

I *Cannot* See it in Their Eyes: How Autism Symptoms Hamper Dating

by

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Abstract

Despite having typical sexual interests, research shows that few individuals with autism form romantic relationships. The goal of this thesis was to replicate research showing an association between autism symptoms and inappropriate dating behaviours, in particular. It was also to test whether poor theory of mind (ToM; necessary for empathy), mediates the association between autism symptoms and inappropriate dating. University students ($n=124$, $M_{age}=19.7$ years) completed measures of autism symptoms, inappropriate dating behaviours, self-reported flirt perception, and the Eyes Test-Revised ToM measure (Baron-Cohen et al., 2001a). Mediation tests revealed that poor ToM mediated the association between autistic communication symptoms, and inappropriate dating behaviours. Poor ToM, together with increased perception of others' flirtations, also serially mediated the autism/inappropriate dating association. That ToM is a mediator for inappropriate dating behaviours is important for understanding the basis of these behaviours, and also for the development of potential interventions to prevent stalking in this population.

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I Cannot See it in Their Eyes: How Autism Symptoms Hamper Dating

Autism spectrum disorder (ASD) diagnoses are on the rise in Canada, increasing at a rate of 10% to 15% annually for children aged 2 to 14 years (Ouellette-Kuntz et al., 2014). Over 50% of these diagnoses are at the mild, high-functioning end of the spectrum (Lai, Tseng, Hou, & Guo, 2012). For this reason, researchers are now investigating topics with long-term health implications for higher-functioning youth (Howlin, Goode, Hutton, & Rutter, 2004; Howlin, Moss, Savage, & Rutter, 2013; Magiati, Tay, & Howlin, 2014). One health topic that has received relatively little attention to date is the romantic relationship success of young adults with autism.

As children with autism become adults, they develop levels of sexual motivation comparable to those of their non-autistic peers (Dewinter, Vermeiren, Vanwesenbeeck, & van Nieuwenhuizen, 2013; Gabriels & Van Bourgondien, 2007; Mehzabin & Stokes, 2011). However, recent research suggests that when individuals with clinical diagnoses of an ASD attempt to establish committed relationships, they are more likely to engage in inappropriate dating behaviours, than typically-developing peers (Stokes, Newton, & Kaur, 2007). These behaviours interfere with the development of healthy romantic relationships (Spitzberg & Cupach, 2007; Stokes et al., 2007). Examples of these behaviours include intrusively monitoring, or threateningly pursuing romantic prospects.

If nothing is done to change this by middle to late adulthood, no more than 6% of these mostly high-functioning children will be married or in a long-term relationship (Howlin et al., 2004; Howlin et al., 2013; Magiati et al., 2014). In contrast, 48.5% of Canadians in the general population over 15 years of age are married (Statistics Canada, 2006). This is unfortunate, because individuals with high-functioning autism have the

potential to experience positive, sexual relationships (Byers, Nichols, & Voyer; 2013; Byers, Nichols, Voyer, & Reilly, 2012).

One factor known to influence dating success in non-autistic populations is the ability to read nonverbal behaviours in a pre-romantic context (i.e., initial interactions). This ability requires the awareness that others' mental states may differ from one's own, or theory of mind (ToM). The relationship between ToM and dating success in the autistic population has not yet been studied. The primary goal of this thesis was to investigate whether general ToM, mediates the relationship between autism symptoms and inappropriate dating behaviours. It was also to test whether the application of ToM to perceive subtle, nonverbal signals of romantic interest from others, would contribute to the mediation.

Before describing the current study, three main areas of research will be reviewed. The first area concerns autism spectrum disorders (ASDs). This review of ASDs will include the review of diverse theoretical perspectives on autism. It will also introduce theory of mind research conducted with large samples of university students possessing mild, or *sub-clinical*, autism symptoms. The second area to be reviewed pertains to the role of theory of mind in perceiving nonverbal flirtatious communication (i.e., silent face and body expressions) during initial romantic interactions. The third area of research will be the much smaller body of literature concerning romantic functioning among individuals with autism, and sub-clinical autism symptoms. A description of the study design, methodological considerations for the study measures, and the hypotheses will follow. First, however, some definitions of common terms are provided.

Definitions

The terms *theory of mind*, *nonverbal flirting perception*, *dating initiation*, and *high-functioning autism*, will appear regularly throughout this study. In this project, Baron-Cohen's (2002) conceptualization of theory of mind will be used. In addition to appreciating that others have separate mind states, ToM in this context refers broadly to the ability to tell what someone is probably thinking (Baron-Cohen, 2002; Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001). One example of how to exercise theory of mind, is by reading others' nonverbal expressions, particularly from the eyes (Baron-Cohen, Jolliffe, Mortimore, & Robertson, 1997; Baron-Cohen et al., 2001a; Kirkland, Peterson, Baker, Miller, & Pulos, 2013). Nonverbal eye expressions include, for instance, eye-brow flashes, intense direct eye-gazing, or winking. These serve to signal liking between friends or romantic prospects (Moore, 1985). In the latter case, these expressions comprise examples of "flirting". Nonverbal flirting perception refers to one's perception that someone is flirting with them, or that someone is nonverbally communicating their romantic interest in them. Throughout this study, the terms theory of mind, theory of mind eye-reading, and nonverbal communication, will be used interchangeably.

Dating initiation will refer to the initial interactions between acquainted, or unacquainted, romantic prospects, as described in the interpersonal attraction literature (e.g., Cunningham & Barbee, 2008; Green, Buchanan, & Heuer, 1984; Knapp & Vangelisti, 2005; Moore, 2010; Muehlenhard & Scardino, 1985). Due to the scope of this thesis, the focus of these interactions will be on heterosexual interactions. However, the interested reader is encouraged to read Chorney and Morris (2008) for references on minority sexual orientation dating interactions.

Often, initial interactions entail engaging in a variety of dating initiation behaviours. These range from appropriate dating initiation behaviours, such as telephoning a romantic prospect, to inappropriate dating initiation behaviours, such as threateningly pursuing a romantic interest. Throughout this study, the term *dating behaviours* will be used as a short form for dating initiation behaviours.

Finally, the term high-functioning autism (HFA) refers to individuals on the mild end of the clinical autism spectrum. This is not to be confused with low-functioning autism (autism accompanied by intellectual disability) or sub-clinical autism symptoms (Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001). The latter are an even milder form of clinical, high-functioning autism. Though these terms differ, they all describe autism.

Autism Spectrum Disorders (ASDs)

Autism was first defined by Leo Kanner in 1943. Since then, North-American clinicians have been diagnosing ASDs using successive editions of the Diagnostic and Statistical Manual of Mental Disorders (DSM). The current edition of the DSM is the DSM-5. Since 1943, clinical, developmental, and epidemiological researchers have been gathering information on ASD prevalence rates (Fombonne, 2007; Lai et al., 2012; Ouellette-Kuntz et al., 2014), prognoses (Hong & Xiao-Yan, 2003; Thompson, 2013) and possible causes (Annet, 2006; Baron-Cohen et al., 2001a; Baron-Cohen et al., 2011). These topics will all be addressed, after expounding on the concept of autism.

Changes in the DSM system have had a significant impact on the way autism is conceptualized. Until recently, ASD diagnoses have been classified as either classical autistic disorder (AD), Aspergers syndrome (AS), childhood disintegrative disorder, or

pervasive developmental disorders not otherwise specified (PDD-NOS) under the Pervasive Developmental Disorder (PDD) subgroup of the DSM-IV. Now, under the DSM-5, they are undifferentiated, under the term *autism spectrum disorder* (ASD; American Psychiatric Association, 2013; Lai, Lombardo, Chakrabarti, & Baron-Cohen, 2013; Ozonoff, 2012). This change has been welcomed by focus groups of individuals with Aspergers syndrome, and high-functioning autism (Linton, Krcek, Sensui, & Spillers, 2014). However, according to Lai, Lombardo, Chakrabarti, and Baron-Cohen (2013), developmentalists still desire to use the DSM-IV distinction between types of ASDs, in their research.

Moreover, the DSM-IV summarized ASDs as a triad of impairments of social difficulties, communication difficulties (i.e., difficulties understanding fully the implicit and explicit aspects of what others are saying), and narrow, repetitive behaviours and interests. The latter may consist of intense hobbies or fetishes (e.g., a fascination with stamps, or women's feet), and/or stereotyped behaviours (e.g., body-rocking, or hand-flapping). Whereas this triad had been instituted since the DSM-III (American Psychiatric Association, 1980), it has been collapsed in the DSM-5, into a dyad of social difficulties and narrow, repetitive behaviours and interests (Lai et al., 2013; Ozonoff, 2012). Together with collapsing the different autism spectrum disorders under one term (i.e., autism spectrum disorders), this new arrangement has sparked a minor controversy.

Critics interested in researching different causes behind the variety of DSM-IV autism spectrum disorders (ASDs), raise issues with the current DSM-5 view of undifferentiated ASDs. However, including all types of autism into one ASD classification promotes more equitable application of government policies for individuals

with autism (Lai et al., 2013). It may also help to manage and track prevalence rates of ASDs. This is because the difficult task of considering what type of ASD goes into what prevalence count, is obviated. To appease criticisms of the DSM-5's undifferentiated view of autism spectrum disorders, the DSM-5 does include a "specifier" system. The specifier system allows one to describe the type of ASD (e.g., Aspergers syndrome, or autistic disorder), even while adhering to the undifferentiated view of autism. The specifier system also implies that clinicians are free to describe both social and communication difficulties in autism (not just undifferentiated social interaction difficulties as in the new dyad view of ASDs). In a similar fashion, the DSM-5 is acknowledged in this study, even while the DSM-IV triad of impairments will be used to distinguish between autistic social and communication symptoms.

Autistic characteristics are on the rise in the general population (Ouellette-Kuntz et al., 2014) and there are many ways of discussing autism spectrum disorder (ASD) prevalence rates. Regarding gender differences in prevalence rates, the male to female ASD diagnosis ratio is approximately 4:1. Overall prevalence rates are typically found in the range of a few dozen per 10, 000 children (e.g., Baird et al., 2006; Charman, 2002; Fombonne, 2007). This contrasts the higher autism prevalence rates of 1 in 100 children, or even 1 in 68 children, broadcast in the popular media. Notably, higher prevalence rates such as these refer to prevalence rates restricted to a particular cohort such as 8-year-olds in a specific geographic region (Fombonne, 2007; Lai et al., 2012; Ouellette-Kuntz et al., 2014). Notwithstanding, a recent study shows that prevalence rates are rising. Average annual increases lie in the vicinity of 9.7% to 14.6% for Canadian children aged 2-14 years (Ouellette-Kuntz et al., 2014). This is partly due to the fact that the awareness of

autism is increasing among clinicians. Furthermore, the diagnosis of ASDs has become more sophisticated. As such, youths are being diagnosed at a higher rate than previous cohorts (Ouellette-Kuntz et al., 2014). Although these facts make it difficult to correctly interpret autism prevalence rates, researchers agree that rates are rising indeed. For this reason, researchers and clinicians have increased their interest in prognosis research, for autism.

Prognoses for autism treatments are more favourable for those with high-functioning autism, than they are for those with other types of ASDs. Treatment strategies receiving the greatest amounts of attention fall into two broad classes of approaches: the behavioural, and developmental approaches to autism treatment. The behavioural approach falls under the broad strategy of early intensive behavioural interventions (EIBI). These consist of rote, repetitive exercises meant to put child clients through “drill” exercises of social and communication scripts. These drills live up to their name, sometimes running in excess of 40 hours per week during a significant portion of a child’s waking hours (Eldevik et al., 2009; Strauss, Mancini, & Fava, 2013).

Developmental approaches to autism treatments stand in contrast to behavioural approaches. Developmental approaches are rooted in the belief that autistic social and communication symptoms represent delayed typical development, rather than immutable characteristics (Thompson, 2013). Therefore, developmentalists prefer more naturalistic means of facilitating the social development process inherent in all autistic individuals. For example, instead of rewarding good social behaviour with candy, or chocolate during drill exercises, naturalistic social facilitation might include rewarding good social behaviour with a naturally enjoyable social activity (e.g., two-player video-games).

Although considerable research evidence supports the use of EIBIs and provincial medical systems in most Canadian provinces now fund them to some degree, many families and professionals blend in naturalistic components to the drill exercises. These engender the strongest (yet still modest) prognoses for the remediation of autistic symptoms (Granpeesheh, Tarbox, & Dixon, 2009). Given this, some researchers are beginning to call for a rapprochement between behavioural and developmental psychologists on either side of the debate on EIBI treatments (Hong & Xiao-Yan, 2003; Thompson, 2013). They suggest that prognosis is strongest for evidence-based structured, yet naturalistic and sensitive social skills training for school-aged children with both low, and high-functioning autism.

Sub-Clinical Autism Symptoms

In the recent literature, social cognition and clinical researchers have found it useful to study samples of high-functioning autistic individuals. In the process, they began studying those with mild autistic symptoms who are so high-functioning, they do not qualify for a diagnosis. These individuals are said to possess sub-clinical autistic traits, or sub-clinical autism symptoms (Baron-Cohen et al., 2001b; Kamio et al., 2013; Sucksmith, Roth, & Hoekstra, 2011). One measure of these symptoms is the Autism Quotient (AQ; Baron-Cohen et al., 2001b). The AQ includes subscales that measure social and communication difficulties, respectively, as well as imagination, attention-switching, and attention to detail difficulties. It was discovered that these autism symptoms exist throughout the general population. They are also especially common among hard-science and engineering students, relative to those in the humanities and social sciences (Baron-Cohen et al., 2001b). Subsequent family studies have also

confirmed that these traits are more common among first-degree relatives of individuals with high-functioning autism (Wheelwright, Auyeung, Allison, & Baron-Cohen, 2010). Autistic symptoms are also described by the term Broad Autism Phenotype (BAP; Baron-Cohen et al., 2001b; Wheelwright et al., 2010). In addition to the AQ, there are now a wide variety of self-report tools available that measure sub-clinical autism symptoms.

Social cognition and clinical researchers, in particular, have developed questionnaires to measure one's severity of autism symptoms. While the BAP-Questionnaire (Hurley, Losh, Parlier, Reznick, & Piven, 2007) and the Social Responsiveness Scale-A (Constantino & Gruber, 2012) demonstrate greater internal consistency and subscale structure than does the AQ, the AQ has been around the longest and is highly valid (Baron-Cohen et al., 2001b). In contrast to control participants, 80% of individuals with high-functioning autism score in the upper-end of the questionnaire (i.e., 32+). Given its frequent use, the AQ has been shown to be useful for the purpose of comparing current study findings with results from previous major studies. The AQ and other tools, have helped researchers proliferate findings on both sub-clinical, and clinical autism.

Summary. The rate of ASD diagnoses are on the rise in Canada. Meanwhile, the DSM-5 has revamped the conceptualization of, and diagnostic processes for, ASDs. Changes to the DSM-5 include joining different ASD diagnoses under a single ASD umbrella term. Notwithstanding, individuals still naturally range in their sub-types of ASDs (e.g., Aspergers syndrome, or autistic disorder). A “specifier” system is included in the DSM-5 that takes this fact into consideration. This system allows clinicians to describe the type of ASD. According to Lai et al. (2013), developmental researchers still

rely heavily on distinguishing between types of ASDs, especially between low and high-functioning autism. This has allowed researchers to describe even higher-functioning autism that is sub-clinical.

Theories of Autism Spectrum Disorders (ASDs) and Sub-Clinical Autism Symptoms

Many theories have been offered to explain both clinical, and sub-clinical social and communication autistic symptoms (Lai et al., 2013; Ozonoff, 2012; Wing & Potter, 2002). While the DSM's description of autism also includes narrow, repetitive behaviours and interests, this study will focus primarily on discussing theories behind social and communication symptoms, in autism. Three of these theories will be discussed in this section.

Right-shift theory (Annett, 2006). One theory that attempts to explain autism, relies on the distinction between the left and right brain hemispheres. In this theory, poor development of distinguished left-brain/right-brain functions, contributes to autism. In normal brains, the left-brain is genetically programmed to dominate the right-brain (Annett, 2006; Leboyer, Osherson, Nosten, & Roubertoux, 1988; McCann, 1981). However, because the left brain controls the right side of the body, many body functions for most people shift to the right side of the body. These include language, writing, kicking a ball, even kissing (Ocklenburg and Güntürkün, 2009), and in particular, speech production, which all shift to the right side of the body (Annett, 1972). Many researchers believe that autism arises from disruptions in the development of dominance in the left brain. The implication is that many every-day functions, such as writing, should lack right shift among autistic individuals. This right-shift theory of autism demonstrates strengths and weaknesses in explaining autistic social and communication delays.

Two strengths of the right-shift theory are worth mentioning in addition to its limitations. First, it accounts for isolated aspects of ASDs loosely related to possible poor social skills. Examples are non-right handedness (Barry & James, 1978; Colby & Parkinson, 1977) and music preferences (Blackstock, 1978). These are consistent with left-brain impairment. Secondly, it accounts for aspects of language delays among some individuals with ASDs (Annet, 1972; Annett, 2006). Notwithstanding, it does not account adequately for social and communication problems across the entire spectrum. Some autism spectrum disorders (ASDs), namely Aspergers syndrome, or pervasive developmental disorders not otherwise specified, do not include language problems (American Psychiatric Association, 2000). For these reasons, other theories are needed to explain social and communication impairments across the spectrum. Two such theories will form the focus of the next few paragraphs.

Theory of mind theory (Leslie, 1992). The second theory accounting for the social and communication delays in autism, comes from the field of social cognition. The social cognitive view asserts that autism represents delays in theory of mind development (Baron-Cohen et al., 2001a). As mentioned in preceding sections, theory of mind refers to someone's general ability to empathize with others, and appreciate changes in their distinct mind states. As such, it is important for one's social and emotional development (Baron-Cohen et al., 2001a; Leslie, 1992; Sterck & Begeer, 2010). Given this, the theory of mind theory of autism accounts more directly for autistic social and communication difficulties than the right-shift theory of autism.

Wimmer and Perner (1983) developed one of the earliest tasks designed to measure theory of mind. The task involved presenting child participants with a story

about a protagonist named Sally, and an object a friend had surreptitiously hidden from Sally. The child participants were asked to indicate where Sally would look for the object. They would demonstrate theory of mind, if they stated that Sally would look for the hidden object where she thought it was located, not where Sally's friend had actually hidden it. This is because the children would be demonstrating that they could put aside their knowledge of the situation and take Sally's perspective when answering the question. Such tasks are called false belief tasks. This methodology remains popular in theory of mind measurement with children (Leslie, 1992; Miller, 2006; Wimmer & Perner, 1983). Using this and similar tasks, researchers have established age-norms by which theory of mind develops across a variety of children.

Children with autism experience significant delays in the development of theory of mind (Fisher, Happé, & Dunn, 2005; Happé, 1995; Tager-Flusberg & Sullivan, 2000). Although their IQ and problem solving skills develop normally, Leslie (1992) reported that autistic children continued to fail the false belief task even after age four. Age four is the age at which typically developing children pass the false belief task.

Fuelled by these findings, many developmental and social cognition researchers have characterized autism as a disorder of theory of mind delay (Baron-Cohen et al., 2001a; Kirkland et al., 2013; Leslie, 1992; Sterck & Begeer, 2010; Tager-Flusberg, 2000). Characterizing autism as a delay in theory of mind, allows many researchers to explain autistic social and communication symptoms. They reason that difficulties taking others' perspectives lead to lost opportunities for autistic children to acquire important social and communication skills.

Despite the breakthroughs in explaining social and communication difficulties in children with autism, the way theory of mind is conceptualized and measured by false belief tasks, has its limitations. First, given the tests are designed for children they cannot capture the theory of mind deficits possessed by autistic adults whose skills have matured since childhood. Autistic adults do lag behind their peers in theory of mind ability (Baron-Cohen et al., 1997; Baron-Cohen et al., 2001a; Kirkland et al., 2013). However, this is not to be taken as an outright deficit of theory of mind. Individuals with autism do develop theory of mind, however, at a slower pace than typically developing individuals. A second limitation is that even if false belief and similar tasks can capture subtle theory of mind delays in adults, the skills used to complete the tasks are not very generalizable. They all involve hypothetical situations (e.g., judging where a toy is hidden). As such, they fail to identify and measure a naturally-occurring skill, based on theory of mind, that is widely used by adults across a variety of every-day social situations. Finally, a third limitation is that false-belief tasks can be time-consuming and expensive. This is because they need to be administered one on one by trained psychologists (see Wimmer & Perner, 1983). These limitations have encouraged researchers to develop new theories and measures of both theory of mind, and autism.

Extreme male brain theory (EMBT; Baron-Cohen, 2002; Knickmeyer & Baron-Cohen , 2006; Teatero & Netley, 2013). Supporters of the extreme male brain theory of autism believe that autism is caused by exaggerated male cognitive profiles. First, it is noted in the theory that social cognitive gender differences exist between males and females. These differences include theory of mind abilities that are delayed among males, relative to females. The theorists go on to say that these gender differences are

mirrored and exaggerated when comparing non-autistic individuals (considered similar to the females) against autistic individuals (considered similar to the males). These researchers believe that theory of mind delays are central to autism, and that these and other traits are a result of prior exposure of the foetal brain to excessive levels of male hormones called androgens (Teatero & Netley, 2013). This, they say, accounts for why autism is more prevalent in males (Fombonne, 2007).

