)	Yes	N/A
Faux Pas Detection Test	Stone & Baron-Cohen (1998)	Yes	N/A
Reading the Mind in the Eyes Task	Baron-Cohen et al. (2001)	Yes	N/A
Dating and Friendship Questionnaire	Jobe & Williams White (2007)	No	Yes – permission to use measure granted by Lisa Jobe on August 21, 2015
Cambridge Friendship Questionnaire	Baron-Cohen & Wheelwright (2003)	Yes	N/A
Social and Emotional Loneliness Scale-Shortened Version	DiTommaso & Spinner (1993)	Yes	N/A
Dating Goals Questionnaire	Schindler et al. (2010)	No	Yes – permission to use measure granted by Ines Schindler on August 5, 2015

## APPENDIX D

### Interview Questions

1. Briefly describe a situation where a friend or romantic partner felt distressed and how you responded to his or her distress.
2. What do you hope your life looks like in the next 10-15 years in terms of friendships and romantic relationships?
3. What have you heard close friends or romantic partner(s) say about you?
4. Have you ever had a friendship or romantic relationship end?
  - a. (If yes) What about you do you believe may have added to the end of this relationship?
5. How does your ability to understand others impact your friendships and romantic relationships?

#### Relatives

1. Briefly describe what it was like being raised with a sibling with ASD.
2. How has having a relative with ASD affected your social life (e.g., in terms of friendships and romantic relationships)?

Ruby Jamil created the interview questions for the present study.

## APPENDIX E

## Themes by Question from Qualitative Interview

*Themes Identified per Qualitative Question*Themes Identified

1. Briefly describe a situation where a friend or romantic partner felt distressed and how you responded to his or her distress.

- Empathic
- Give Advice
- Give time
- Listen
- Weak empathy
- Tough love

2. What do you hope your life looks like in the next 10-15 years in terms of friendships and romantic relationships?

- Same friends
- Married/partner
- More friendships/romantic relationship
- Romantic weariness

3. What have you heard close friends or romantic partner(s) say about you?

- Empathic
- Abrasive
- Overachieving
- Neurotic
- Calm
- Honest
- Nice
- Loyal
- Optimistic/happy
- Outgoing

4. Have you ever had a friendship or romantic relationship end? What about you do you believe may have added to the end of this relationship?

- Relationship changed
- My fault
- Other person's fault

5. How does your ability to understand others impact your friendships and romantic relationships?

- Strengthens relationships
- Empathic
- Negative impacts on participant
- Do not understand others

*The two questions below were only asked to participants from the Relative group.*

1. Briefly describe what it was like being raised with a sibling with ASD.

- Grew up quickly/responsibility
- I am a better person
- Less attention growing up
- Global positive impacts

- Positive family relations
- Unaware of different family dynamics
- 2. How has having a relative with ASD affected your social life (e.g., in terms of friendships and romantic relationships)?
  - Negative social impact
  - Difficult
  - Choose intimate partners with relative with ASD in mind
  - Choose romantic partner to help care for sibling with autism
  - I am a better person
  - Positive social impacts

---

*\*Note.* The responses to the questions are reported in decreasing order, such that response theme with the most individual responses appears first, and the response theme with the fewest responses appear last.

## APPENDIX F

## Overarching and Sub Themes from Qualitative Interview

*Overarching Themes and Themes Identified From Interview*Overarching Themes and Subthemes

1. Positive Traits
  - Empathic
  - Being empathic strengthens relationships
  - Calm
  - Honest
  - Nice
  - Loyal
  - Optimistic/happy
  - Outgoing
2. No Empathy
  - My fault
  - Abrasive
  - Overachieving
  - Neurotic
  - Weak empathy
  - Tough Love
  - Do not understand others
3. Interest in Relationships
  - Same friends
  - Married/Partner
  - More friends/relationships
4. Non empathic/practical help
  - Give advice
  - Helpful person
  - Give time
  - Distraction
  - Listen
5. Consequences of relationships
  - Relationship changed
  - Other person's fault
  - Romantic Weariness
  - Negative impact on participant
  - My fault -

*The themes below came from responses from the Relative group.*

1. Negative impacts of being raised with a relative with autism
  - Negative social impact
  - Difficult
  - Less attention growing up
2. Personal growth and special considerations as result of having a relative with autism
  - Grew up quickly/responsibility
  - Choose intimate partners with relative with ASD in mind
  - Choose a romantic partner who will help care for relative with ASD
3. Positive impacts of having a relative with autism

I'm a better person  
Global positive impact  
Positive family relations  
Positive social interactions

4. Didn't realize it was different

---

*\*Note.* The overarching themes and subthemes are reported in decreasing order, such that the theme or subtheme with the most individual responses appears first, and the theme or subtheme with the fewest responses appears last.

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