The EMBT is based on Baron-Cohen's (2002) empathizing-systemizing theory of gender differences. Proponents of this theory also draw from other theories for support. These include the biological foetal theory, X and Y chromosome theories, and the reduced autosomal penetrance theory (Baron-Cohen et al., 2011). Though controversial, the EMBT of autism is supported by an impressive collection of biological, genetic, and social cognitive evidence.

Social cognition articles on the EMBT take particular and frequent note of women's superiority, on average, in the wide-ranging social skill of reading others' nonverbal expressions (Baron-Cohen, 2002). Baron-Cohen, Wheelwright, Hill, Raste, and Plumb (2001) have developed an adult theory of mind test that measures one's ability to read nonverbal expressions from the eyes. It was tested with both clinical and sub-clinical autistic participants. It is a self-administered test that can be completed in minutes, and so it is inexpensive. It is known as the Eyes Test-Revised. Men perform worse than women on the Eyes Test-Revised (Kirkland et al., 2013). Given this, and using the EMBT, one would predict that those with autism would perform worse on the Eyes Test-Revised than those without autism. This is what both social cognition and brain research finds when considering both clinical autism, and sub-clinical autism

symptoms (see Baron-Cohen et al., 1997; Baron-Cohen et al., 2001a; Kirkland et al., 2013; Uljarevic & Hamilton, 2013). As a result of this and similar evidence, the EMBT of autism adequately explains social and communication theory of mind delays among autistic adult populations. Unlike previous theory of mind paradigms relying on false belief tasks, it explains these using inexpensive, theory of mind task research. Moreover, this theory of mind task is appropriate for post-pubescent, adult populations.

Summary. The DSM system classifies ASDs as a group of social interaction and repetitive behaviours disorders. However, social cognition and developmental researchers have been seeking how to explain clinical and sub-clinical autistic social and communication symptoms, in particular. Theories have ranged in their approach to this issue. Using children, Leslie (1992) demonstrates how theory of mind explains autistic social and communication difficulties. However, Baron-Cohen's (2002) extreme male brain theory of autism is particularly adept at explaining autistic social and communication delays as theory of mind delays continuing into adulthood. He observed that gender differences in theory of mind skills were paralleled when comparing autistic and typically developing individuals. He demonstrated this using an inexpensive, adult theory of mind test (Baron-Cohen et al., 1997; Baron-Cohen et al., 2001a). The test identifies a key theory of mind skill in eye-reading (Baron-Cohen et al., 2001a), which is used across a range of social situations.

Sub-Clinical Autism Symptoms and Theory of Mind

Baron-Cohen and other developmental psychopathologists and social cognition researchers, have discovered that those with sub-clinical autism symptoms have difficulties processing social information from the eyes (Erstenyuka, Swansona, &

Sillera, 2014; Rhodes, Jeffery, Taylor, & Ewing, 2013; Swanson & Siller, 2014). To investigate this, Baron-Cohen et al. (2001a) devised theory of mind tests of complex mental state recognition from the eyes (Baron-Cohen et al., 1997; Baron-Cohen et al., 2001a; Kirkland et al., 2013). They used them to test both adults with autism spectrum disorders (ASDs) and adults with sub-clinical autism symptoms, on their theory of mind ability.

Complex mental state recognition. The Eyes Test-Revised is a test of complex mental state recognition (e.g., incredulity) from the eyes. Originally created in 1997, by Baron-Cohen, Jolliffe, Mortimore, and Robertson, the Eyes Test was revised in 2001. To create the Eyes Test-Revised stimuli, Baron-Cohen et al. (2001a) selected a few dozen fashion and sports magazine face clippings and cropped them down to just the eyes. In step one of their stimuli validation process, two men and two women judged the eyes for a range of social complex mental states (e.g., flirting, suspecting, accusing, etc...). A mental state was agreed upon for each photo of eyes. Then, a new team of researchers added three distracter mental state terms to the correct term chosen for each photo of eyes. This was after four more male and four more female judges, unaware of the study aims, had approved of the “correct” terms used to describe each set of eyes. These precise stimuli are available on Baron-Cohen’s autism research centre website.

Baron-Cohen et al. (2001a) hypothesized that on the Eyes Test-Revised, those with high-functioning autism (HFA) would perform significantly worse than typically developing controls. He also predicted that those high in Autism Quotient (AQ) scores, would perform worse than those low in AQ score. Finally, he predicted that men would perform worse than women. To test this, he recruited 103 sub-clinical university students

(50 male) and 122 sub-clinical adults (55 male) from the general population. He also recruited 15 men with HFA, and 14 more typically developing men from the general population. These typically developing men were matched to the 15 HFA men on IQ. Participants were asked to judge which one of four mental state terms presented, depicted each of 36 pairs of eyes stimuli. They were also asked to complete a control task, where they rated the gender of each pair of eyes. Taken together, Baron-Cohen et al.'s (2001a) hypotheses were in line with the theory of mind theory, and the extreme male brain theory of autism.

Each of Baron-Cohen et al.'s (2001a) hypotheses were confirmed by statistically significant findings. The HFA group performed worse than the typically-developing group on the Eyes Test. AQ score negatively predicted Eyes Test-Revised score in the subsamples of 14 sub-clinical men, 15 HFA men, and 122 typically-developing individuals forming the community sample. However, Eyes Test-Revised scores in the university subsample, negatively predicted scores on the social skills and communications subscales of the AQ only—not on the overall AQ. Finally, men performed significantly worse than women as predicted by the extreme male brain theory of autism (Baron-Cohen, 2002; Knickmeyer, & Baron-Cohen, 2006). The results established that subtle differences in theory of mind ability could be detected among adults ranging in clinical HFA diagnosis, or even in sub-clinical autism symptoms.

Furthermore, these findings have recently been replicated. In a recent study by Rhodes, Jeffery, Taylor, and Ewing (2013), individuals high in autism symptoms performed worse on theory of mind eye-reading, relative to individuals low in autism

symptoms. Men also exhibited more difficulties than women in reading the eyes stimuli, supporting the extreme male brain theory of autism.

Summary. Using their revised Eyes Test, Baron-Cohen et al. (2001a) showed that both participants with clinical high-functioning autism, and participants with sub-clinical autism symptoms, showed delays in theory of mind eye-reading. Since both men showed worse theory of mind than women, and autistic individuals showed worse theory of mind than typically developing individuals, the study findings support the theory of mind theory, and the extreme male brain theory, of autism.

The role that theory of mind plays in dating initiation, is the topic of the next section.

Dating Initiation and Theory of Mind

Dating initiation is described as the initial interactions between romantic prospects as they signal romantic interest in one another. In North America, this typically occurs before the onset of dating, or casual outings between romantic prospects (Bredow, Cate, & Huston, 2008; Knapp & Vangelisti, 2005; Moore, 2010). This type of signalling of romantic interest is often nonverbal.

Nonverbal communication is defined by social script and social learning theorists, as whatever is expressed through body language, facial expression, gesturing, or eye-contact, as opposed to through the direct use of words (Moore, 1985; 1995; Moore, 2010). As such, it involves being able to tell what another person is thinking. This effectively describes the concept of theory of mind (Baron-Cohen et al., 2001a; Kirkland et al., 2013; Sterck & Begeer, 2010). The importance of nonverbal communication in understanding both theory of mind, and dating initiation, is well established across many

social cognition and developmental, social script, social learning, and evolutionary psychology research studies (e.g., Baron-Cohen et al., 2001a; Moore, 2010; Renninger, Wade, & Grammer, 2004). This section is a historical review of some of these major research studies.

Adherents to social learning theory, in particular, posit that nonverbal communication is learnt from a young age from peers within friendship networks (Connolly, Craig, Goldberg, & Pepler, 2004; Connolly, Furman, & Konarski, 2000; Connolly, Nguyen, Pepler, Craig, & Jiang, 2013; Moore, 1985; 1995). However, not all adults, let alone children, are aware of nonverbal communication processes (Grammer, Kruck, & Magnusson, 1998; Grammer, Kruck, Juette, & Fink, 2000). Nonetheless, nonverbal communication is used throughout the dating initiation process.

Nonverbal communication facilitates a type of mate competition that goes on between men and women during initial romantic interactions. According to evolutionary psychology theories, this mate competition is fuelled by men and women's conflicting mate goals (Grammer, 1990; Grammer et al., 1998; Grammer et al., 2000). During the human mate selection process, women's goals of mate "choosiness", or high selectivity, is thought to conflict with men's goals of sexual variety (Trivers, 1972). This hypothesis stems from evolutionary theories which note that a woman bears the utmost responsibility in reproduction by gestating, and raising her child to the point of maturity. She must therefore be selective and seek out a man who is able and willing to commit resources to her and potential offspring (Buss, 1989; 1994). In contrast, a man can defer the responsibility of raising offspring to others (e.g., the mother) and still have a good chance at maintaining the success of the offspring, indirectly (Trivers, 1972). This allows men to

(unconsciously) be relatively more indiscriminate, and less careful, regarding with whom they copulate (Buss, 1989; 1994). Consequently, researchers such as Grammer, Kruck, and Magnusson (1998), and Grammer, Kruck, Juette, and Fink (2000) believe that women have evolved systems of nonverbal communication, such as flirtatious behaviour or laughter, to surreptitiously influence men into higher levels of investment towards them and any potential offspring.¹ Men have also evolved nonverbal flirtatious communication. This is in order to be able to respond to, and interact with, women during the dating initiation process (Renninger et al., 2004). However, it is widely held that the human courtship process commonly originates with women's nonverbal-communication, followed by more direct responses from men (Eaton & Rose, 2011; Grammer et al., 2000; Moore, 1985; 1995). This last point will be expanded towards the end of this section.

Giving and receiving nonverbal communication allows women to assess male suitors' true willingness and ability to invest in them (Oberzaucher, 2013; Sadalla, Kenrick, & Vershure, 1987). Coy, nonverbal communication, such as glancing at male suitors then looking away, laughing at their jokes, or attentively nodding during conversation (Moore, 1985), allows women to facilitate dating initiation to their advantage. These types of communication can encourage men to pursue them, while allowing the women to remain ambiguous in their initial commitment to any strange male suitor. This gives women enough time to assess the male's investment potential before verbally agreeing to him as a dating partner (Grammer, 1990). In confirmation of this line

¹ Cultural, feminist and humanist psychologists alike hold issue with some of these evolutionary hypotheses. They state that evolutionary hypotheses suffer from hindsight biases on the adaptive nature of women's sexual preferences, and are intricately woven with untestable beliefs about ancient environmental contexts for evolutionary processes (Eagly & Wood, 1999; Halpern, 2000). Nonetheless, their usefulness as working models of gender differences in sexual behaviour are useful. For instance, the idea that the female brain is better at processing non-verbal communication is confluent with the research demonstrating female superiority in nonverbal communication discussed in the last section on the extreme male brain theory.

of reasoning, research since the 1980s has shown the importance of nonverbal communication to the dynamics of dating initiation.

Women's approval of men's courtship advances often depends on how well coordinated the men's nonverbal communication is with their own nonverbal communication. To this end, Grammer et al. (1998) confirmed that higher perceived pleasure resulted for both the women and men in their study when they could synchronize their nonverbal communications. They accomplished this by matching their body language and intensity of facial expressions. This allowed their interactions to be interactive and less independent from one another.

In facilitating dating initiation, women employ a variety of noncommittal, nonverbal solicitation behaviours to test men's responsiveness and ability to communicate nonverbally. In her study, based on the evolutionary perspective, Moore (1985) observed 200 adult women, cataloguing 52 such nonverbal behaviours. These were defined as courtship behaviours, given they were observed to attract male attention. Men and women who could receive, and respond with, nonverbal behaviours understood nonverbal flirtatious communication. Moore (1995) did a follow-up to her work on women's nonverbal solicitation of men, this time using adolescent girls as participants. She catalogued a set of nonverbal solicitation behaviours that was almost identical to that observed in adult women. One important caveat was that the behaviours sometimes appeared exaggerated and less well-developed. Her conclusions contributed to social learning theory by purporting that nonverbal communication likely goes through a developmental process that takes place between girls and boys beginning around puberty.

Some of these nonverbal communications consisted of eye-glances meant to facilitate dating initiation.

Several evolutionary psychology researchers have focused on describing nonverbal romantic communication originating from the eye areas (Moore, 1985, 1995; Weerth & Kalma, 1995). In Weerth and Kalma's (1995) courtship behaviour study, participants expressed their belief that eye-contact was the most important process during dating initiation. In their observational study, two major groups of nonverbal courtship communications were general and direct eye-glances. At singles' venues, women would send general eye glances around the room to help them begin to make eye-contact with attractive men. Subsequent direct eye-glances were then meant to help women communicate romantic interest to particularly attractive men. Women expected men to distinguish between platonic and romantically charged nonverbal eye signals, with no accompanying verbal instructions.

Although most studies on emitting nonverbal courtship behaviours have involved women as the emitters of nonverbal signals, Renninger, Wade, and Grammer (2004) did perform an observational study where men also emitted nonverbal communication. Coming from an evolutionary perspective, they found that those men who were the most successful during initial romantic interactions were those emitting the most nonverbal signals, in response to initial signals from women. These emitted nonverbal signals had to appropriately match the nonverbal signals initially sent by the women (Grammer 1990; Grammer et al., 1998; Grammer et al., 2000). Men's emissions of nonverbal behaviour (and women's reception of those emissions) led to the most successful romantic interactions, because men and women were able to synchronize their nonverbal

communication (Grammer et al., 1998; Renninger et al., 2004). These behaviours included general, as well as direct eye-glances. Like men, women needed to be able to successfully read nonverbal communication, to facilitate the date initiation interactions.

Notably, failing to respect nonverbal flirtatious invitational cues before approaching a romantic prospect can result in the perceived inappropriateness of either men or women's date initiation efforts (Moore, 1985). This type of dating inappropriateness in its benign form leads to embarrassment. However, in its extreme form it can lead to inappropriate intrusiveness, or even harassment (Bookwala, Frieze, Smith, & Ryan, 1992; Sawyer, Desmond, & Lucke, 1993). This suggests that difficulties reading flirtatious invitational cues may lead to unsuccessful dating initiation.

Autism Spectrum Disorders (ASDs) and Inappropriate Dating Behaviours

Researchers understand that as a theory of mind skill, proficiency in nonverbal communication promotes success in dating initiation and overall dating success (Moore, 2010; Renninger et al., 2004). However, as reviewed earlier, clinical and developmental psychologists have long documented that autism spectrum disorders (ASDs) are associated with a delay in theory of mind, which implies delay in understanding nonverbal communication (Baron-Cohen et al., 1997; Leslie, 1992; Tagger-Flusberg & Sullivan, 2000). Recently, some researchers have begun directly investigating the impact of ASDs on acquiring dating success. Following a brief review of the limited research on ASDs and dating experiences, will be a review of even more limited research on sub-clinical autism symptoms and dating experiences.

Recent research has suggested that individuals with high-functioning ASDs face challenges in forming romantic relationships. These challenges include increased social

and communication difficulties, sexual anxiety, difficulty with sexual arousability, reduced positive sexual cognitions, and being young and male (Byers et al., 2012; Byers et al., 2013). However, according to this recent research, those with high-functioning ASDs still have the potential to form positive sexual relationships.

In their study on ASDs and courtship behaviours, Stokes, Newton, and Kaur (2007) set out to describe the types of dating initiation behaviours engaged in by ASD and typically developing youth. Their sample included 25, mostly male, individuals with high-functioning autism (aged 13-36), and 38, mostly male, typically developing individuals (aged 13-30). They hypothesized that their ASD participants would be less likely to acquire sexual knowledge from peers and friends during childhood development. They also hypothesized that as a result, ASD youth would be more likely to perform inappropriate dating behaviours. These inappropriate dating behaviours included inappropriate touching, unacceptable commenting and gesturing, erroneous beliefs of reciprocated feelings, monitoring, following, and obsessing over/stalking romantic interests, threatening romantic interests, threatening self-harm, stealing or damaging property, and other more serious behaviours. They also hypothesized that ASD youth would be less likely to engage in more appropriate dating behaviours, than typically developing youth. These appropriate behaviours included telephoning romantic interests, initiating social contact, asking interests out on a date, and mailing romantic interests.

To conduct their study, Stokes et al. (2007) administered their Courtship Behaviours Scale questionnaire to the parents of the youth. As hypothesized, they found that ASD youth were significantly less likely to acquire sexual knowledge from peers and friends during development. Stokes et al. (2007) also found that, as hypothesized, it was

fairly common for youth and young adults with ASDs to engage in dating initiation behaviours. However, as hypothesized, they found how much more likely individuals with ASDs were to range in the appropriateness of their dating initiation behaviours, relative to non-ASD peers. Youth with ASDs were less likely than typically developing youth to telephone a romantic prospect, or ask them out on a date. Also as hypothesized, they were more likely to monitor and threateningly pursue romantic prospects, among other problematic behaviours.

Mehzabin and Stokes did a follow-up study to Stokes et al. (2007) in 2011. They demonstrated again, that those with high-functioning ASDs were more likely to experience relationship difficulties than typically developing individuals. However, unlike Stokes et al., they did not examine specific dating initiation behaviours. Rather, they concentrated on studying romantic functioning more generally.

Recently, Post, Haymes, Storey, Loughrey, and Campbell (2012) and Post, Storey, Haymes, Campbell, and Loughrey (2014) reviewed clinical case studies of autism and inappropriate romantic behaviour. They illustrated several examples of not only inappropriate courtship, but outright stalking behaviours among adults with ASDs. They attributed autistic individuals' stalking tendencies to anxiety and/or emotional regulation problems, obsessional tendencies, ignorance of the social and legal consequences of such behaviours, and misunderstanding behaviours that indicate lack of reciprocated feelings.

Such inappropriate dating behaviours are likely to disrupt dating initiation. Not only are ASD youth at risk for engaging in inappropriate dating behaviours, they are also less likely to gain significant casual dating experience, necessary to form established, committed relationships (Knapp & Vangelisti, 2005). This was demonstrated by Ousley

and Mesibov (1991) who had recruited a group of high-functioning ASD participants and a control group of individuals with intellectual delays. They demonstrated that those with ASDs had less dating initiation experiences than intellectually delayed participants. These experiences included going out alone, or holding hands with romantic prospects, as well as “necking”, or going “further than necking”, with romantic prospects. These findings were replicated by Konstantareas and Lunsky (1997), who compared additional samples of adults with high-functioning ASDs, against those with intellectual disabilities. Taken together with the other studies reviewed in this section, these findings suggested that autism is not only associated with inappropriate dating initiation behaviours. It is associated with reduced casual dating and relationship experiences as well.

Summary. ASDs do not altogether preclude romantic relationships. Byers, Nichols, Voyer, and Reilly (2012) and Byers, Nichols, and Voyer (2013) found that individuals with high-functioning ASDs possess the ability to form high-quality relationships. However, the collection of studies reviewed show that individuals with ASDs face challenges in forming romantic relationships. ASDs also raise the chances of making inappropriate dating behaviours, and reduce the chances of gaining positive dating experiences.

Sub-Clinical Autism Symptoms and Dating Initiation

Having an ASD may make it less likely for someone to hold a romantic relationship (Mehzabin & Stokes, 2011; Ousley & Mesibov, 1991). However, clinical, developmental, and social cognition research shows that the effect of sub-clinical autism symptoms on romantic prospects, may not be as severe (Jobe & Williams White, 2007; Pollmann, Finkenauer, & Begeer, 2010). Research suggests that due in part to the

subtlety of sub-clinical autism symptoms, they may not interfere with the development of romantic relationships to the extent that clinical autism spectrum disorders might (ASDs; Jobe & Williams White, 2007). This makes studying those with sub-clinical autism symptoms an optimal choice for studying autism and romantic relationship phenomena.

Developmental research shows that autism symptoms do not preclude being in a romantic relationship (Jobe & Williams White, 2007). However, very few studies have examined dating initiation, or the absence/presence of inappropriate dating behaviours, among sub-clinical autistic populations. As a possible exception to the former, Jobe and Williams White (2007) researched loneliness, dating history and romantic motivation among a sample of 97 undergraduate students varying in autism symptoms. They reported that both those high and low in autism symptoms began dating at the same age. Furthermore, both genders reported a high level of personal interest in dating. Notwithstanding, those high in autism symptoms reported more loneliness relative to those low in autism symptoms. Jobe and Williams White (2007) also reported that, oddly, dating relationships did not evolve from friendships in the sub-clinical autistic population as they normally do among typically-developing individuals (Connolly et al., 2000; Connolly et al., 2004; Connolly et al., 2013). However, even Jobe and Williams White (2007) did not investigate *dating behaviours*, per se, and sub-clinical autism.

Pollmann, Finkenauer, and Begeer (2010) studied 195 married couples, ranging in non-clinical autism symptoms. Their goal was to study multiple mediators of the link between sub-clinical autism symptoms and advanced marital relationship difficulties. They found that, reduced intimacy, increased partner-specific trust, and responsiveness were successful mediators.

However, as mentioned, the socially awkward dating initiation behaviours of individuals with high-functioning autism, may make it difficult for them to gain relationship experiences (Konstantareas & Lunsky 1997; Ousley & Mesibov, 1991; Stokes et al., 2007). The study of sub-clinical autism symptoms has provided an opportunity to study autism and more advanced romantic relationships, such as long-term committed, and marriage relationships (Jobe & Williams White, 2007; Pollmann et al., 2010). However, if wanting to generalise findings back to the clinical population, sub-clinical autism research that focuses on initial interactions, and dating initiation, may be needed.

Neither the Pollmann et al. (2010), nor the Jobe and Williams White (2007) studies have described the presence of specific behaviours used to initiate relationships. On the other hand, Stokes et al. (2007) thoroughly investigated the impact of clinical ASDs on the frequency of engaging in up to 13 inappropriate dating behaviours. Researchers have only to examine mediators that might explain the association between autism and inappropriate dating behaviours. Like Pollmann et al. (2010), the goal of the present study was to study potential mediators of autism/romantic functioning associations. However, in the present study, this was done in a dating initiation context.

Current Study

The goal of the current study was to replicate research that had shown that autism symptoms are associated with inappropriate dating behaviours (Stokes et al., 2007). It was also designed to test whether two proposed mediators, would mediate the association between autism symptoms and inappropriate dating behaviours. The first mediator was theory of mind eye-reading ability. The second mediator was self-reported nonverbal

flirting perception. Nonverbal flirting perception represented theory of mind applied to the specific context of navigating dating initiation interactions. I hypothesized that poor theory of mind eye-reading, and poor self-reported nonverbal flirting perception, would mediate any associations found between autism symptoms and inappropriate dating behaviours.

Methodological Considerations

This last section of the introduction is a detailed review of research on the measurement of the variables of interest. These included measures of autism symptoms, theory of mind, perception of nonverbal flirting, and inappropriate dating behaviours.

Methodological considerations such as the possible expectation of ceiling effects given certain measures, or how specific measures should be adapted for use in the current study, are presented here. Also presented are covariates to be included in the analyses.

Autism symptoms. The first major methodological consideration was which measure of autism symptoms to use. In addition to the popular AQ (Baron-Cohen et al., 2001b), questionnaires available to measure sub-clinical autism symptoms include the Broad Autism Phenotype Questionnaire (BAP-Q; Hurley et al., 2007) and the Social Responsiveness Scale for Adults (SRS-A Constantino & Gruber, 2012). When comparing these three scales in a review, Ingersoll, Hopwood, Wainer, and Donnellan (2011) found that the BAP-Q and SRS-A had demonstrated greater subscale structure and internal consistency than the AQ. This suggested that using one of these as the measure of autistic symptoms in the current study, would be a good choice.

Notwithstanding, the long-held reputation of the AQ as a measure of autism symptoms, and its high validity, made it a better choice for the current study. Given its

more widespread use in the field, choosing it would make it easier to compare the current study's findings to others in the literature. Another reason the AQ was chosen, was because of its social subscale, and its communication subscale. As mentioned, the theory of mind theory of autism adequately explains autism as a difficulty with social and communication skills. Using the AQ uniquely allowed for the assessment of autistic social and communication skill difficulties.

Theory of Mind. Researchers disagree on how to measure theory of mind in autistic adults. Baron-Cohen et al. (1997) and Baron-Cohen et al.'s (2001a) eyes tests comprised the first such measuring devices. Using their revised Eyes Test, Baron-Cohen et al. (2001a) showed that both participants with clinical high-functioning autism and participants with sub-clinical autism symptoms, showed delays in reading complex mind states from photos of eyes.

Recently, however, Roeyers and Demurie (2010) objected to the increasing use of the eyes test in the field. Their reasoning was that reading static photos of eyes might not generalise to reading dynamic nonverbal behaviour in real social life. Another methodological concern, therefore, was whether or not the Eyes Test-Revised would be the best choice of a theory of mind measure.

In keeping with their objections, Roeyers and Demurie (2010) developed an alternative to the Eyes Test-Revised theory of mind measure. They called their measurement paradigm, the naturalistic paradigm. The naturalistic paradigm involves testing one's ability to detect nonverbal behaviour from videos of conversational partners. However, these naturalistic paradigm studies, in turn, have been criticized for their lack of methodological control (Roeyers & Demurie, 2010). They have also been criticized for

their weakness in identifying a foundational skill by which theory of mind operates. In contrast, Baron-Cohen et al.'s (1997) and Baron-Cohen et al.'s (2001a) studies demonstrate a specific source of theory of mind delay, in difficulty reading eye-expressions. This made it a better choice than the naturalistic paradigm for the current study.

In the development of the Eyes Test-Revised, Baron-Cohen et al. (2001a) addressed the potential for ceiling effects from the use of their measure. Autistic individuals experience *delays*, not impairments in theory of mind (Baron-Cohen et al., 2001a). Therefore, Baron-Cohen et al. (2001a) had to deal with the possibility that subtle delays in theory of mind ability, would not be detected by their theory of mind test. However, in light of this concern, Baron-Cohen et al. (2001a) had included three, as opposed to one distracter response for each eyes stimulus in the revised version of the Eyes Test. Making the test more difficult allowed Baron-Cohen et al. (2001a) to find a range of performances well below ceiling.

Participants with and without clinical high-functioning autism, were not the only ones to perform below ceiling. Individuals ranging in sub-clinical autism symptoms also differed in their Eyes Test-Revised score. In particular, community sample participants' total AQ score, was associated with a reduced Eyes Test-Revised score. However, it should be noted that this was not the case in the university student sample. Among university students, only the social subscale and community subscale scores were negatively correlated with theory of mind eye-reading score (Baron-Cohen et al., 2001a). Nonetheless, men performed worse than women on the Eyes Test-Revised, and individuals with at least *some* kind of autistic difficulty performed worse than those

lacking in autistic difficulties. These findings were compatible with both the theory of mind theory (Leslie, 1992) and the extreme male brain theory (Baron-Cohen, 2002) of autism. In these ways, the measure was successful.

Finally, unlike other alternatives such as the naturalistic paradigm, the theory of mind eye-reading takes minutes to complete, and can also be self-administered. For these reasons, the Eyes Test-Revised was chosen as the current study's measure of theory of mind.

Perception of Nonverbal Flirting. Although the Eyes Test-Revised represents a theory of mind measure specific to a certain social skill (i.e., reading non-verbal eye-expressions), a context-specific measure of theory of mind, specific to dating initiation situations, was also desired. An inexpensive measure that would take minutes to complete, like the Eyes Test-Revised, was especially desired. Finally, a measure was sought based on its ability to assess one's sensitivity level to others' mental readiness to be approached romantically. Such a measure was difficult to come by in the literature.

Fortunately, extensive observational research had been done on nonverbal courtship and flirting behaviours (e.g., Grammer, 1990; Grammer et al., 1998; Moore, 1985; 1995; 2010; Renninger et al., 2004). In her studies, Moore observed women's nonverbal behaviour in bars and nightclubs singles' venues. She catalogued 52 nonverbal flirtatious behaviours and confirmed their function as flirtatious nonverbal invitations (Moore, 1985). She did this by observing which of the behaviours, emitted by women, led to responses from men. She also excluded those behaviours from the list, that women had performed in non-singles' areas such as libraries, and cafeterias. Moore (1995) observed many of these same 52 behaviours again in a sample of adolescent girls in

shopping malls. The behaviours were again deemed courtship behaviours, when adolescent boys responded to them by approaching the girls.

However, given this and other studies were observational studies in field, they did not lead to the development of self-report measures of nonverbal courtship perception. Therefore, any self-report measures for use in the current study, would have had to be adapted from the observational research. Such an adaptation had to be inexpensive and be able to be self-administered.

In light of these considerations, a measure of nonverbal flirting perception was created for the current study. It was adapted from Moore's (1985) 52 standard nonverbal courtship behaviours. Because Moore's courtship signals were reported as behaviours, each had to be adapted to phrases representing perceptions. For example, the *hand-hold* behaviour was adapted to a sentence asking participants about the frequency with which they perceived others' holding their hand, with romantic intent. This measure was intended to assess one's level of sensitivity/perception to others' actual nonverbal courtship invitations, through the participants' self-report. It was expected that increased frequency of inappropriate dating behaviours would result from low scores on the measure. That was because I expected participants scoring low on this measure, to infrequently detect others' nonverbal invitations. Without perceiving others' nonverbal romantic invitations, it was expected that one may be prone to make random dating attempts that are not appropriately timed to one's romantic readiness.

Inappropriate Dating Behaviours. Stokes et al. (2007) provided both qualitative and quantitative ways to study dating behaviours in autistic populations (Courtship Behaviour Scale, CBS, Stokes et al., 2007). Their qualitative dating activity

measure consisted of asking participants to check off on the occurrence of each of 21 dating initiation behaviours, per six directed-to targets (i.e., celebrity, friend, colleague, ex-partner, acquaintance, or stranger). These included eight appropriate activities (e.g., asking a prospect for a date, or telephoning prospect) and 13 inappropriate dating initiation behaviours and cognitions (e.g., threatening, or obsessing over romantic prospects). After being asked to check off all activities engaged in, they were then asked the frequency with which each behaviour was performed, on a five-point numerical Likert scale. The response options on the scale ranged from infrequently to frequently. Those with clinical ASDs were more likely to perform inappropriate courtship activities, more often, and with inappropriate targets like celebrities.

While a lack of appropriate dating attempts may lead to difficulties forming relationships, inappropriate dating behaviours may be especially damaging to one's romantic prospects (Post, Haymes, Storey, Loughrey, & Campbell, 2012; Post, Storey, Haymes, Campbell, & Loughrey, 2014). Thus, the numerical Likert questionnaire method, as it pertained to inappropriate dating behaviours only, was applied to the current study.

Covariates. A final methodological consideration concerned covariates. It was determined that care should be taken to ensure that results from the Hayes (2013) PROCESS mediation test, would not be due to covariates. In this context, covariates would be variables responsible for driving the associations between the theory of mind eye-reading/nonverbal flirting perception mediators and the inappropriate dating outcome variable. Variables potentially covarying with theory of mind when negatively predicting inappropriate dating behaviours include intimacy, trust, commitment, love, and passion

(Fletcher, Simpson, & Thomas, 2000), self-disclosure (Hendrick, Hendrick, & Adler, 1988), and secure attachment (Baumeister & Leary, 1995). Along with responsiveness, four of these variables, namely attachment, intimacy, self-disclosure, and trust, were included as covariates in Pollmann et al.'s (2010) study on autism symptoms and marriage difficulties. Although responsiveness, intimacy, and trust are typically used in the study of ongoing relationships, adding them was deemed appropriate. This was due to their inclusion as relationship initiation issues, throughout Sprecher, Wenzel, and Harvey's (2008) relationship initiation handbook. As such, attachment, intimacy, responsiveness, self-disclosure, and trust, were analysed as covariates when testing the mediation of any associations found between autism symptoms and inappropriate dating behaviours.

Finally, the tendency to frequent singles' venues was also thought to predict inappropriate dating behaviours. I reasoned that the more one attended singles' venues, the more exposure they had to singles' of the opposite sex. Opportunity for contact with the opposite sex would be a necessary requirement to engage in inappropriate heterosexual dating behaviours. Thus, a single item measuring singles' venue frequency, was also included as a covariate in the mediation analyses.

Having included these covariates in the mediation model, ensured that findings could be attributed to a meaningful variable (i.e., theory of mind) over and above the covariates.

In the present study, university students varying in number of autistic symptoms completed several self-report measures and the Eyes Test-Revised. Self-reported autism symptoms formed the predictor variable. Meanwhile, self-reported inappropriate dating

behaviours formed the outcome variable. Proposed mediators were theory of mind eye-reading, and self-reported perception of non-verbal flirting. Finally, self-reported attachment anxiety, attachment avoidance, intimacy, responsiveness, self-disclosure, and trust were covariates. The latter were included to improve the validity of the findings.

Primary Hypotheses

Hypothesis 1. Based on research showing that autism symptom severity negatively correlated with successful romantic functioning (Byers et al., 2013; Jobe & Williams White, 2007; Pollmann et al., 2010), and that high-functioning autism positively correlated with inappropriate dating behaviours in particular (Stokes et al., 2007), it was hypothesized that as individuals increased in autism symptom severity, they would increase in inappropriate dating behaviours. In other words, autism was expected to lead to increased frequency of inappropriate dating behaviours.

Specifically, Baron-Cohen et al.'s (2001b) Autism Quotient (AQ) score (including AQ Social, and AQ Communication Subscale scores) was expected to positively correlate with scores on the adaptation of Stokes et al.'s (2007) Courtship Behaviour Scale that focuses on inappropriate dating behaviours frequency.

Hypothesis 2. Research has also demonstrated how autism symptoms predict poor theory of mind (Baron-Cohen et al., 2001a; Rhodes et al., 2013). As reviewed, theory of mind, in turn, has been necessary for effective date initiation communication. Dating initiation communication includes the perception of others' nonverbal courtship behaviours (see review, Moore, 2010). Based on this collection of research, it was hypothesized that poor theory of mind would explain any associations found between autism symptom severity and inappropriate dating behaviours. In fact, theory of mind

eye-reading and nonverbal flirting perception, were each expected to uniquely mediate any associations found between autism symptoms, and inappropriate dating behaviours.

Specifically, a Hayes' (2013) PROCESS parallel multiple mediator test was expected to show that (a) reduced Eyes Test-Revised score, and (b) reduced Nonverbal Flirting Perception Scale scores, would each mediate the positive associations found between each of the AQ Scale's scores, and scores on the measure of inappropriate dating.

Secondary Hypothesis

Hypothesis 3. Gender. The extreme male brain theory states that the social skill differences between those low in autism symptoms, and those high in autism symptoms, should be reflected in gender differences between women and men (Baron-Cohen, 2002).

Based on this, it was hypothesized that the number of autism symptoms among men, would be greater than that among women (Baron-Cohen, 2002; Knickmeyer & Baron-Cohen, 2006; Teatero & Netley, 2013). It was also hypothesized that men would score higher means than women on any main variables from the review, that have positively correlated with autism symptom severity. On the other hand, men were expected to score a lower mean than women, on any variable likely to be negatively associated with autism symptom severity.

This meant that men were expected to score higher means of autism symptoms, but lower means on theory of mind eye-reading and nonverbal flirting perception (Baron-Cohen et al., 2001a; Rhodes et al., 2013), yet exhibit more inappropriate dating behaviours (Grammer et al., 1998; Stokes et al., 2007) than women.

Specifically, ANOVAs (or MANOVAs where appropriate), were expected to indicate that relative to women, men would score (a) lower means on the AQ (including on the AQ Social Subscale, and on the AQ Communication Subscale), (b) a lower mean on the Eyes Test-Revised, (c) a lower mean on the measure of nonverbal flirting perception, and (d) a higher mean on the measure of inappropriate dating behaviours.

Method

Participants

A power-analysis led to a goal of recruiting at least 100 participants to test the hypotheses. A moderate effect size of .3 represents the strength of the negative effect of sub-clinical autism symptoms on extent of dating relationship experience (Jobe & Williams White, 2007). Using G-Power software, it was determined that 100 participants were needed to detect an effect of this size, using an alpha level of .05. Jobe and Williams White (2007) had included a sample of 97 undergraduate university students in their study on the effect of sub-clinical autism symptoms on dating history. This further supported the goal of recruiting 100 participants for the current study. Notwithstanding, the ideal goal would have been 100 men, as well as 100 women, for enough power to detect gender effects.

Recruitment of participants progressed through two stages. The first stage took place in the fall of 2013. During this stage, 178 male, and 667 female undergraduate students from Carleton University, taking first and second year psychology courses, completed the Autism Quotient (AQ). This was part of a mass-testing procedure to screen for participants scoring high and low on the AQ. The participants received course credit for their participation. The distribution of men's AQ scores was normal with a mean of 19.29 (out of 50), standard deviation of 5.98, and a median of 19. The women's scores

were also normal, and they scored an average of 17.97 ($SD = 5.98$) and a median of 17. Mass testing participants scoring one standard deviation above the mean or higher, and one standard deviation below the mean or lower on the AQ, in their gender category, received an email invitation to participate in the study online. In total 55 males, and 188 females received emails to participate. Of these, four males (7.27%) and 39 females (20.74%) responded to participate; however two males (3.64%) and 15 females (7.98%) were participants for this specific study. During the second stage of recruitment, 113 additional first and second year psychology students self-selected to complete the study online. This second stage was necessary to achieve an adequate number of participants. In the second stage, they volunteered for the study by reading the study's description on an online recruitment system administered by the university (see Appendix G).

In both stages, informed consent was obtained online from the participants before they began the study (see Appendix H). All participants were treated in accordance with the online research standards of the Carleton University Psychology Research Ethics Board and the Canadian Tri-Council research agency.

Final Sample. The final sample consisted of 124 participants. These were all first and second year Carleton University psychology students. The sample contained 19 men (15.32%), and 105 (84.68%) women. Age information was missing from two male participants, and one female participant. However, the remaining men were aged 19.94 years on average ($SD = 2.36$), and the remaining women 19.69 years on average ($SD = 3.44$). The three age-missing participants completed 100% of the remaining questionnaires, and so their data was kept in the analyses. The sample was majority heterosexual (90.3%), over half were single or casually dating (53.3%), and over half

indicated they frequented singles' venues at rates ranging from "sometimes" to "always" (52.5%). Although single participants were desired, those in relationships were included to increase sample size and analysis power. This was not expected to interfere with hypothesis assessment, because participants were asked to recall their past dating initiation behaviours (e.g., threatening self-harm) if they had ever pursued a new romantic relationship in the past. A strong majority of the sample indicated that English was their first language, and only four participants (3.2%) indicated they had a clinical autism spectrum disorder. However, the distribution of AQ scores ranged from 6-30, with no participants scoring above Baron-Cohen et al.'s (2001a) clinical cut-off of 32+. Two of the four participants indicating they had an ASD scored above a liberal AQ cut-off of 22 (Lepage, Lortie, Taschereau-Dumouchel, & Théoret, 2009) with scores of 24, and 26, respectively. The AQ distribution was also normal with a mean of 17.49, standard deviation of 5.58, and median of 17.

Apparatus

The questionnaires and the Eyes Test-Revised were administered using a specific software package. This package allowed participants to complete the study online from home or school. For this reason, it is not known what types of computers were used. However, details of the software package are provided below.

The questionnaires were displayed using the 2013 Qualtrics Research Suite free online software. In accordance with the Research Ethics Board standards, participants were fully informed of the level of privacy and confidentiality of their online responses. They were informed that Qualtrics responses would be stored in secure servers located in the U.S.A. They were also informed that their data could be accessed only if in extremely

rare circumstances, the U.S.A. government used their Patriot Act to legally access their data. They were informed that this would only occur by court order for anti-terrorism investigations.

The *Minimal “Look and Feel”* template was chosen for the questionnaires. For the self-report questionnaires (see Appendices A, B, D, and E), no more than approximately 10 questions were displayed at a time on each page.

For the Eyes-Test Revised, each stimulus page was a copied and pasted screenshot of the original, respective, PDF stimulus page, downloaded from the Autism Research Centre (2013). When participants hovered their on-screen mouse pointer over a response option word on a stimulus page, a green field lit up behind the response option. The response option stayed green after the participant clicked on it, representing their choice (see Figure 1). To present a glossary of response option words in addition to the stimuli pages (as in Autism Research Centre, 2013), a link was provided to a separate page of the glossary terms. This link to the glossary terms was provided on the instruction page preceding the stimuli pages (also copied verbatim from, and in the same font as, the Eyes Test-Revised material downloaded from Autism Research Centre, 2013). This link would lead to a separate window that could stay on the participants’ “desktops” behind the study computer window. It could be accessed any time, while the participants completed the study. In accordance with the Research Ethics Board standards, an option to withdraw from the study was provided at the bottom of each page (see Figure 1).

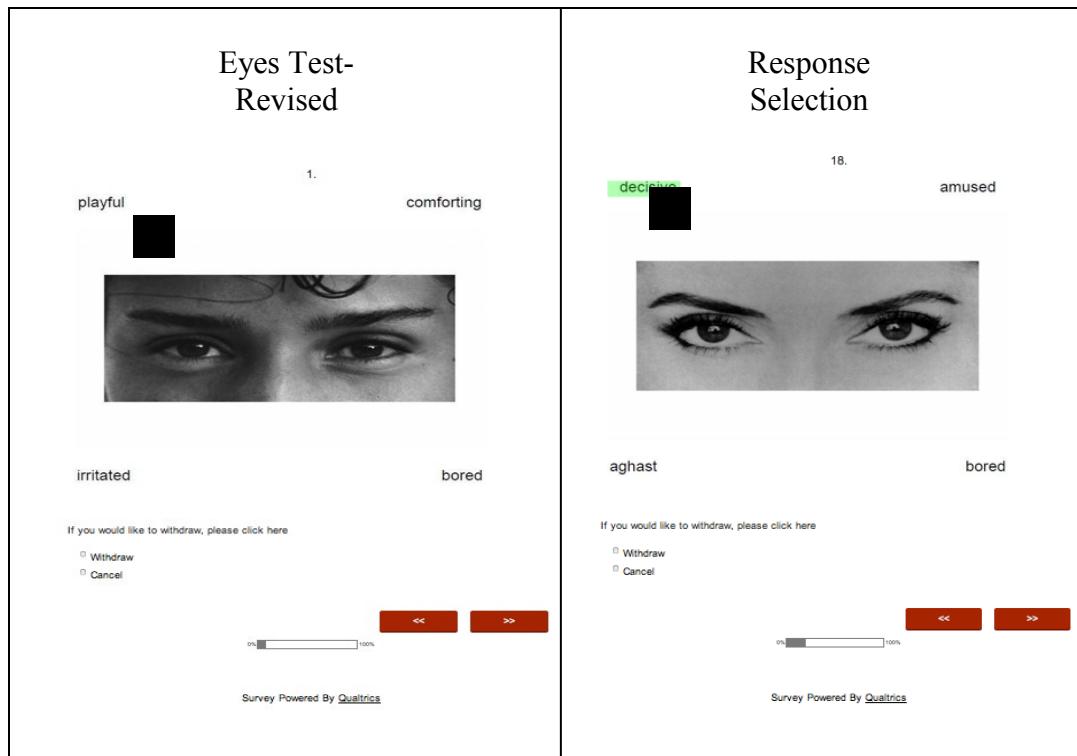


Figure 1. The Eyes Test-Revised online, where each stimulus page is a screenshot copy and paste from Baron-Cohen et al.'s (2001a) Eyes Test-Revised. The user's selection stayed green after clicking on it. Also shown is the withdraw option on each page.

Materials

1. The Autism Quotient (AQ; Baron-Cohen et al. 2001b) measure of autism

symptom severity. The AQ is a popular self-report measure of sub-clinical autism in adults. It is composed of 50 items (e.g., “I usually notice car number plates or similar strings of information,” see Appendix A). The scale includes five subscales, with 10 items per subscale. These are named the social, communication, imagination, detail, and attention subscales. The reliability of this overall scale, computed from the current sample, was moderate (Cronbach alpha = .71). The overall scale has shown excellent construct validity in the literature, as 80% of those with high-functioning autism scored 32+ on the scale, the purported clinical cut-off, compared to only two percent of non-autistic controls (Baron-Cohen et al., 2001b). It also showed excellent convergent validity with the Social Responsiveness Scale measure of autism symptoms (Armstrong & Iarocci, 2013). Response options include *definitely disagree*, *slightly disagree*, *slightly agree* and *definitely agree*. Scoring followed the procedure outlined in Baron-Cohen et al. (2001b), which included reverse-scoring certain items. Final scores range from 0-50, with higher scores indicating greater autism severity.

2. The AQ Social Subscale (Baron-Cohen et al., 2001b) measure of autistic social difficulties. This subscale of the AQ measures one’s self-reported interest in and experience with social activities. It contains 10 items (e.g., “I prefer to do things with others rather than on my own,” see Appendix A and Baron-Cohen et al., 2001b for specific items). Its internal consistency measurement for the current sample was high (.79). Response options and scoring procedures (including reverse-scoring certain items)

are described in Baron-Cohen et al. (2001b). As in the overall AQ, it displays high construct validity. A group of individuals with clinical autism scored higher on each subscale item, than non-autistic controls (Baron-Cohen et al., 2001b). Scores range from 0-10 with higher scores reflecting greater social difficulties.

3. The AQ Communication Subscale (Baron-Cohen et al., 2001b) measure of autistic communication difficulties. The communication subscale assesses one's self-reported ability for social communication (see Appendix A). An example item is "Other people frequently tell me that what I said is impolite, even though I think it is polite." This subscale demonstrates high construct validity, as a group of individuals with high-functioning autism scored higher than controls, on each of its 10 items (Baron-Cohen et al., 2001b). Its internal consistency in the current sample was marginal (.55). Response options and scoring procedures (including reverse-coding certain items) followed Baron-Cohen et al. (2001b). Scores range from 0-10, with higher scores indicating greater communication difficulties.

4. The Background Questionnaire (BQ) measure of participant characteristics. This measure was developed for use in the current study. In this questionnaire, participants provide information on demographics information such as age, psychiatric conditions, and relationship status. Participants can also indicate their current relationship length. An example item is "What is your sexual orientation (please circle one)?" It contains 10 items in total, with no subscales. Response options are different for each question. Questions are scored individually. See Appendix B for exact items.

5. The Eyes Test-Revised (Baron-Cohen et al., 2001a) measure of theory of mind. This test assesses one's development of theory of mind, by measuring one's ability

to read eye expressions. Baron-Cohen et al.'s (2001a) test consists of 36 cropped photos of eye pairs (16 female and 20 male) cut from magazine clippings (see Appendix C). Out of four words surrounding each eyes photo, participants must choose which is the one that best describes each pair of eyes (e.g., "serious, ashamed, alarmed, and bewildered"; see Figure 1 for layout). The reliability of the test items was demonstrated when at least five out of eight judges could agree on the mental state depicted by each pair of eyes, and no more than two judges picked a particular distracter mental state option (Baron-Cohen et al., 2001a). The original eyes-test (on which the revised version is based, Baron-Cohen et al., 1997) showed good convergent validity as scores were highly correlated with Happé's (1994) strange stories theory of mind tasks (Baron-Cohen et al., 1997). Scores are compiled by counting the number of correct responses and range from 0-36. Greater scores represent greater theory of mind.

6. Dating Success Questionnaire. This questionnaire begins with two background questions pertinent to dating. These were created for the purposes of this study. The first concerns the frequency with which one attends singles' venues, with responses ranging from *1 never* to *7 always*. The second question probes into a participant's current relationship status [i.e., "What is your current relationship status (please check one)?"]. (Note that a question on current relationship length was included in the Background Questionnaire.) See Appendix D.

6.1. The Nonverbal Flirting Perception Scale (adapted from Moore's, 1985, Catalog of Nonverbal Solicitation Behaviours) measure of nonverbal flirting perception. This scale measures participants' self-perceived frequency of others' nonverbal flirtatious behaviours. Participants received instructions in a question stem, to

think of these behaviours having been directed towards themselves (i.e., “Please indicate the frequency with which you noticed any of the following silent behaviours directed toward yourself of the intention to catch your attention romantically.”). A preceding statement also set the context for the question stem (i.e., a romantic singles’ venue). To make the 52 individual items, 52 flirtatious behaviours were taken from Moore’s (1985) Catalog of Nonverbal Solicitation Behaviours. Each behaviour was transformed into a grammatically correct sentence about the behaviour. For example, catalogue item “hand hold” became “take/hold/grab my hand” in response to the question stem “Please indicate the frequency with which you noticed any of the following silent behaviours... (see Appendix D, set A, for exact items)”. Seven-point Likert response options ranged from *1 never* to *7 always*. Scoring consisted of averaging scores across items within each scale, and no items needed reverse-scoring. Final scores ranged from 1-7, with greater scores indicating greater self-reported perception of others’ nonverbal romantic interest in themselves. Participants’ responses were subjected to exploratory factor analysis. This led to discovering subscales within the overall invented measure.

Principal-axis factoring is a factor analytic strategy likely to return a conservative number of more highly consistent factors, rather than more less internally consistent factors (Wood, Tataryn, & Gorsuch, 1996). It was used to discover any meaningful subscales within the nonverbal flirting perception scale. Observing scree-plots and using a standard of 1.0 minimum Eigen values for the factor analysis, guided factor extraction (Cattell, 1966; Wood et al., 1996). To return a conservative number of highly internally consistent factors, items were retained so long as they loaded at a statistic of .6 or greater onto a factor with no cross-loadings on other factors, greater than .4.

A 25-item solution and four meaningful factors emerged from the analysis. The first factor, labelled flirtatious touch perception, was loaded with 11 items. Seven items loaded highly onto the second factor, titled flirtatious body-language perception. The third factor contained three items. It was named flirtatious hug perception. Finally the fourth factor was named flirtatious eye-contact perception, and it contained four highly-loaded items. The total variance accounted for was 53.52%. The Kaiser-Myelin-Olkin (KMO) statistic and Bartlett's test of sphericity provide an index of a successful factor analysis resulting in reliable dimensions. This successful factor analysis contributed to the construct validity of the collective scales. The KMO was strong at .93, by Kong, Cheung, and Song's (2011) standards. Bartlett's test was also successful. See Table 1 for the percent of variance in responses accounted for by each factor, specific items and their factor-loadings, and Cronbach alpha statistics of internal consistency, for each factor.

Table 1

Results of Exploratory Factor Analysis of Nonverbal Flirting Perception Scale

Perception Dimensions	Factor 1	Factor 2	Factor 3	Factor 4	% Variance	A
Factor 1: flirtatious touch					18.89	.96
Stroke leg	.83					
Caress face	.79					
Patt buttocks	.77					
Touch thigh	.70					
Pucker lips	.68					
Place my hand on their body	.67					
Caress torso	.65					
Whisper	.62					
Touch noses	.61					
Hold hand	.59					
Walk right up to me	.56					
Factor 2: flirtatious body- language					15.60	.90
Flip hair		.81				
Apply lipstick/lipchap		.79				
Show neck		.78				
Expose leg		.66				
Pout		.64				
Dance solitarily		.60				
Gesticulate		.58				
Factor 3: flirtatious hug perception					11.20	.88
Side-hug		.75				
Hold body against mine		.67				
Double-arm hug		.66				
Factor 4: flirtatious eye- contact					7.84	.80
Fix gaze on me			.78			
Nod head			.64			
Glance around room			.61			
Glance at me/turn away			.60			
KMO: .93.						

6.2. The Courtship Behaviour Scale (CBS; adapted from Stokes et al., 2007)

measure of inappropriate dating behaviours. This scale measures one's self-reported frequency of inappropriate dating initiation behaviours. It was compiled using Stokes et al.'s (2007) Courtship Behaviour Scale (CBS). It came from their study on appropriate and inappropriate courtship behaviours in autism. Individuals with high-functioning autism whose lack of social skills were thought to lead to more inappropriate behaviour, had performed more inappropriate behaviours as measured by this scale. This contributed to the scale's construct validity (Stokes et al., 2007). The thirteen of these courtship behaviours that had occurred with greater relative probability in Stokes et al.'s (2007) clinical autism group, than in their control group, were defined as the inappropriate dating behaviours. These were selected for the current study's measure for use with the sub-clinical sample. The stem question was "If you have attempted to pursue a relationship (romantic), with what frequency have you engaged in any of the following behaviours in the past." See Appendix D, set B, for all specific behaviours. Likert responses to each of the 13 behaviours ranged from *I never* to *5 always*, in keeping with Stokes et al. (2007). Scores were means across items and ranged from 1-5, with higher scores indicating greater intrusive stalking tendency. Responses to these questions were subject to exploratory factor analysis (see Nonverbal Flirting Perception Scale for factor analytic strategy details).

The specific items were chosen because of their use with autism samples (Stokes et al., 2007). However, the items were never compiled in the way they were in this study and not meant to make a total score. It was, therefore, necessary before adding the scores together, (and dividing them to find the average), to factor analyse them to raise the

chances of developing a measure, or measures, of inappropriate dating behaviours that were highly reliable. Seven items loaded onto the only resulting factor which was named inappropriate dating behaviours. The total variance accounted for by this factor was 31.41%. The KMO statistic was high at .84 (i.e., according to Kong, Cheung, & Song, 2011). The analysis also passed Bartlett's test of sphericity. This showed that a highly reliable factor emerged from the analysis (Cronbach alpha = .93). See Table 2 for a listing of items and their factor loadings.

Table 2

Results of Exploratory Factor Analysis of Inappropriate Dating Behaviours Scale

Dimensions	Factor	%Variance	α
Factor 1: inappropriate dating behaviours		31.41	.93
Threateningly pursued	.92		
Other more serious behaviours	.87		
Stolen/damaged property	.85		
Made threats	.82		
Threatened self-harm	.80		
Inappropriate gestures	.73		
Inappropriate comments	.61		
KMO: .84.			

7. The Experiences in Close Relationships Scale (Brennan, Clark, & Shaver, 1998) measure of attachment. This scale measures self-reported attachment in adult romantic relationships (see Appendix E, set A). The measure consists of 18 items within each of the two subscales *attachment avoidance* (e.g., "I want to get close to my partner,

but I keep pulling back") and *attachment anxiety* (e.g., "my desire to be very close sometimes scares people away"). Likert-scale response options for these items range from *1 strongly disagree* to *7 strongly agree*. Scoring involved averaging across normal and reverse-coded items. No total scores across the two scales are computed for this measure. Instead, scoring leads to a separate score for attachment anxiety, and a separate score for attachment avoidance. Total scores range from 1-7 for each scale with higher scores representing greater attachment problems in relationships. Cronbach alpha coefficients for each scale were high in the current study sample (.94 for avoidance, and .94 for anxiety). Given the strength of internal consistency among the scales, this measure also shows strong construct validity.

8. The Perceived Relationship Quality Component Inventory (adapted from Fletcher et al., 2000) measure of intimacy. This scale measures levels of self-perceived intimacy between romantic partners using just three items. It has been used to assess intimacy in a sample of individuals possessing sub-clinical autism symptoms (Pollman et al., 2010). This scale demonstrates good face validity, which is necessary for accurate responding from participants (Fletcher et al., 2000). To increase the reliability of the scale, its number of items was increased from three to six in the scale adapted for this study. In this adaptation, the last three items were mere reverse-versions of the first three (e.g. "how intimate is your relationship?" became "to what extent does your relationship lack intimacy"? in its duplication). Using the current study's sample, the internal consistency index of the measure was .85. Responses range from *I not at all*, to *7 a lot*. Final scores are derived by averaging points across items, keeping in mind to reverse

code the last three items. Scores range from 1-7 with higher scores representing higher levels of relationship intimacy. See Appendix E, set B, for specific questions.

9. The Perceived Partner Responsiveness Scale (adapted from Manne et al., 2004; Laurenceau, Barrett, & Pietromonaco, 1998) measure of responsiveness. This scale measures one's self-perceived level of responsiveness between them and a romantic partner. The original scale contains three items. Using the original three-item scale, authors had found that responsiveness mediated the relationship between self-disclosure and intimacy in a sample of romantic couples with one very vulnerable member (i.e., a cancer patient). The mediation finding contributed to the scale's construct validity. However, in this adaptation, the three items were reversed in meaning and added to the non-reversed items to make six items (Cronbach's alpha = .79 in the current study). One example of an item is "to what extent did your partner feel you did not care for them or what they had to say?" Response options ranged from *I not at all* to *7 a lot*. Final scores ranged from 1-7 with greater scores indicating higher responsiveness between romantic partners. These final scores were calculated by averaging points across the items. See Appendix E, set C, for specific items.

10. The Self-Disclosure Index (Finkenauer, Engels, Branje, & Meeus, 2004) measure of self-disclosure. This scale measures self-perceived levels of disclosure, or the sharing of intimate details, between someone and their romantic partner. It contains nine items (Cronbach's alpha = .92 in the current study), and no subscales. An example of an item is "I talk to my partner about positive things that happened during the day"). Responses range from *I never* to *5 almost always* where points are awarded according to the response options. Final scores are averages across the items. These range from 1-5,

with higher scores indicating greater self-disclosure. This scale has been used by Pollmann et al. (2010) among samples of married individuals ranging in AQ score. That it was significantly, negatively, correlated with sub-clinical autism symptoms, contributes to its construct validity (Pollmann et al., 2010). See Appendix E, set D, for specific items.

11. The Trust in Close Relationships Scale (Rempel, Holmes, & Zanna, 1985)

measure of trust. This scale measures self-perceived trust between a participant and their romantic partner across three subscales (predictability, dependability, and faith).

However, only a total score was computed for this study, across a total of 17 items (Cronbach's alpha in the current study, computed across all 17 items was .93). An example of an item is “my partner has proven to be trustworthy and I am willing to let him/her engage in activities which other partners find too threatening.” The scale shows that trust has predictive validity in predicting relationship success (Rempel et al., 1985) contributing to its construct validity. To match other scales used in the current study, Likert responses for this scale, in this study, ranged from *I strongly disagree* to *7 strongly agree*. However, to be able to compare data from past literature with this data from this study, data were translated to match a scale of *-3 strongly disagree*, to *3 strongly agree*. This was done by subtracting four from each data point. Scores are derived by awarding points according to the numbers associated with the response options, and adding them together. Final scores range from -51 to 51, with higher scores representing greater trust. See Appendix E, set E, for specific items.

Procedure

The purpose of this study was to examine the effect of autism symptom severity on romantic, or dating success. However, it was advertised as a study on *personality and*

romance. This was necessary during the first recruitment stage, to avoid suggesting to participants that they were being emailed because their mass-testing results showed they had autism (which cannot be determined from the AQ self-report questionnaire). It was also necessary during the second stage to engage participants noticing the study on the online recruitment system. Therefore, participants underwent a minor deception regarding the true purpose of this study. The procedures for debriefing the participants, following the deception, followed the standards set by the Psychology Research Ethics Board (see Appendix I). All participants read the debriefing page. Only one participant's data was not used because they did not consent to their use of data following the debriefing on the deception.

The measures listed under materials were part of a larger battery of questionnaires forming part of the personality and romance study battery (see Appendix F). Initially, participants gave their consent to participate in the “personality and romance” study via a website title page. They then began to fill out the online questionnaire battery. Participants first completed the AQ. Next, they completed the Background Questionnaire, followed by the Eyes Test-Revised. They then completed the Dating Success Questionnaire which also contained other questionnaires not associated with the current study (see Appendix F). The last five questionnaires listed under Materials came after the Dating Success Questionnaire. The goal was that participants complete measures of key variables, such as the Autism Quotient, and the Eyes Test-Revised earlier on in the questionnaire battery.

All participants spent an estimated 75 minutes responding to the total questionnaire battery. The questionnaires used in this study took approximately 20

minutes to complete. At the end of the online study, or upon withdrawing, participants read a debriefing page containing information on the true purpose of the study, and an explanation for the need for the deception (see Appendix I). They then read and agreed online to a second consent page for the use of their data. All participants were given a choice to receive course credit, or a chance to win a book gift for compensation. All participants, including the one who did not agree to have their data used, opted for course credit.

Results

Preliminary Analyses

Preliminary analyses were conducted to investigate missing values, the assumptions of the ordinary least squares multiple regression model needed for mediation analyses, and sample and variable mean characteristics. Version 21 of the Statistical Package for the Social Sciences (SPSS) software was used for all analyses.

Missing values. Six cases had been excluded to arrive at the final sample of 124 participants. Four of these participants had been excluded for not completing any dating success questionnaires. Two more participants were excluded for reporting too many diagnoses of psychiatric disorders (i.e., 10 and 20, respectively). This represented a 4.62% complete case exclusion rate.

There was only one discernible pattern of missing data from whole measures. The measures most frequently missed in whole were the attachment, intimacy, responsiveness, self-disclosure, and trust measures. Responding to these measures required participants to imagine their experiences with a romantic partner. Although the instructions encouraged single participants to imagine a past relationship, or failing that, a close platonic relationship, single participants may have been unwilling to respond to

these questionnaires. These questionnaires also appeared at the end of the entire questionnaire battery (see Appendix F). Therefore, the lower response rate may have also been due to fatigue. As these were measures of variables to be used as covariates during the analyses, the small amount of missing values from these measures was not a critical issue.

Aside from these few unusual cases, the participants in this study were faithful in responding to most of all other measures. For each measures, approximately 90% of participants completed approximately 90% of all the items. The remaining 10% of participants with minor amounts of missing values were not excluded outright. The SPSS software-automated pairwise and listwise deletion strategies would ensure that the missing data would not interfere with the analysis calculations. That was because cases would not be included in the analyses involving variables for which they had missing values. In the most extreme circumstances, only four or 21.05% of male cases; or 15, or 14.23% of female cases, were missing from cross-correlation analyses between all measure-pairs. Keeping in mind that in all these cases, participants responded to roughly 80% of not one, but a combination of two of the measures in the analysis, this left little concern over the response rate of the study questions. Overall, there were no serious issues with missing data due to participant response.

Aside from the minor issue with whole measures, there were two technical issues with specific measure items. The first was that after being discovered missing, and inserted into the online Autism Quotient (AQ) questionnaire, item 15 of the social subscale of the AQ did not save into Qualtrics. It was re-entered again and successfully saved after the first 74 participants had completed the study. Secondly, the first half of

the sentence comprising item 2 of the responsiveness measure was saved into one Qualtrics question, and the second half was erroneously saved as another separate Qualtrics question. Participants' responses between the two halves of the sentence were inconsistent. I employed specific strategies to deal with each of these two minor issues.

While the responsiveness item(s) were deleted outright, the issue with the AQ Social Subscale was remediated using a pro-rated total subscale score. This technique has been successful in other self-report research (Zehr, Culbert, Sisk, & Klump, 2007). First, the AQ Social Subscale score out of nine was calculated for each affected participant with the missing item. Then, that score was divided by nine and multiplied by 10. That value was a score out of 10, the usual total, which became the affected participant's AQ Social Subscale score. Analyses revealed no significant differences in AQ Social Subscale mean scores, between those participants receiving nine items, and those who had received 10, either before [$M = 2.55, SD = 2.01$; and $M = 2.81, SD = 2.40$, respectively; $F(1, 119) = .394, p = .53$], or after [$M = 2.94, SD = 2.22$; and $M = 2.66, SD = 2.40$, respectively; $F(1, 119) = .442, p = .51$] their score was pro-rated. This technique was used in the present sample, to better compare participants' scores who had received nine items, and participants' scores who had received 10 items.

Missing values when computing subscale and total scale scores. A strategy was also employed when computing subscale and total scale scores by addition. Total scale scores computed from less than 94% of the items in the scale, were deleted and counted as missing values. However, data from at least 90% of the items in a *subscale* had to be present for any computed subscale score to be counted. So, for example, the autism quotient (AQ) score of a participant only completing 47 (or 94%), of the 50 AQ items

would normally be counted. However, any AQ subscale score would be counted as a missing value, if two or three of the missing items came from the same subscale. That is because the subscale scores are out of 10, and at least 90%, or nine, of the AQ subscale items had to be complete for the case to receive an AQ subscale score.

A different strategy was employed when computing subscale scores by averaging. The use of computing subscale mean scores has been common practice in the construction and validation of other published questionnaires, standardized for use across population samples (e.g., Buhrmester, Furman, Wittenberg, & Reis, 1988). Thus, subscale mean scores were mean scores for every participant that answered a minimum of two items within the subscale. Therefore, if someone answered two items within a subscale, or 12 items within a subscale, their final (mean) subscale scores would be comparable and in the same order of magnitude. This was deemed suitable for items within highly internally consistent subscales, such as the ones in this study (see also Buhrmester et al., 1988). However, it was desired that at least two items on the subscale be included, to take advantage of greater reliability on subscale scores when more than a single item is used. This provided the advantage of using cases with greater numbers of missing values, while adhering to the standard that no subscale scores were to be computed from single items.

How missing values were handled during subscale computation depended on whether addition, or averaging, was used. This depended on whether or not in their seminal article, the creators of the subscale had instructed other researchers to sum the items. If creators of the subscale had instructed others to sum the items within the subscale, then those items were summed to arrive at total subscale scores in the current

study. In these cases, as mentioned, data from at least 94% of the items across the whole scale, and from at least 90% of items across each subscale, had to be present. The sum method was the case for the AQ subscales, the trust measure, and the theory of mind eye-reading measure. The averaging method was preferred for subscale scores resulting from groups of factor-analysed items, such as in the case of the nonverbal flirting perception, and inappropriate dating scales. The averaging method was also used to handle missing data in the attachment, intimacy, responsiveness, and self-disclosure subscales. Finally, all total scale scores computed from subscale scores were sums of the subscale scores. Missing values were entered unless there were 100% of the subscale scores present to compute the total scale score. This last point requires explanation.

Unlike for subscale scores, total scale scores were always computed using addition. Subscales contain groups of several items. These items should be highly inter-correlated. Each subscale is also meant to represent specific, distinct, constructs. In contrast, as components of total scale scores, each subscale score is unique and it is not necessarily desired for the subscale scores to be highly inter-correlated (Field, 2009, p. 664). As such, scores from each subscale contribute more significantly to a total scale score than do item scores for a subscale score. Unlike for average subscale scores computed from single items, missing subscale scores when computing a total scale score can make comparing total scores invalid. So a total scale score was only entered for a case if 100% of the subscale scores were present for that case.

Up to this point, a strategy was described for handling missing values when computing subscale and total scale scores. However, a strategy was also required to handle missing subscale and total scale scores when analyzing the data. For this purpose,

missing values during analyses were caught by listwise (Cohen, Cohen, West, & Aiken, 2003, p. 433) and pairwise deletion (Cohen et al., 2003, p. 434). This meant that if a value for any case was missing on any variable given a particular analysis (i.e., correlation analysis for pairwise deletion, and listwise deletion for other analyses), that case would be excluded from that particular analysis only. That is why subsample sizes may vary depending on the correlation, or analysis performed. A few cases missing subscale or total scale scores may have been missing for that particular analysis.

Univariate outliers and skew. The computed variables were scanned for univariate outliers. To determine univariate outliers, a cut-off of +/- three standard deviations from the mean was used across the values for each variable. Using this cut-off, only the inappropriate dating variable contained outliers.

Two variables were skewed. The positively skewed variable was the inappropriate dating behaviours variable. The theory of mind eye-reading variable was negatively skewed. Neither trimming the inappropriate dating outliers to +/- three standard deviations, nor applying a log transformation to the entire distribution of values (Field, 2009, p. 155) corrected skew in this variable. A log and reflect transformation corrected the negative skew of the theory of mind eye-reading variable. Given the transformations did not correct its skew, the original data on the inappropriate dating behaviours variable was retained. The skew-corrected (logged, and reflected) data was retained for the theory of mind eye-reading variable. However, the logged and reflected theory of mind eye-reading variable was then reflected again so that greater scores represented greater theory of mind.

Multivariate assumptions. Before scanning the data for multivariate outliers, the linearity, independence of residuals, measurement error, multi-collinearity, normality of residuals, and specification assumptions of the multiple regression mediation model were examined. A scatterplot of the regression's standardized residual against its standardized predicted value revealed that the model was sufficiently linear (see Figure 2). A graph of the regression's standardized residual values regressed on order number in which participants completed the study online, revealed sufficient independence of residuals. There was no multi-collinearity between the variables, mediators, and covariates entered into the model. Finally, with the possible exception of the AQ Communication Subscale, there was sufficient internal consistency reported for each variable (see Methods). This suggested low measurement error. These represented the non-violated assumptions of the regression mediation model.

There were also violations of the assumptions of the regression mediation model. There was marked heteroscedasticity, or inconstant variance, revealed by the scatterplot of the regression's standardized residual plotted against its standardized predicted value (see Figure 2). The reliability of the measure of autistic communications was modest. PP-plots and QQ-plots revealed that residuals were not normally distributed. Finally, with a relatively low proportion of explained variance of .20, the model was not highly specified. There were also several Mahalanobis distance outliers, as well as DFFITS and DFBETA (for the theory of mind eye-reading variable) influence outliers. These violations needed to be addressed.

Bias-corrected bootstrapping was used to handle the violations of the multiple regression mediation assumptions (Haukka, 1995; Hayes, 2013; Hayes & Cai, 2007; Lv

& Liu, 2014; Wu, 1986). Bootstrapping is a resampling method that renders estimates of standard errors and regression coefficients robust against violations of the ordinary least squares regression model. In bootstrapping, a study sample is treated as a population. From this “population”, smaller “samples” are drawn repeatedly (i.e., thousands of times), with replacement. This produces a better simulation of the population, than does the sample. This accounts for the robustness of the bootstrap analyses against regression model violations.

The bootstrapping procedures in the PROCESS multiple mediation macro for the SPSS software (Hayes, 2013) are highly useful. One technique to provide heteroskedastic-consistent standard error estimates, ensures additional rigour against the violation of the constant variance assumption (Hayes & Cai, 2007). The bias-corrected bootstrapping also provides robustness against violations of the normality assumption (Hayes, 2013; Hayes & Cai, 2007; Wu, 1986). Moreover, the ability to increase the number of “samples” allows one to increase the power of the analyses. This reduces the unwanted effects of measurement error on deriving unbiased estimates of standard errors and regression coefficients (Haukka, 1995). Given this increased power (Salibian-Barrera & Zamar, 2002), bootstrapping has also been used to show robustness against the presence of necessary outliers.

Overall, bootstrapping represents a better alternative to other remediation techniques. An alternative to dealing with univariate and multivariate outliers is to delete the outlying values. However, when outliers are theoretically meaningful, deletion is not recommended (Cohen et al., 2003, ch. 10). As it pertains to the current study, most individuals in a sub-clinical sample were not expected to engage in inappropriate dating

(Stokes et al., 2007). However, the few outliers that did, were important to the study. Therefore, their data needed to be retained. Like regression model misspecification, these outliers cannot be avoided in practice (Lv & Liu, 2014). The use of bootstrapping resampling allowed me to mitigate the impact of the outliers, and the other violations of the multiple regression model, on the data analyses.

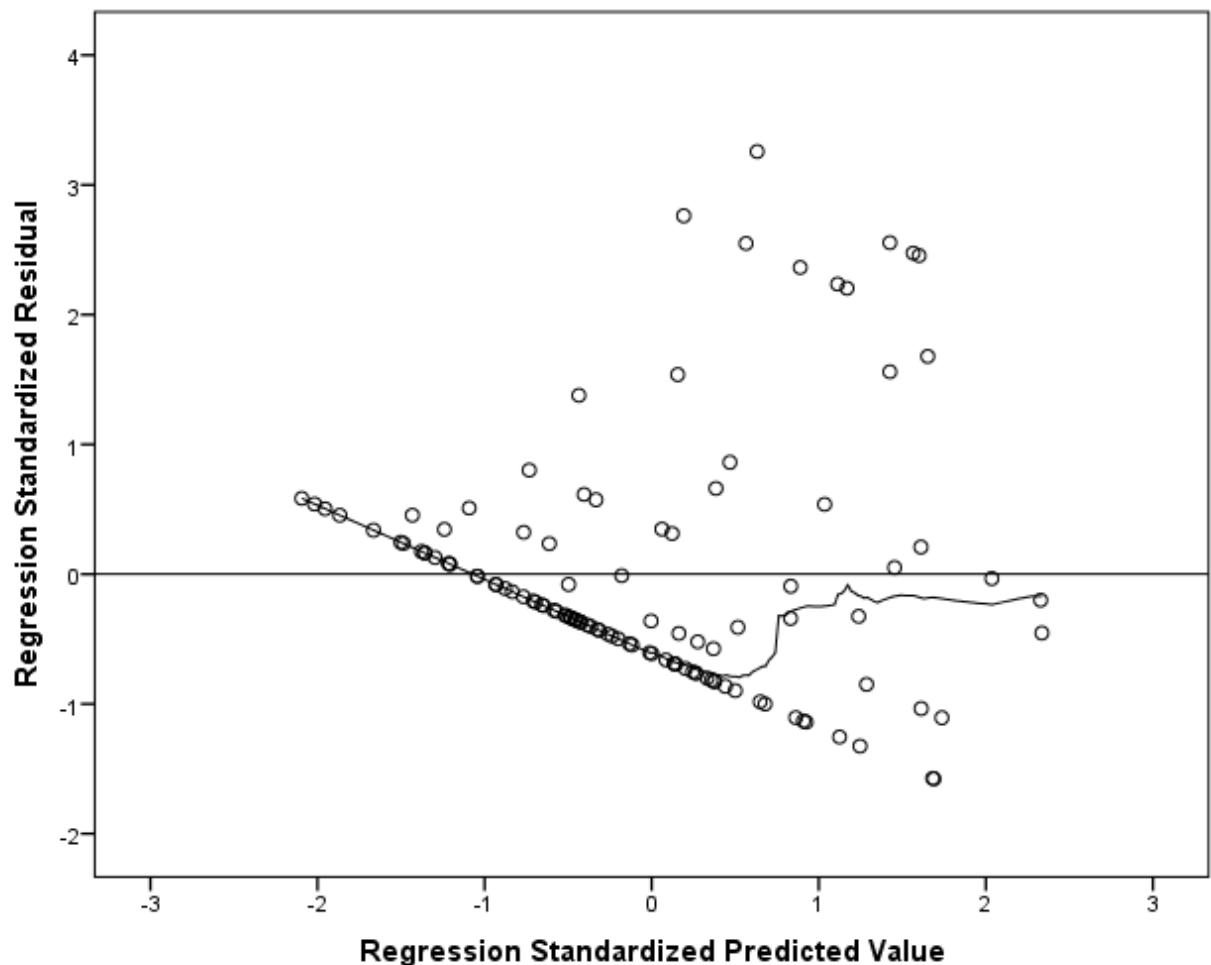


Figure 2. Regression of the standardized residual of the mediation model on standardized predicted value. The Loess line drawn through the points surrounds the 0-line, demonstrating the appropriateness of linearly specifying the model.

Sample Descriptives. To provide a context for the description of the main analyses, full sample and variable descriptives were calculated. These descriptives were calculated based on four sub-samples taken from the total sample. These subsamples resulted after splitting the Autism Quotient (AQ) at the median, and crossing each “AQ group” with gender (see Table 3 below).

The ages of participants in the four groups did not differ significantly. Neither did the groups seem to differ in sexual orientation, with the majority of each group being heterosexual. Women had more anxiety disorders than men, regardless of AQ group. They also seemed to have longer current relationships. One man and one woman in the high AQ group indicated they had an autism spectrum disorder (ASD). Interestingly, two women in the low AQ group did also. No men in the low AQ group indicated they had an ASD. Regardless of AQ group, more women reported having bipolar disorder, or depression. This gender difference was expected given the literature on gender and depression (see Parker & Brotchie, 2010). More women were in relationships, than men,, and so were participants with low autism symptoms (see exact numbers in Table 3). Overall, the majority of the sample was single, or casually dating (53.3%). Chi-square analyses did not reveal any statistically significant differences in proportions according to AQ group or gender.

Table 3

Participant Characteristics

Variable	Low AQ Group (56) 46.2%				High AQ Group (65) 53.7 %				F-test
	Men (5) 4.1%		Women (51) 42.1%		Men (12) 9.9%		Women (53) 43.8%		
Age (years)									
Mean	20.00	n=4	20.20	n=50	20.18	n=11	19.19	n=53	1.80
SD	2.31		4.65		2.60		1.61		
Current Relationship Length (months)									
Mean	3.60	n=5	18.12	n=51	5.72	n=12	10.42	n=53	1.28
SD	6.99		43.84		10.19		15.62		
Sexual orientation									
Hetero	5	100.0%	45	88.2%	11	91.7%	48	90.6%	
Other	0	0.0%	6	11.8%	1	8.3%	5	9.4%	
Diagnosis									
Anxiety disorder	0	0.0%	12	23.5%	2	16.4%	11	20.8%	
ADHD	0	0.0%	5	9.8%	2	16.4%	2	3.8%	
Aspergers	0	0.0%	1	2.0%	1	8.3%	1	1.9%	
Autism	0	0.0%	2	3.9%	1	8.3%	1	1.9%	
Brain injury or stroke	0	0.0%	1	1.96%	1	8.3%	1	1.9%	
Behavioural disorder	0	0.0%	1	2.0%	2	16.4%	1	1.9%	
Depression or bipolar disorder	0	0.0%	12	23.5%	4	33.3%	12	22.6%	
PTSD	0	0.0%	3	5.9%	1	8.3%	1	1.9%	
Schizophrenia	0	0.0%	1	2.0%	1	8.3%	1	1.9%	
Occupation									
University student only	5	100.0%	50	98.0%	12	100.0%	52	98.1%	
Indicated other	0	0.0%	1	2.0%	0	0.0%	1	1.9%	
Relation. status									
Single	3	60.0%	15	30.0%	7	58.3%	24	45.3%	
Casual Dating	1	20.0%	10	20.0%	0	0.0%	4	7.5%	
Steady Relat.	1	20.0%	20	40.0%	2	16.7%	21	39.6%	
Split recently	0	0.0%	0	0.0%	1	8.3%	1	1.9%	
Living togeth.	0	0.0%	3	6.0%	0	0.0%	2	3.8%	
Married	0	0.0%	2	4.0%	1	8.3%	0	0.0%	
Other	0	0.0%	0	0.0%	1	8.3%	1	1.9%	

* $p < .05$, ** $p < .01$, *** $p < .001$.

The variable descriptives are also displayed in an AQ group by gender table (see Table 4). The means of participants in the low AQ group were significantly lower for the AQ, AQ Social, and AQ Communication variables. The low AQ group also had statistically significantly lower means on the flirtatious hug perception, flirtatious eye-contact perception, intimacy, responsiveness, and singles' attendance variables.

The statistical significance of gender differences among the variables will be discussed below (see Hypothesis 3). However, to set the context for the main analyses, differences in the means according to gender should be noted. Men had slightly higher means across the AQ variables. Women had a greater mean on the flirtatious hug perception variable, while men had a greater mean on the measure of inappropriate dating behaviours. Finally, men had reduced trust, attachment avoidance difficulties, and attachment anxiety difficulties, relative to women.

Table 4

Variable Descriptives

Variable	Low AQ Group (56)				High AQ Group (65)			
	Men (5)		Women (51)		Men (12)		Women (53)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
AQ	11.87(5)	2.75	12.67(51)	2.60	23.65(12)	3.70	21.65(53)	3.52
AQSocial	1.067(5)	1.059	1.063(51)	1.075	4.81(12)	1.46	4.24(53)	2.052
AQCommunication	0.80(5)	1.095	1.22(51)	1.25	4.25(12)	1.60	3.17(53)	1.65
Eyes-Test	26.80(5)	2.59	25.75(51)	4.68	24.25(12)	6.25	25.62(52)	5.01
Touch P.	2.84(5)	.78	4.055(51)	1.51	3.40(11)	1.91	3.59(53)	1.97
Body-language P.	3.029(5)	.75	2.94(50)	1.30	3.21(11)	1.70	2.81(53)	1.50
Flirtatious hug P.	3.67(5)	.97	4.93(49)	1.39	3.61(11)	2.043	4.10(53)	1.79
Eye-contact P.	4.050(5)	.84	4.31(50)	0.99	3.84(11)	1.49	3.79(53)	1.54
Inappropriate dating behaviours	1.23(5)	.37	1.25(50)	0.57	1.39(12)	0.67	1.37(53)	0.64
Att Avoidance	2.51(5)	.92	2.94(50)	1.28	3.39(12)	1.055	3.23(53)	1.17
Att Anxiety	3.13(5)	.93	3.41(48)	1.29	3.19(12)	1.20	3.78(53)	1.17
Intimacy	11.40(5)	2.80	10.62(48)	2.28	9.25(12)	3.32	9.78(52)	2.89
Responsiveness	5.15(5)	1.24	5.29(48)	1.14	4.27(12)	1.46	4.86(51)	0.96
Self-disclosure	4.11(5)	.82	3.86(47)	0.86	3.16(12)	1.22	3.70(53)	0.79
Trust	10.40(5)	12.24	12.067(45)	11.32	7.55(11)	14.75	9.019(52)	13.19
Singles' attendance	2.80(5)	1.30	4.36(50)	1.91	2.92(12)	1.44	3.28(53)	1.96

Main Analyses

Correlation analyses. The purpose of the next set of analyses was to describe three sets of inter-correlations. The first was the inter-correlations between the AQ predictor variables, the potential mediator variables (i.e., the theory of mind eye-reading, and the four nonverbal flirting perception variables), and the inappropriate dating outcome variable. Secondly, correlations were calculated between the potential mediating variables, the variables to be used as covariates (i.e., the attachment, intimacy, responsiveness, self-disclosure, and trust variables), and the inappropriate dating outcome variable. Only predictor variables, and proposed mediating variables that were correlated

with one another, and with the inappropriate dating variable, were tested for mediation. All alpha levels for the analyses were set to .05.

Hypothesis 1: AQ score (as well as the AQ Social Subscale, and the AQ Communication Subscale score) should be positively associated with scores on the measure of Inappropriate Dating Behaviours. To test the hypothesis that AQ, AQ Social, and AQ Communication score should be positively associated with the inappropriate dating behaviours variable, I performed a correlation between each AQ scale variable, and the inappropriate dating behaviours variable. As hypothesized, AQ score was positively associated with inappropriate dating. However, contrary to hypotheses, this association was not significant, $r(118) = .13, p = .17$. Similarly, the AQ Social score was positively associated with inappropriate dating, as expected, but contrary to expectations, this association was not significant, $r(118) = .094, p = .31$. The association between AQ Communication and inappropriate dating was positive, and as expected, this association was statistically significant, $r(118) = .22, p < .05$. The greater one's autistic communication symptoms, the greater their likelihood of engaging in inappropriate dating behaviours.

Other correlations were also statistically significant. For example, the autism symptoms variables were highly inter-correlated amongst themselves, as were the nonverbal flirting perception variables. AQ Social Subscale score was negatively correlated with some of the nonverbal flirting perception variables (e.g., flirtatious hug perception, $r(117) = -.23, p < .05$). In other words, autistic social difficulties were associated with less perceived frequency of receiving flirtatious hugs from others in singles' venues. Interestingly, however, the Eyes Test-Revised score was negatively

associated with the Flirtatious Body-language Perception Subscale score, $r(117) = -.19, p < .05$. That is, the worse one's theory of mind eye-reading, the *more* their perceived frequency of others' flirtatious body-language. There were no other significant correlations between Eyes Test-Revised score and other nonverbal flirting perception variables. Flirtatious Body-language Perception Subscale score was also positively associated with the Inappropriate Dating Behaviours Scale. The *greater* one's perceived frequency of others' flirtatious body-language, the greater their likelihood of engaging in inappropriate dating. Finally, AQ Communication was significantly, negatively associated with the Eyes Test-Revised, $r(121) = -.18, p < .05$. Eyes Test-Revised score, in turn, was negatively associated with inappropriate dating, $r(120) = -.33, p < .05$. Greater autistic communication symptoms were associated with worse theory of mind, which was associated with greater inappropriate dating.

Table 5

Correlation Matrix Between the Autism Quotient Scales, Eyes Test-Revised, Nonverbal Flirting Perception Subscales, and Inappropriate Dating Behaviours Scale

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. AQ	1								
2. AQ Soc	.80**	1							
3. AQ Com	.74**	.67**	1						
4. Eyes Test(tr.)	-.062	.039	-.18*	1					
5. Touch P.	-.10	-.16	-.085	-.020	1				
6. Bd-Language P.	.0060	-.14	.089	-.19*	.66**	1			
7. Flirtatious Hug	-.22*	-.23*	-.16	-.11	.78**	.58**	1		
8. Eye-Cont. P.	-.18	-.31**	-.084	-.0050	.54**	.54**	.51**	1	
9. Inappropriate dating behaviours	.13	.094	.22*	-.33**	.14	.34**	.047	-.053	1

Note. The Eyes Test-Revised score was transformed (tr.) by a log and reflect process to remove negative skew. The skew-corrected score was transformed again by a simple reflection so that greater Eyes Test-Revised score would signify greater theory of mind.
 * $p < .05$, two-tailed, ** $p < .01$, two tailed.

Interesting correlations appeared between the covariate variables, the potential mediators, and the inappropriate dating variable (see Table 3). The variables to be used as covariates were moderately inter-correlated with one another. Flirtatious Hug Perception Subscale score and Flirtatious Touch Perception Subscale score were negatively associated with scores on the avoidant-attachment issues measure. The greater the self-reported perception of flirtatious hugging in singles' venues, the less avoidant one was. Flirtatious Hug Perception Subscale score (and Flirtatious Touch Perception Subscale score) was also positively associated with greater scores on the measures of self-disclosure and trust. Interestingly, greater scores on the Flirtatious Body-language Perception Subscale were *negatively* associated with scores on the measure of responsiveness. Scores on the frequency of attending singles' venues item were positively associated with all four Nonverbal Flirting Perception subscales. Inappropriate Dating Behaviours score was positively associated with scores on the measures of attachment issues, and negatively associated with scores on the measure of responsiveness. There were no new significant correlations between the variables, and the Eyes Test-Revised, that have not already been described.

Table 6

Correlation Matrix Between Scores on the Measures of Attachment, Intimacy, Responsiveness, Self-disclosure, Trust, and Singles' Venue Attendance, as well as Nonverbal Flirting Perception, Theory of Mind Eye-reading, and Inappropriate Dating Behaviours

Var	ATV	ATX	IN	RS	SD	TR	SV	T-P	B-P	H-P	E-P	ToM	IDB
ATV	1												
ATX	.41**	1											
IN	-.68**	-.36**	1										
RS.	-.48**	-.24**	.57**	1									
SD	-.68**	-.15	.63**	.41**	1								
TR	-.52**	-.074	.63**	.32**	.66**	1							
SV	.15	.12	-.093	-.039	-.14	-.093	1						
T-P	-.19*	.0020	.23*	.048	.32**	.35**	.22*	1					
B-P	.052	.17	-.031	-.25**	.16	.17	.29**	.66**	1				
H-P	-.21*	-.067	.15	.021	.36**	.25**	.20*	.78**	.58**	1			
E-P	.093	.080	-.046	-.052	.064	.086	.24*	.54**	.54**	.51**	1		
ToM	-.037	-.11	.075	.074	-.080	-.010	-.18	-.020	-.19*	-.11	-.0050	1	
IDB	.20*	.23*	-.10	-.27**	.036	.029	.17	.14	.34**	.047	-.053	-.33**	1

Note. Var = variable; ATV = avoidant attachment; ATX = anxious attachment; IN = intimacy; RS = responsiveness, SD = self-disclosure; TR = trust; SV = high singles' venue attendance; T-P = flirtatious touch perception; B-P = flirtatious body-language perception; H-P = flirtatious hug perception; E-P = flirtatious eye-contact perception; ToM = Eyes Test-Revised; IDB = inappropriate dating behaviours.

* $p < .05$, two-tailed. ** $p < .01$, two tailed.

Summary and conclusion. There was partial support for Hypothesis 1. Neither AQ score, nor AQ Social score were significantly associated with the Inappropriate Dating Behaviours score. However, AQ Communication score was positively associated with the Inappropriate Dating Scale. It was also negatively associated with the Eyes Test-Revised. The Eyes Test-Revised, in turn, was negatively associated with the Inappropriate Dating Scale. There were also other interesting correlations. For example, Eyes Test-Revised score was negatively associated with the Flirtatious Body-language Perception Subscale, which was positively associated with the Inappropriate Dating Behaviours Scale.

Only the autistic communication subscale was significantly associated with the Eyes Test-Revised, and the Inappropriate Dating Behaviours Scale. Therefore, only it

was subsequently used to test the mediation of the relationship between autism and inappropriate dating. Similarly, only the Eyes Test-Revised, and not the Nonverbal Flirting Perception Subscales, was correlated with autistic communication symptoms. Therefore, it was not expected that the nonverbal flirting perception variables would be successful parallel mediators. Given that the AQ score, and AQ Social Subscale score, were also hypothesized as predictors of the Inappropriate Dating Behaviours score, the original alpha level of .05 was divided in three. This led to a conservative alpha level of .01 to test the mediation hypothesis. The nonverbal flirting perception variables were still included in a test of the hypothesis. This was in order to test whether the Eyes Test-Revised would be a successful mediator, over and above any influence from these other proposed mediators.

Mediation. Hypothesis 2 was also tested. It was thought that the Eyes Test-Revised would mediate the association between the AQ Communication Subscale, and the Inappropriate Dating Attempts Scale. Hayes' (2013) PROCESS multiple mediation analyses, with bootstrapping resampling, were used to test this hypothesis. Given the bootstrapping method is robust against violations of normality, all non-corrected original data was used in the analysis, including the original non-corrected Eyes Test-Revised score.

Hypothesis 2: The Eyes Test-Revised score should mediate the association between AQ Communication score, and scores on the measure of inappropriate dating behaviours. In order to test the hypothesis that the eyes test, and several measures of one's self-perceived frequency of others' nonverbal interest, mediated the association between autistic communication symptoms and inappropriate dating, a PROCESS

parallel multiple mediation test (Hayes, 2013) was run on the variables. Bootstrapping resampling was set to a common number of 5000 iterations (Hayes, 2013). I entered AQ Communication Subscale score as the predictor variable; Eyes Test-Revised, Flirtatious Touch Perception Subscale, Flirtatious Body-language Perception Subscale, Flirtatious Hug Perception Subscale, and Flirtatious Eye-contact Perception Subscale as the mediators; and the Inappropriate Dating Behaviours Scale as the outcome variable.

Contrary to expectations, the total effect of AQ Communication Subscale score on the Inappropriate Dating Behaviours Scale was not significant, $B = .0705$, $SE = .0372$, 99% CI [-.0269, .1679]. Furthermore, when the effects of the group of mediators was taken into account, the direct effect of AQ Communication Subscale score on the Inappropriate Dating Behaviours Scale score, was not significant, $B = .0152$, $SE = .0333$, 99% CI [-.0721, .1025]. The indirect effect of AQ Communication Subscale score on the Inappropriate Dating Behaviours Scale score, through the mediators as a group, was then tested. This was statistically significant, $B = .0553$, $SE = .0206$, 99% CI [.0077, .1145]. This signified mediation of the effect of autistic communication symptoms on inappropriate dating. Autistic communication symptoms had an impact on inappropriate dating, indirectly, through either the theory of mind eye-reading variable, and/or the nonverbal flirting perception variables: flirtatious touch perception, flirtatious body-language perception, flirtatious hug perception, flirtatious eye-contact perception.

In order to test which of the specific mediators significantly mediated the association between AQ Communication Subscale score and the Inappropriate Dating Behaviours Scale score, the effects of the mediators were examined one at a time. When doing so, only the Eyes Test-Revised emerged as a statistically significant mediator, B

$= .0294$, $SE = .0141$, 99% CI [.0035, .0778]. Autistic Communication Subscale score negatively predicted Eyes-Test Revised score, $B = -.6866$, $SE = .2407$, 99% CI [-1.3166, -0.0565], which negatively predicted the Inappropriate Dating Behaviours Scale score, $B = -.0428$, $SE = .0145$, 99% CI [-.0808, -.0048]. This signified that out of the group of proposed mediators, low theory of mind eye-reading alone explained the positive effect of autistic communication symptoms on increased inappropriate dating behaviour frequency.

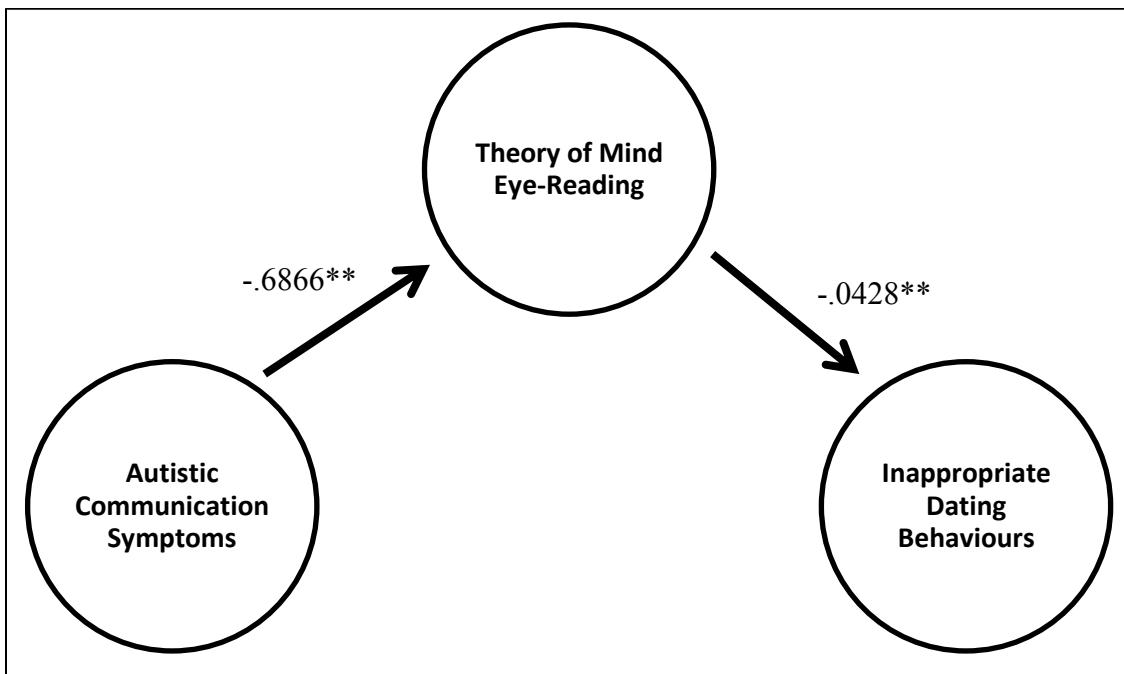


Figure 3. The effect of autistic communication symptoms on inappropriate behaviours, was mediated by theory of mind eye-reading.

* $p < .05$, ** $p < .01$.

In an additional analysis, scores from the attachment avoidance, attachment anxiety, intimacy, responsiveness, self-disclosure, trust, and self-perceived frequency of

attending singles' venues variables, were added to each step of the regression analyses. These did not alter the mediation results.

Summary. A Hayes (2013) multiple mediation analysis was used to test hypothesis 2. Low theory of mind eye-reading mediated the positive association between autistic communication symptoms and inappropriate dating behaviours, over and above other proposed mediators. The results were shown using 99% confidence intervals to guard against type I error. Adding scores to the model from the attachment avoidance, attachment anxiety, intimacy, responsiveness, self-disclosure, trust, and singles' venue frequency measures to the mediation regression models, did not alter the mediation results.

The third hypothesis involved examining gender effects on the study variables. Theoretically similar variables were grouped together in MANOVA analyses (Field, 2009, p. 586). There were two such groups. These included the group of AQ variables (AQ Social Subscale, and AQ Communication Subscale) and the group of nonverbal flirting perception variables, respectively. Gender effects on the AQ total mean, Eyes Test-Revised mean, and on the Inappropriate Dating Behaviours mean, were tested using individual ANOVAs.

Hypothesis 3: Men should score higher than women on the measures of autism symptoms. They should also score higher on the means of variables positively predicted by increased autism symptoms, and lower means on variables which are negatively predicted by autism symptoms. The third hypothesis was that gender would have an effect on the main variables used in this study. It was hypothesized that men would score higher means on autism symptoms measures (including on

measures of autistic social symptoms, and on autistic communication symptoms), a lower mean on the Eyes Test-Revised, a lower mean on the measures of nonverbal flirting perception, and higher means on the measure of inappropriate dating behaviours. A glance over the means in Table 4 revealed that high AQ men had higher AQ score means, and higher AQ Social Subscale scores than did the women. Women overall seemed to have greater means on the flirtatious touch perception, and flirtatious hug perception variables, than men. In contrast, men seemed to have greater flirtatious body-language perception means, than women. Finally, women seemed to have greater means on the attachment anxiety and trust measures, than did the men.

A MANOVA was used to determine whether one gender had significantly greater means than the other, on the autism symptom severity variables. Gender was the predictor variable. The AQ Social Subscale, and AQ Communication Subscale variables, were entered as the outcome variables. A MANOVA was appropriate because the goal was to detect the effect of gender on the combination of AQ Social Subscale and AQ Communication Subscale scores (Field, 2009, p. 586). It was thought that when expecting an effect on more than one outcome variable, Pillai's Trace would represent the most robust statistic (Olson, 1976). Since it seemed that the means would be greater for men for both of these variables, Pillai's Trace seemed suitable. Contrary to expectations, however, the MANOVA was not statistically significant, $F(2, 118) = 2.35, p = .10$. It did not seem as though either men or women had greater autism symptoms, relative to one another. However, see post-hoc analyses for the results of separate ANOVAs conducted for gender effects on each AQ variable, separately, including on the AQ total variable.

In order to test the hypothesis that women had greater perceptions of others' nonverbal interest, a MANOVA was performed using gender as the predictor variable. Flirtatious touch perception, flirtatious body-language, flirtatious hug perception, and flirtatious eye-contact perception were all conceptually linked (see Table 5). Therefore, it was suitable to enter them as outcome variables in the same MANOVA (Field, 2009, p. 586). However, contrary to expectations, the MANOVA was not statistically significant, $F(4, 116) = 2.34, p = .059$. This signified that additional separate ANOVA tests on the each of these predictor variables might not be significant. If they were, it might not be meaningful given the failed MANOVA. Post-hoc analyses revealed that indeed, separate ANOVAs conducted for each variable, were not statistically significant.

Individual ANOVAs were conducted to test for gender effects on theory of mind eye-reading, and inappropriate dating behaviours. Setting alpha levels to .05, gender was used as the predictor variable in each analysis. Meanwhile, Eyes Test-Revised score, and the Inappropriate Dating Behaviours Scale score, were used as the respective outcome variables. Contrary to expectations, the two separate ANOVAs were not statistically significant. It could not be determined that one gender had either greater inappropriate dating frequency, or greater theory of mind, than the other.

Summary. For the final main analysis, gender effects on the main study variables were tested. It was hypothesized that men would score higher means on variables positively predicted by the Autism Quotient (AQ), and lower means on variables negatively predicted by the AQ. However, according to the analyses performed men and women did not have any statistically significant differences in means on these variables.

Post-Hoc Analyses

Multiple serial mediation. A post-hoc analysis was conducted to test whether instead of in parallel, the two originally proposed mediators (i.e. Eyes-Test Revised score, and Flirtatious Body-language Perception Subscale score) would serially mediate the association between the measure of autistic communication symptoms, and the measure of inappropriate dating. It was noted that in particular, AQ Communication Subscale score was negatively correlated with the Eyes Test-Revised score, Eyes Test-Revised score was negatively correlated with the Flirtatious Body-language Perception Subscale score, and that the Flirtatious Body-language Perception Subscale was positively associated with the Inappropriate Dating Behaviours Scale. The purpose of this post-hoc analysis was to test this autistic communication symptoms → theory of mind eye-reading → nonverbal flirting perception → inappropriate dating behaviours, serially mediated pathway.

Total mediation. A Hayes (2013) PROCESS serial mediation test was run to test the post-hoc hypothesis. The test's use of bootstrapping resampling, made it robust against violations of ordinary least squares regression assumptions (Hayes, 2013). AQ Communication Subscale score was entered as the predictor variable, and the Eyes Test-Revised score was specifically entered as the first mediating variable. The second mediating variable entered was the Flirtatious Body-language Perception Subscale score. Inappropriate Dating Behaviours Subscale scores were entered as the outcome variable. Bootstrapping resampling size was set to 5000 iterations, as per common practice (Hayes, 2013). Contrary to expectations, there was no significant total effect of AQ Communication Subscale score on Inappropriate Dating Behaviours score, $B = .0705$, SE

$= .0372$, 95% CI [-.0031, .1442]. When taking the effects of the mediators into account, the direct effect of AQ Communication Subscale score on Inappropriate Dating Behaviours score, was also not significant, $B = .0303$, $SE = .0336$, 95% CI [-.0362, .0968]. On the other hand, the total indirect effect was significant, $B = .0402$, $SE = .0138$, 95% CI [.0094, .0836]. As in the main analysis, autistic communication symptoms had an effect on inappropriate dating through variations in the mediators (theory of mind eye-reading and/or flirtatious body-language perception).

It was desired to test what exact serial mediation pathway mediated the link between AQ Communication Subscale score and the Inappropriate Dating Behaviours Scale score. Upon examining the results, two significant pathways emerged. One was directly through the Eyes Test-Revised as a single mediator, $B = .0308$, $SE = .0148$, 95% CI [.0080, .0680]. In this case, as before, AQ Communication Subscale score negatively impacted the Eyes Test-Revised score, $B = -.6866$, $SE = .2407$, 95% CI [-1.1631, -.2100], and Eyes Test-Revised score, in turn, negatively impacted the Inappropriate Dating Behaviours Scale score, $B = -.0449$, $SE = .0148$, 95% CI [-.0741, -.0156]. The other significant pathway was through the proposed serially mediated pathway. Specifically, AQ Communication Subscale score negatively impacted the Eyes-Test Revised score, $B = -.6866$, $SE = .2407$, 95% CI [-1.1631, -.2100], which negatively impacted Flirtatious Body-language Perception Subscale score, $B = -.0530$, $SE = .0254$, 95% CI [-.1032, -.0028], which, in turn, positively impacted the Inappropriate Dating Behaviours Scale score, $B = .1240$, $SE = .0405$, 95% CI [.0438, .2042]. The data suggested that autistic communication symptoms positively predict inappropriate dating behaviours though

reduced theory of mind eye-reading, which leads to increased perceptions of others' flirtatious body-language, which then leads to increased inappropriate dating behaviours.

Finally, it was desired to determine which, if any, of the two statistically significant mediated pathways had a greater role of explaining the variance in the Inappropriate Dating Behaviours Scale score, over the other. To this end, a contrast was constructed by PROCESS (Hayes, 2013) by subtracting the effect of the serially mediated pathway from the effect of the single theory of mind eye-reading, mediated pathway. The difference in effects was positive and statistically significant, $B = .0263$, $SE = .0141$, 95% CI [.0051, .0168]. This signified that the mediated effect of the Eyes Test-Revised score on the link between AQ Communication Subscale score and the Inappropriate Dating Behaviours Scale score, was statistically significantly greater than that of the serially mediated pathway. In other words, the link between autistic communication symptoms and inappropriate dating behaviours, was mediated either by poor theory of mind eye-reading, or poor theory of mind eye-reading leading to increased perception of flirtatious body-language from others. However, the mediated pathway through theory of mind eye-reading alone, best explained variance in the Inappropriate Dating Behaviours Scale scores. See figure 4 for diagram.

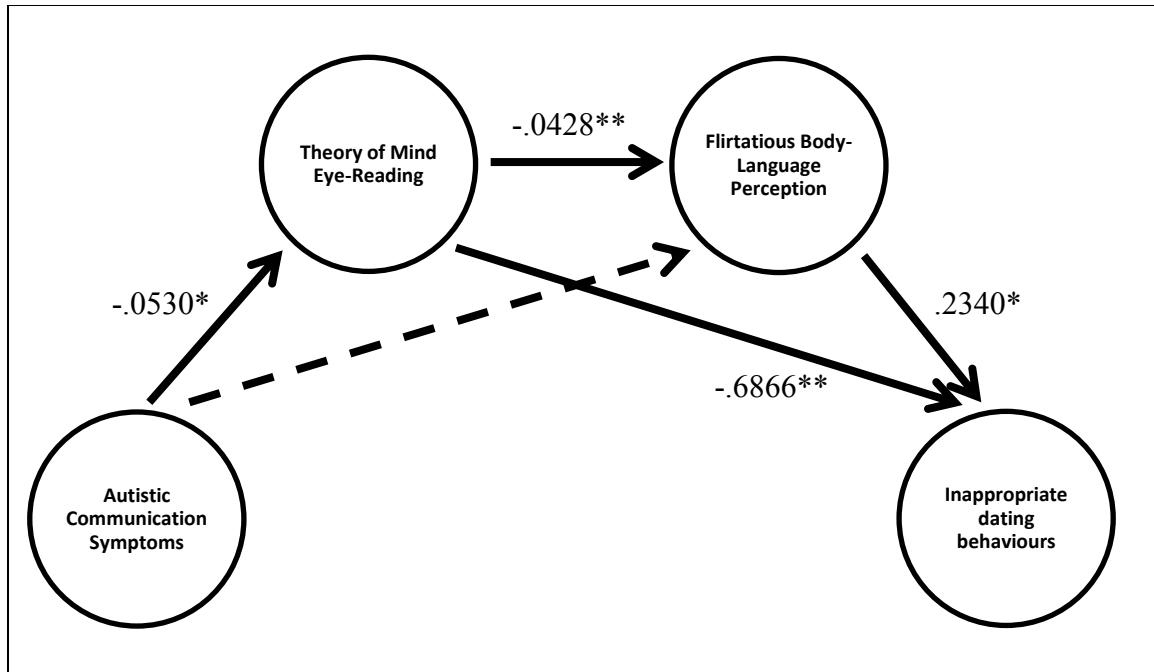


Figure 4. Serial mediation of the effect of autistic communication symptoms on inappropriate dating behaviours. This figure shows serial mediation by decreased theory of mind, then increased flirtatious body-language perception. No other mediation pathways were significant (e.g., dashed line).

* $p < .05$, ** $p < .01$.

Results after adding covariates. It was desired to test the effect of adding the covariates to the model. This entailed adding covariates trust, intimacy, responsiveness, attachment, self-disclosure, and frequency of attending singles' venues, to the model. In this case, the autistic communication symptoms → decreased theory of mind eye-reading → increased flirtatious body-language perception → increased inappropriate dating behaviours pathway continued to be significant with an alpha level set to .10, $B = -.0021$, $SE = .0023$, 90% CI [.0000, .0084].

Gender effects tested using simple ANOVAs. MANOVAs can be useful when testing the effect of a predictor variable on a group of theoretically similar variables that are moderately, to highly, inter-correlated (Field, 2009, p. 586). When deciding between

a MANOVA to test a group of similar variables, or a series of separate simple ANOVAs, one must take into account their type I error rate. Non-adjusted alpha levels can lead to inflated type one error when conducting a series of ANOVAs (Field, 2009, p. 586). For this reason, when a MANOVA analysis fails to reveal a statistically significant effect of the predictor variable on the group of outcome variables, one does not typically examine the separate, simple ANOVAs for significance. However, in the context of a post-hoc analysis, it was deemed interesting, and theoretically meaningful, to investigate the effects of gender on the Autism Quotient (AQ) variables, separately.

Separate ANOVAs were conducted to test for the effects of gender on each AQ variable, separately. As expected, men had a statistically significantly higher mean of autistic communication symptoms, than women, $F(1, 119) = 4.62, p < .05$. Men scored, on average, 3.24 on the AQ Communication Subscale ($SD = 2.17$) while women only scored, on average, 2.21 ($SD = 1.76$). No other ANOVAs were statistically significant.

Discussion

The goal of the current study was to replicate Stokes et al.'s (2007) study which had shown that autism symptoms are positively linked with inappropriate dating behaviours. It was also to go beyond that replication, and explain the positive link between autism symptoms and inappropriate dating behaviours. In developing that explanation, I reasoned from the literature that theory of mind eye-reading difficulties (Baron-Cohen et al., 2001a; Leslie, 1992; Sterck & Begeer, 2010) would mediate any observed effect of autism symptoms on dating initiation behaviours. As expected, even in a sub-clinical university sample, autistic communication symptoms, in particular, were associated with engaging in serious inappropriate dating behaviours (e.g., making

inappropriate comments, threateningly pursuing romantic prospects, etc...). Also as expected, autistic communication symptoms were associated with lower scores on the Eyes Test-Revised.

Mediations. It was originally hypothesized that not only the Eyes Test-Revised, but that also the subscales of the Nonverbal Flirting Perception Scale, would directly mediate the relationship between autism symptoms and inappropriate dating behaviours. However, only theory of mind eye-reading was a direct mediator of the relationship between autism symptoms and inappropriate dating behaviour. Furthermore, this relationship was only observed for the AQ Communication Subscale and not for the overall AQ, or AQ Social Subscale.

Post-hoc analyses were also conducted. These showed that, surprisingly, *increased* perception of others' flirtatious body language, mediated the association between autistic communication symptoms and inappropriate dating behaviours. However, this was through low theory of mind eye-reading, in serial mediation (Hayes, 2013). This was defined by an increased autistic communications symptom → decreased theory of mind eye-reading → *increased* flirtatious body-language perception → increased inappropriate dating behaviours, pathway. This represented a hypothesis confirmation, but in the opposite direction. Despite this unexpected finding, the mediated pathway explaining the most variance in inappropriate dating, was through theory of mind eye-reading alone.

Gender differences. The set of gender difference findings in the current study was less conclusive, than the mediation findings. The hypothesis was that men would score higher on measures of autism symptoms, including on measures of autistic social

symptoms, and autistic communication symptoms. According to the extreme male brain theory of autism (Baron-Cohen, 2002), men should then score higher on measures that are positively predicted by the Autism Quotient (AQ) scales, and lower on measures that are negatively predicted by the AQ scales. Unfortunately, only the effect of gender on autistic communication symptoms, during post-hoc analyses, was found to be significant in the current study. Nonetheless, a look at the actual means between gender (see Table 4) was still warranted.

In fact, the pattern of men's and women's means on measures of autism symptoms, flirtatious hug perception, and flirtatious body-language perception, supported the extreme male brain theory of autism. Originally, autism symptoms were hypothesized to predict decreased nonverbal flirting perception, including decreased flirtatious body-language perception. Therefore, it was hypothesized that men would score lower means on all nonverbal flirting variables. As expected, overall autistic, and autistic social symptoms, negatively predicted flirtatious hug perception, in particular. However, contrary to expectations, autistic communication symptoms were *positively* associated with flirtatious body-language perception (i.e., indirectly, through reduced theory of mind eye-reading). This signified that *greater* communication impairments, not less, predicted greater perception of others' nonverbal body-language flirtations. This pattern was reflected in the gender means on these variables. Men scored a lower mean on flirtatious hug perception, but a higher mean on flirtatious body-language perception. Like individuals with higher autistic communication symptoms, men greatly perceived others' nonverbal romantic interest in them.

On the other hand, a pattern predicted by the extreme male brain theory of autism was not found across other variables. For instance, men did not score consistently lower means on the theory of mind eye-reading variable, or the flirtatious eye-contact perception variable. Meanwhile, autistic communication symptoms had negatively predicted theory of mind eye-reading. Although in the current study, care was taken to obtain enough overall participants to detect gender effects, there may not have been enough men, in particular, to ensure that any effect of gender would be reliably detectable. Notwithstanding, it is possible that even with more men, the hypothesized pattern of means would not be found. Taken together, the current study's findings suggest that more research is needed before supporting, or refuting the extreme male brain theory of autism.

Explanations Based on the Literature

As mentioned, autistic communication symptoms predicted low theory of mind eye-reading in the current study. However, contrary to expectations, neither overall autism symptoms, nor autistic social symptoms predicted the same. Baron-Cohen et al.'s (2001a) seminal article on theory of mind eye-reading can at least account for why overall autism symptoms did not predict theory of mind eye-reading score in the current study. Specifically, Baron-Cohen et al. (2001a) only reported that autism symptoms predicted theory of mind eye-reading score in a *community* sample. In the student sample they recruited, they reported that only Autism Quotient (AQ) Social Subscale score, and AQ Communication Subscale score had predicted theory of mind eye-reading score. This finding was supported by theory that social and communication difficulties, in particular, are responsible for autistic theory of mind/eye-reading difficulties (Baron-Cohen, 2002;

Baron-Cohen et al., 2001a; Baron-Cohen et al., 2011; Knickmeyer & Baron-Cohen , 2006). Given such theory, it makes sense why the overall AQ did not predict eyes-score. The overall AQ also includes the imagination, attention to detail, and attention switching difficulties subscales. There is no literature to suggest that these would predict theory of mind eye-reading. However, this still leaves the question open as to why the AQ Social Subscale score did not predict the theory of mind eye-reading score in the current study.

One answer comes from Roeyers and Demurie (2010). Instead of the Eyes Test-Revised, they favour a naturalistic empathic accuracy task in measuring theory of mind. In fact, they argue that eye-reading does not accurately measure theory of mind. Therefore, they might explain the inability of the AQ Social Subscale to predict theory of mind in the current study, as an issue of poor theory of mind measurement. However, at this point it is important to emphasise that the AQ Communication Subscale was a significant predictor of theory of mind eye-reading score in both Baron-Cohen et al. (2001a), and the current study. This leads to the question that if the Eyes Test-Revised is not a good theory of mind test, why would it be predicted by the AQ Communication Subscale? More research may be needed to answer questions about how the AQ Social Subscale relates to the Eyes-Test Revised.

Even more research will be needed to explain the complex set of findings surrounding the measure of flirtatious body-language perception. This measure had been adapted from Moore's (1985) study on nonverbal courtship behaviours. Flirtatious body-language perception was positively associated with the other Nonverbal Flirting Perception Scale subscales, including the Flirtatious Touch Perception Subscale, the Flirtatious Hug Perception Subscale, and the Flirtatious Eye-Contact Perception

Subscale. Subscales other than the Nonverbal Body-language Perception Subscale were positively associated with social success in the current study. So, for example, increased frequency of perceiving others' flirtatious hug behaviour was associated with increased social skills (measured as low autistic social symptoms). However, unlike these other subscales, the Flirtatious Body-Language Perception subscale seemed to be (indirectly) *negatively* associated with social success. For instance, the *greater*, not less, one perceived others' flirtatious body-language, the greater their socially unsuccessful, inappropriate dating behaviours, through reduced theory of mind. There is a good possible explanation behind the unexpected direction of this finding.

Being a measure of self-reported perception, perhaps the Flirtatious Body-Language Perception subscale did not capture one's actual amount of received, actual, signals of nonverbal romantic interest from others (e.g., someone flipping their hair, exposing their leg, or showing their neck to someone, to attract their attention romantically). Instead, it may have captured the extent of one's biased, or exaggerated perception of others' flirtatious body-language. This phenomenon may not have occurred with the other subscales. Other subscales such as flirtatious touch perception, or flirtatious hug perception represent the perception of somewhat more direct, less ambiguous, nonverbal behaviours. Their use as measures of accurate flirting perception, might be more valid for that purpose. However, perception of flirtatious body-language may lend itself to greater opportunities for miscommunication. Speculatively, these miscommunications may then have led to behaviours deemed inappropriate by romantic targets. Therefore, the flirtatious body-language perception subscale might better have been named the *Exaggerated Perception of Flirtatious Nonverbal Body-language*

Subscale. Research applied to courtship contexts may shed some light on these issues and on the findings overall.

Research Applied to Courtship Contexts. One possibility is that a lack of social understanding and sophistication leads those with higher autistic symptoms to oversimplify dating initiation (Church, Alisanski, & Amanullah, 2000). In oversimplifying dating initiation processes, these individuals may apply a one-size-fits-all conclusion to interactions they experience with romantic prospects. This broadly applied conclusion would be that the prospects are romantically attracted to them, explaining why they over-perceive others' romantic interest in them. This may then lead those with higher autistic symptoms to act on these erroneous perceptions, engaging in intrusive, or inappropriate, dating behaviours.

One difficulty with this explanation is why a lack of social understanding would default to an *over*-perception of others' romantic interest, in particular. Why would the default not be to underestimate others' romantic interest in oneself? Church, Alisanski, and Amanullah (2000) and Carrington and Graham (2001) note that even those with clinical high-functioning autism are keenly self-aware of their social limitations. In accordance with such awareness into their poor social skills and relationship prospects, one might expect those with autistic symptoms to regularly assume others' are *not* interested in them. Another theory is needed to explain the bias that those with autistic symptoms might have, to over-perceive others' romantic interest in them.

Signal detection theory applied to psychology (Green & Swets, 1966) can offer an explanation for an over-perception of romantic interest in this population. In the context of psychology and psychophysics, signal detection theory concerns decision-making

processes in conditions of uncertainty (e.g., deciding whether one sees a distant light, or not, in foggy conditions). Decisions revolve around whether one has subjectively detected, or not detected, an actually present, or absent, stimulus. Examples of signal detection amidst uncertain conditions include detecting faint lights in foggy conditions (Green & Swets, 1966), detecting camouflaged snakes in the jungle canopy (Mineka, 1992), or detecting ambiguous cues of romantic interest in crowded singles' venues (Hasleton & Buss, 2000). Correctly detecting a present stimulus is known as a "hit", and not detecting a stimulus when it is absent is known as a correct rejection. Furthermore, failing to detect a present stimulus is known as a "miss" and detecting an absent stimulus is known as a "false alarm".

Biases in signal detection occur when there are differential rewards or punishments for misses, versus false alarms (Green & Swets, 1966). Error management theory (Haselton & Buss, 2000) applies signal detection theory to males' decisions on the detection of ambiguous cues of romantic interest from women, during dating initiation. It predicts that men are far more rewarded for hits (correctly detecting female interest) than punished for false alarms (over-perceiving romantic interest). It focuses its tenants on men's decisions to attribute romantic interest to perceived ambiguous communication from women. However, there is no reason why, in the broader context of signal detection theory, the principle cannot be extended to the uncertain decisions that an autistic man or woman must make, when faced with social/romantic communication they find ambiguous.

It is a possibility that the participants with greater autistic communication symptoms in the current study were engaging in signal-detection biases, aimed to

maximize their chances of finding romantic “hits”. Male or female, they may have regularly anticipated communication difficulties, and hence uncertainty, when seeking a mate. To cope with this uncertainty, and maintain adequate chances for engaging attractive mate prospects, they may have resorted to over-perceiving others’ romantic interest in them. In some cases, this may have even led some to act on their over-perceptions and engage in dating initiation behaviours that others deemed inappropriate (e.g., threateningly pursuing, or making inappropriate comments).

Signal detection theory, is only useful in explaining the current study’s findings, if it explains individuals’ *non-intentional* disregard for others’ nonverbal courtship communication. That is because the current study findings showed how increased flirtatious body-language perception was predicted by reduced theory of mind. Resulting from poor theory of mind, such misperception of others’ interest might therefore not have been deliberate.

In fact, signal-detection biases need not be operating on a conscious level of awareness (Green & Swets, 1966; Haselton & Buss, 2000). In light of this, signal-detection theory provides a thought-provoking possible explanation behind the current study’s findings.

Further alternative explanations. When pursuing romantic interests, some individuals are more apt than others, to consciously disregard others’ signals of non-romantic interest (or disinterest) in them. And this is despite having a theory of mind (Spitzberg & Cupach, 2007). For instance, individuals with antisocial psychopathic personality traits have less empathy than others (Rogers, Viding, Blair, Frith, & Happé, 2006). This may lead to increased chances of inappropriate dating in that population

(Spitzberg & Cupach, 2007). Where this possibility might be relevant to the current discussion is if antisocial personality traits are highly correlated with autistic symptoms. This leads to a possible alternative explanation for the data. That is that unmeasured comorbid antisocial personality traits, may have accounted for the increased inappropriate behaviours among individuals with autistic symptoms.

If autistic symptoms are sufficiently comorbid with antisocial personality disorder traits, then some characteristics directly associated with inappropriate dating behaviours, may also be shared between the two groups. For example, a disregard for others' feelings, or low empathy, may characterize both anti-social personality disorder and autism spectrum disorders (Lugnegård, Hallerbäck, Gillberg, 2012). If so, then instead of autistic symptoms, antisocial personality traits may have been responsible for the apparent low theory of mind, increased flirtatious body-language perception, and increased inappropriate dating behaviours, found in the current study. It would be difficult to test this possibility given information on antisocial personality traits were not gathered.

Despite these concerns, there are two reasons why anti-social personality traits were not likely to have confounded the link between autistic communication symptoms and inappropriate dating behaviours. The first is the uniqueness between, and independence of, the two disorders. While autistic symptoms may overlap with schizotypal, schizoid, and obsessive compulsive disorder traits, they are not likely to overlap with antisocial personality traits (Lugnegård et al., 2012; Rogers et al., 2006). Because this means that autistic symptoms would not likely predict antisocial personality traits, there may not be any reason to believe that antisocial personality traits were a third

confounding variable, driving the link between autistic communication traits and inappropriate dating.

The second reason why antisocial personality traits were not likely to have driven the results, is because antisocial personality traits do not predict poor theory of mind (Dolan & Fullam, 2004). If an individual over-perceived others' romantic interest in them, poor theory of mind would not necessarily be the cause. As suggested earlier, an individual may have theory of mind, but choose to disregard information they gather about another's mind state (Dolan & Fullam, 2004). Given the two reservations offered, it is unlikely that antisocial personality traits had confounded the current study results.

Stalking. Stalking is the unwanted romantic pursuit of others (Spitzberg & Cupach, 2007). Researchers not only suggest that stalking results from antisocial personality traits (Spitzberg & Cupach, 2007). They have also investigated whether or not autism spectrum disorders (ASDs) contribute to the possibility of stalking. Whether they do, or not, should be of particular interest in this discussion.

Study findings are mixed as to whether high-functioning autism predicts stalking (Haskins & Silva, 2006; Post et al., 2012; Post et al., 2014; Stokes et al., 2007; Woodbury-Smith, Clare, Holland, & Kearns, 2006). The current study suggested that stalking-like behaviours (e.g., pursuing a romantic prospect in a threatening manner) are likely to occur as individuals over-perceive romantic interest from others. However, this was set in the context of a singles' venue where strangers or mere acquaintances, are likely to meet. To the contrary, the literature on stalking (see Spitzberg & Cupach, 2007, for a review) asserts that most cases of stalking in the general population result from

relationship break-up between long-term romantic relationship partners, or between otherwise well-acquainted individuals.

Even in the literature on high-functioning autism and offending behaviour, the findings are not clear. In addition to Stokes et al. (2007), Post et al. (2012) and Post et al. (2014) illustrate the link between autism and stalking with stalking case-studies from individuals with high-functioning autism. Notwithstanding, other researchers report very low rates of stalking-related, and general criminal, offending in samples of adults with high-functioning autism (e.g., Allen et al., 2008; Haskins & Silva, 2006). Perhaps the results from the current study can shed light on the debate.

In fact, findings from the current study best support Stokes et al.'s (2007) findings. That is, that groups of typically developing individuals are just as likely as groups of individuals with autistic symptoms, to exhibit a range of dating initiation behaviours. However, of the few that may engage in inappropriate dating behaviours, these may be more likely to come from the group of individuals higher in autistic symptoms. More research will be needed to investigate the level of conscious awareness of individuals with autism symptoms, of their inappropriate dating behaviours, if they engage in some. In such research, investigators should reflect well on the choices of measures they will use.

Limitations

Choice of measures. There are limitations in using the Autism Quotient (AQ) for research. First, in terms of factor structure, the Autism Quotient (AQ) no longer corresponds to the dyad of impairments structure used in the latest edition of the DSM, the DSM-5 (American Psychiatric Association, 2013). This brings the validity of the AQ

into some question. The difference in factor structure is largely due to the collapse, in the DSM-5, of autistic social and communication difficulties, into social interaction difficulties, irrespective of social/communication distinction. There is even disagreement as to what items in the AQ pertain to autistic communication difficulties (Kloosterman, Keefer, Kelley, Summerfeldt, & Parker, 2011). This is a reflection of the problems inherent in defining exactly what is meant by autistic communication difficulties. Unlike the DSM-5, the AQ also currently assesses other aspects of autism such as limited imagination, and high attention to detail (Baron-Cohen et al., 2001b). It is not clear if these aspects are associated with the DSM's dyad of impairments (American Psychiatric Association, 2013). Finally, the AQ Communication Subscale also faces challenges in reliability. This is due to its low Cronbach's alpha value reported in the literature (Baron-Cohen et al., 2001b), and in the current study. Perhaps using a different measure other than the AQ to assess autism symptom severity would lead to different study results, than those from the current study.

Despite having its challenges, however, it should be underlined that a replication was achieved using the AQ Communication Subscale. Like in the current study, low Eyes Test-Revised score was associated with high AQ Communication Subscale score in Baron-Cohen et al. (2001a). The AQ Communications Subscale was the only autistic symptom measure to be used in replicating a previous autism/theory of mind finding. This should also be noted in interpreting the measure's reliability.

The AQ aside, it is a challenge to find highly reliable and standardized measures in the field of dating initiation in general, and in the field of autism and relationship functioning, in particular. In regards to dating initiation measures, much self-report social

psychology research on relationships focuses on long-term relationship functioning. Stage models of relationship development which focus on an initiating stage during relationship formation, are losing favour (Mongeau & Henningsen, 2008). For this reason, the covariates pulled from the relationship initiation literature (Sprecher, Wenzel, & Harvey, 2008) seem to pertain more to the maintenance of committed relationships, rather than to initial interactions and dating initiation (Perlman, 2008). More research on issues that pertain directly to initial interactions in dating initiation, would be useful when deciding on useful covariates.

It is also difficult to find measures that have been previously used with samples of individuals with autistic symptoms. Measures of inappropriate dating behaviours and of nonverbal flirting had to be adapted significantly for use in the current study. Future research should be devoted to developing more measures that can capture dating initiation data from samples of individuals with autistic symptoms.

The measure of inappropriate dating initiation behaviours, in particular, was also adapted for use with participants in steady relationships. For some, this may raise concerns for a study on dating initiation. However, the measure's question stem was modified to ask participants to report on their past dating initiation behaviours when they had attempted to pursue a new relationship in the past. Given that the average relationship length was under two years (after not including singles in the calculation), the minority of participants in a relationship would only have had to recall their single life from two years, or less, prior. The wording of the question stem in the measure of inappropriate dating, combined with the low proportion of those in very long committed relationships, should alleviate concerns over the inclusion of non-singles in the study.

Selection biases. Another point of concern was the possibility of selection bias. Given that the study was advertised as a study on romance, those with particular preoccupations with romance may have been more likely to sign up for the study. Thus, perhaps individuals experiencing romantic difficulties were overrepresented in our samples. While this is certainly a possibility, it is also possible that those experiencing romantic success were equally as drawn to the study. Those both wanting to express their success in romance, and those wanting to express problems with romantic issues through the study, may have been equally likely to sign up for the study. If so, individuals demonstrating a range of success and difficulties in dating activities would be represented in the current study sample. This would mitigate the effects of selection bias in the current study. In fact, as results reveal, those high, low and moderate in dating success signed up for the study (see Table 4). This reduced any further concerns that a selection bias favoured participation of students with a particular level of romantic experience.

It should also be noted that participants knew they would be receiving course credit for participating in the study. Given this, many of them signed up at the end of the fall semester, for the likely reason of trying to raise class grades. Therefore a possible selection bias could have resulted from a higher likelihood of relatively underachieving students deciding to participate in the research. However, many students also signed up for the study to receive academic credit at the beginning of the winter semester just as they did at the end of the fall semester. Only, students who signed up for the study at the beginning of the winter semester may have been academically keen students in the habit of getting their extra study participation credits early. With this balance of student

participation, many effects of selection biases should have cancelled out, and not posing a major concern.

Gender bias. A definite concern for the current study was the gender bias towards female participation. This was not necessarily due to disinterest on the part of men. Instead it reflected the tendency towards greater proportions of female students in introductory psychology courses. Nonetheless, this gender bias significantly compromised the ability to assess gender effects and to assess how inappropriate dating behaviours might manifest among men.

The extreme male brain theory of autism would presume that autistic symptoms manifest similarly among men and women, towards “male-like” behaviour. This would suggest that the tendency towards inappropriate dating behaviours accompanied by low theory of mind observed among autistic women, would also be present, or stronger, among autistic men. However, this should actually be verified in future studies with larger sub-samples of men.

Self-report biases. Although few or no selection biases were likely to have significantly impacted the results, self-report issues may have. With the exception of the Eyes Test-Revised, all of the measures used self-report. One self-report issue concerns how participants respond to a study’s questionnaire and items organisation. According to Weijters, Geuens, and Schillewaert (2009), reverse-coding items and dispersing them throughout the questionnaire increases a researcher’s chances of catching participant patterns of extreme responding (i.e., responding at the high end, or low end of Likert scales; Paulhus & Vazire, 2007; Weijters, Geuens, & Schillewaert, 2009). Unfortunately,

in the current study, very few measures besides the AQ contained dispersed and/or reverse-coded items.

Notwithstanding, it should be noted that in the current study, I achieved significant correlations between the overall AQ Communication Subscale score, and the Eyes Test-Revised, and between the Eyes Test-Revised, and the measure of inappropriate dating. This inspired confidence that the study results did not suffer from a reduced number of dispersed and reverse-coded items. Thus the meaningful study results signalled a type of response bias check. It signalled that the study questions elicited theoretically meaningful patterns of answers. It also signalled that the respondents were paying attention to answering the questions accurately and according to their degree of autistic disposition. Although future follow-up studies should ensure counterbalancing of measures, the current study's results should be received as reliable, and unencumbered by miscellaneous self-report biases.

Online responding. Another concern comprising a self-report issue is the fact that participants completed the study online. Performing the study online means that participants completed the study without direct supervision from the researcher. As a result various kinds of false responding, such as miscellaneous responding, could have adversely affected the results (Paulhus & Vazire, 2007). Notwithstanding, studies have demonstrated that these concerns are not always justified. For example, participants performing studies online were not swayed in their questionnaire responding style as a result of differences in study completion prizes and incentives (Montag & Reuter, 2008). Furthermore, it is telling that this study replicates the findings of a non-internet study (Stokes et al., 2007) that had employed the parents of children with ASDs to report on

their ASD relatives. It suggests that placing this self-report study online may not have necessarily interfered with the nature of the results.

Data dredging. Other biases may not relate to participant responding. Instead, they may be sourced to the decisions made by the data analyst. If a data analyst is biased towards arriving at a certain, or any, significant finding, they may over-analyse or ‘dredge’ the data until they find something meaningful. While some degree of exploring post-hoc hypotheses can be useful, too much data-dredging can increase the possibility of a type one error, which is finding statistically significant results by chance (Berk, Brown, & Zhao, 2010). That is specifically why researchers are called to develop specific hypotheses based on the literature before collecting data. The current study was not immune to the possibility of data dredging.

The literature was, however, consulted to develop specific hypotheses before collecting data. For instance, I determined to find out which of several particular subscales would likely associate with theory of mind eye-reading score, *a priori* (Baron-Cohen et al., 2001b). Baron-Cohen et al. (2001b) reported that the overall AQ score, the AQ Social Subscale score, *and* the AQ Communication Subscale score predicted theory of mind eye-reading score, in their university sample. If I had been setting up for data-dredging, I would have correlated the theory of mind eye-reading score with the three other AQ subscales (i.e., attention, detail, and imagination) as well. However, only the AQ scale, and the social and communication subscales were hypothesized to relate to theory of mind eye-reading score. Therefore it was reasonable to include only all of these in the hypotheses. Moreover, the significant AQ Communication Subscale/Eyes Test-

Revised association, was found using a conservative alpha level of .01. This reduces the chances of a type one error. The results were not likely biased by data-dredging.

Generalisation of data. Aside from sources of bias, of primary interest is whether or not this study's sub-clinical autism data are able to be generalised to populations of those with clinically diagnosed autism. In the research literature, sub-clinical autism findings have successfully generalised to populations clinically diagnosed with autism (Baron-Cohen et al., 2001b; Sucksmith et al., 2011; Wheelwright et al., 2010). For example, social deficits found among samples of sub-clinical autism participants are also found in samples of people with diagnosed autism (Baron-Cohen et al., 2001b). This being stated, there are clear differences between sub-clinical autistic participants' responses to questionnaires and the questionnaire responses of those with clinical autism.

Therefore, it must be acknowledged that in some ways, participants with sub-clinical autism symptoms differ from those with a clinical ASD. The purported clinical cut-off for autism as measured by the AQ is 32+ (Baron-Cohen et al., 2001b), and no participants in the current study scored in this range. Furthermore, even if the current study's sub-clinical autism participants had scored above 32, they may not have been necessarily diagnosable for an ASD. The reason is, the 32+ cut-off for clinical autism in the AQ, is only a sub-clinical research guideline for the detection of a potential ASD diagnosis. For many, this will leave the question open as to whether or not similar results can be obtained between clinical and subclinical autism studies.

Generalisation from university students to the general population. As in many psychology studies, the current study was conducted with university students for

convenience. However, in the context of this particular study, this may not pose as an obstacle to generalizing the data to relevant populations. Sub-clinical autism populations are likely to thrive in academic settings, especially in engineering and the hard sciences (Baron-Cohen et al., 2001b). Considering this, the current study's samples were taken from the appropriate population and should at least be generalised back to them. The only thing left to consider in service of generalizing the data then, would be to weigh the appropriateness of generalizing sub-clinical autism sample findings to populations of persons clinically diagnosed with autism.

Fortunately, sub-clinical autism participants have a clear statistical relationship to people diagnosed with ASDs. Eighty percent of participants with a diagnosis of high-functioning autism (HFA) scored 32+ on the AQ compared to only two percent of controls (Baron-Cohen et al., 2001b). Also, relatives of people with clinical autism possess significantly stronger autism phenotypes than the rest of the population (Baron-Cohen et al., 2001b; Bishop et al., 2004; Wheelwright et al., 2010; Sucksmith et al., 2011). Twin studies reviewed by Sucksmith, Roth, and Hoekstra (2011), have recently confirmed the genetic basis behind both autism and related sub-clinical autism symptoms. For these reasons, there is confidence that the results in this study can be generalised, with the appropriate qualifications, to populations of people diagnosed with clinical autism. That is not to say, however, that future studies cannot improve on the study currently being discussed.

Future Directions

One set of proposed enhancements for future studies involves strengthening the measures used, to protect against self-report and other biases. More questionnaire items

can be counterbalanced, and include reverse-coded items to be able to more easily detect miscellaneous responding. And catch items, which are items not related to the measure at hand, but which test whether a participant is paying attention can be included (e.g., “Please leave the response to this question blank”). Counterbalancing items (i.e., reverse-coding some items in questionnaires) will decrease the chance of self-report bias as participants may be less able to figure out any purposes behind the questionnaires.

The best way to address issues in self report is to create questionnaire-free experiments. In one such study, researchers asked individuals with autism to read unfinished stories about fictitious acquaintances, or friends engaged in social interaction. The goal of the participants was then to finish the stories by indicating how the people in the story might next behave (Sansosti & Powell-Smith, 2008). However these were restricted to only social, and not romantic, interactions. Alternatively, researchers could ask individuals with autistic symptoms to interpret a romantic scene between two confederate actors. The goal would be to see if the participants with autistic symptoms could understand the nonverbal communication transferring between the actors. Such a study was actually performed in a study of socio-emotional processing by Bauminger (2002). However, like with Sansosti and Powell-Smith (2008), the exercise was intended to measure and improve theory of mind skills in social contexts only, leaving no similar alternatives for romantic contexts. With the results of the current study, perhaps such researchers may elect to focus more on the study of autism and romance.

To see if results truly generalise beyond the population of sub-clinical university students, future studies should attempt to replicate this study, with samples of those with clinical autism spectrum disorders (ASDs) and/or sub-clinical individuals in the

community (as in Byers et al., 2012; Byers et al., 2013; Mehzabin et al., 2011; Stokes et al., 2007). However, guarding against selection bias from recruiting participants with ASDs could be even more difficult. Many families understandably want to protect their relatives with ASDs. When recruiting youth with clinical ASDs, incentives may need to be increased to obtain high sample sizes (Stokes et al., 2007). Incentives, as already discussed in the context of school credit to students, however, can result in selection-biases. Fortunately, there are researchers who have been successful at recruiting samples of participants with clinical ASDs from the community, without incentives. Byers et al. (2013) recruited such participants online. Regardless of the future sampling strategies to be used, an extra effort should be made to recruit more men. Greater numbers of men will facilitate the detection of gender differences. Detecting gender differences will make it easier to discern the theoretical implications behind gender-based effects.

Theoretical Implications

There are numerous theoretical implications behind the current study's findings. First, it was found that a high level of sub-clinical autism symptoms predicted inappropriate dating behaviours, in parallel to what was found in research done on clinical ASDs (Stokes et al., 2007). This match challenges the point of view that autism is a categorical, "all-or-none" disorder. Rather, it supports the point of view that the autism spectrum extends continuously into the typically developing population (Baron-Cohen et al., 2001b; Sucksmith et al., 2011; Wheelwright et al., 2010). This suggests that research on autism should include not only clinical, but also sub-clinical samples. Researchers need to continue to investigate the similarities and differences in social functioning between these two autistic populations.

The findings also have implications for the study and measurement of theory of mind. Some researchers have argued that eye-reading is a dubious form of theory of mind. As a result, they have argued that the Eyes Test-Revised is a dubious measure of theory of mind (Roeyers & Demurie, 2010). However, the Eyes Test-Revised was used in the current study, to successfully predict socially insensitive dating behaviours. This pattern of results supports the understanding that eye-reading assesses one's level of sensitivity and empathy towards others (Baron-Cohen et al., 2001a). This entails having an appreciation for other people's mental states. Because the appreciation of others' mental states comprises theory of mind, the current study findings support the use of the Eyes Test-Revised as a measure of theory of mind. They also support the theory of mind theory, behind autism.

The fact that poor theory of mind predicted inappropriate dating behaviours in this population, not only holds implications for the ASD literature. It also holds implications for theory on the dating initiation process, as well as for stalking. It supports the dating initiation error-management theory (Haselton & Buss, 2000). It does so by agreeing that errors in over-perceiving others' romantic interest in oneself, need not be deliberate. Instead, they may be a result of a perceived situation of a paucity of potential mates. Perhaps as a result, the types of inappropriate dating behaviours described in this study and in Stokes et al. (2007) are likely to occur between strangers.

In the non-ASD literature, in contrast, stalking is more common among recently separated long-term romantic partners (Spitzberg & Cupach, 2007). The current study findings challenge the point of view that stalking is largely, or characteristically, a process that unfolds between acquainted individuals. They re-situate stalking to the

common stereotype of strangers stalking strangers (Spitzberg & Cupach, 2007). While not simplifying the view of stalking, these current study results suggest that there are multiple types of stalking. Where ASDs are concerned, this type of stalking describes how strangers inappropriately pursue strangers.

Finally, the failure to detect gender differences in all but the AQ Communication Subscale, also has interesting implications. While this appears to be due to a lack of power in the MANOVA and ANOVA tests (Field, 2009, p. 586), it is still possible that further research will fail to uncover gender effects of autistic communication symptoms on dating. This would imply that the extreme male brain theory (Baron-Cohen, 2002; Baron-Cohen et al., 2011; Knickmeyer & Baron-Cohen , 2006) would not be suitable for describing sub-clinical autism phenomena. More research is needed, however, to either confirm, or refute the extreme male brain theory of autism.

Practical Applications

While these findings do not suggest that improvements in eye-reading skill will impact one's tendency to make dating attempts in general, they do suggest that improving eye-reading skill may make the dating attempts more socially acceptable. If so, therapies training individuals with autism symptoms to read eye-expressions (e.g., Bölte, Golan, Goodwin, & Zwaigenbaum, 2010) may help them achieve a level of social skill that allows them to make more socially appropriate dating attempts. Research and commentary shows that the sexual education curricula is significantly lacking in usefulness for children with an ASD. Such research suggests that proactive programs helping youth with ASDs with the social aspect of dating, may be beneficial (Tullis & Zangrillo, 2013). The skill of making appropriate dating attempts could help ASD youth

generate a greater range of dating options. This could be beneficial, if improved dating initiation behaviours lead to greater power and choice in selecting high-quality mates.

Applications of this research, need not only apply to training and educating individuals with autism symptoms. There is also the possibility of raising awareness among the general public of the nature of relationship initiation difficulties experienced by those with autism symptoms. This could be ushered in through an additional module added to the North American sex education curriculum. It would be designed for both typically developing, and autistic youth (Gougeon, 2010). Once educated, typically developing individuals in singles' venues would be more aware that some autistic individuals who are interested in them romantically, may not necessarily be able to behave appropriately when approaching them. However, they would understand that this would not necessarily be deliberate inappropriate behaviour, but simply reflective of an impairment in social and communication skills.

Conclusion

The purpose of the current study was to replicate previous research, that had shown that autistic social and communication traits are associated with inappropriate dating behaviours (Stokes et al. 2007). The purpose was also to see whether theory of mind eye-reading difficulties (Baron-Cohen et al., 2001a) could explain such an association—especially given the importance of reading eye-expressions to dating initiation (Moore, 2010). Given the findings, it seems that eye-reading skill is important for the appropriateness of one's dating. These findings have implications for researchers such as Howlin, Goode, Hutton, and Rutter (2004), and other advocacy organisations, looking after the long-term outcomes of adults with autism symptoms.

Researchers and advocacy organisations should note that this is the first study to investigate the link between autism symptoms and inappropriate dating behaviours. It suggests that eye-reading ability may be an important area for improvement for emerging adult individuals with autism symptoms, who are seeking relationships. My findings demonstrate that autistic communication symptoms are associated with difficulties reading eye expressions. These difficulties represent challenges in theory of mind, and predict one's tendency to engage in inappropriate dating behaviours.

The numbers of individuals who are either diagnosed with high-functioning clinical autism, or who have sub-clinical autism symptoms is increasing (Ouellette-Kuntz et al., 2014; Sucksmith et al., 2011; Wheelwright et al., 2010). And their ability to navigate a range of potential mates in order to have choice in selecting high quality adult relationships has important health implications (Besculides, Koball, Moiduddin, Henderson, & Goesling, 2010; Graham & Barnow, 2013). It is my hope that this research helps not only those with clinical autism find high-quality romantic relationships, but that it helps the growing population of individuals with sub-clinical autism symptoms in this area as well.

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Appendix A

Autism Quotient

Instructions. Below is a list of 50 statements. Please read each statement very carefully and rate how strongly you agree or disagree with it by circling your answer.

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

14. I find making up stories easy.	definitely agree	slightly agree	Slightly disagree	definitely disagree
15. I find myself drawn more strongly to people than to things.	definitely agree	slightly agree	slightly disagree	definitely disagree
16. I tend to have very strong interests which I get upset about if I can't pursue.	definitely agree	slightly agree	slightly disagree	definitely disagree
17. I enjoy social chit-chat.	definitely agree	slightly agree	slightly disagree	definitely disagree
18. When I talk, it isn't always easy for others to get a word in edgeways.	definitely agree	slightly agree	slightly disagree	definitely disagree
19. I am fascinated by numbers.	definitely agree	slightly agree	slightly disagree	definitely disagree
20. When I'm reading a story, I find it difficult to work out the characters' intentions.	definitely agree	slightly agree	slightly disagree	definitely disagree
21. I don't particularly enjoy reading fiction.	definitely agree	slightly agree	slightly disagree	definitely disagree
22. I find it hard to make new friends.	definitely agree	slightly agree	slightly disagree	definitely disagree
23. I notice patterns in things all the time.	definitely agree	slightly agree	slightly disagree	definitely disagree
24. I would rather go to the theatre than a museum.	definitely agree	slightly agree	slightly disagree	definitely disagree
25. It does not upset me if my daily routine is disturbed.	definitely agree	slightly agree	slightly disagree	definitely disagree
26. I frequently find that I don't know how to keep a conversation going.	definitely agree	slightly agree	slightly disagree	definitely disagree
27. I find it easy to "read between the lines" when someone is talking to me.	definitely agree	slightly agree	slightly disagree	definitely disagree
28. I usually concentrate more on the whole picture, rather than the small details.	definitely agree	slightly agree	slightly disagree	definitely disagree
29. I am not very good at remembering phone	definitely agree	slightly agree	slightly disagree	definitely disagree

numbers.	agree definitely agree	agree slightly agree	disagree slightly disagree	disagree definitely disagree
30. I don't usually notice small changes in a situation, or a person's appearance.	definitely agree	slightly agree	slightly disagree	definitely disagree
31. I know how to tell if someone listening to me is getting bored.	definitely agree	slightly agree	slightly disagree	definitely disagree
32. I find it easy to do more than one thing at once.	definitely agree	slightly agree	slightly disagree	definitely disagree
33. When I talk on the phone, I'm not sure when it's my turn to speak.	definitely agree	slightly agree	slightly disagree	definitely disagree
34. I enjoy doing things spontaneously.	definitely agree	slightly agree	slightly disagree	definitely disagree
35. I am often the last to understand the point of a joke.	definitely agree	slightly agree	slightly disagree	definitely disagree
36. I find it easy to work out what someone is thinking or feeling just by looking at their face.	definitely agree	slightly agree	slightly disagree	definitely disagree
37. If there is an interruption, I can switch back to what I was doing very quickly.	definitely agree	slightly agree	slightly disagree	definitely disagree
38. I am good at social chit-chat.	definitely agree	slightly agree	slightly disagree	definitely disagree
39. People often tell me that I keep going on and on about the same thing.	definitely agree	slightly agree	slightly disagree	definitely disagree
40. When I was young, I used to enjoy playing games involving pretending with other children.	definitely agree	slightly agree	slightly disagree	definitely disagree
41. I like to collect information about categories of things (e.g. types of car, types of bird, types of train, types of plant, etc.).	definitely agree	slightly agree	slightly disagree	definitely disagree
42. I find it difficult to imagine what it would be like to be someone else.	definitely agree	slightly agree	slightly disagree	definitely disagree
43. I like to plan any activities I participate in carefully.	definitely agree	slightly agree	slightly disagree	definitely disagree
44. I enjoy social occasions.	definitely agree	slightly agree	slightly disagree	definitely disagree

	definitely agree	slightly agree	slightly disagree	definitely disagree
45. I find it difficult to work out people's intentions.				
46. New situations make me anxious.	definitely agree	slightly agree	slightly disagree	definitely disagree
47. I enjoy meeting new people.	definitely agree	slightly agree	slightly disagree	definitely disagree
48. I am a good diplomat.	definitely agree	slightly agree	slightly disagree	definitely disagree
49. I am not very good at remembering people's date of birth.	definitely agree	slightly agree	slightly disagree	definitely disagree
50. I find it very easy to play games with children that involve pretending.	definitely agree	slightly agree	slightly disagree	definitely disagree

Appendix B

Background Questionnaire

ID # _____ (for office use only)

Please fill out this questionnaire to the best of your ability:

Age: _____

Gender: Male Female Other (please circle one)

What is your sexual orientation (please circle one)?

Heterosexual Homosexual Bisexual Other _____

Please indicate the length of your current romantic relationship: _____ mths (please indicate 0 if not in a current romantic relationship)

1. Many health conditions can affect academic life. Please indicate if you have been diagnosed with one or more of the following conditions (Indicate YES with an X). If YES, please indicate the age at which you were diagnosed with the condition.

a) Anxiety Disorder _____	(age of diagnosis _____)
b) Asperger syndrome _____	(age of diagnosis _____)
c) Attention Deficit Hyperactivity Disorder _____	(age of diagnosis _____)
d) Autism Spectrum Disorder _____	(age of diagnosis _____)
e) Brain Injury or Stroke _____	(age of diagnosis _____)
f) Behavioural disorder (e.g., Conduct/Oppositional Disorder) _____	(age of diagnosis _____)
g) Cancer _____	(age of diagnosis _____)
h) Depression or Bipolar disorder _____	(age of diagnosis _____)
i) Deaf or hearing impaired _____	(age of diagnosis _____)
j) Learning disability _____	(age of diagnosis _____)
k) Post Traumatic Stress Disorder _____	(age of diagnosis _____)
l) Schizophrenia _____	(age of diagnosis _____)
m) Substance Abuse disorder (alcohol, other) _____	(age of diagnosis _____)
n) Seizure disorder, Epilepsy _____	(age of diagnosis _____)
o) Thyroid disease or disorder _____	(age of diagnosis _____)
p) Tourette's Syndrome _____	(age of diagnosis _____)
q) Visually impaired _____	(age of diagnosis _____)
r) Other neurological condition _____	(age of diagnosis _____)
s) Other non-neurological condition _____	(age of diagnosis _____)
t) Other psychiatric condition _____	(age of diagnosis _____)

2. How would you describe your occupation (please circle)?
 - a) Carleton university student
 - b) Other university student
 - c) College student
 - d) High school student
 - e) Apprenticeship (please describe): _____
 - f) Other (please describe): _____
3. If in number (2) you circled responses a) – d) please write your major of study:

4. How many academic courses are you taking right now/this term? _____
5. Do you currently have a job (please circle one)? Yes No

- If yes, approximately how many hours a week do you work (please circle one):
- a) 5-14
 - b) 15-24
 - c) 25-34
 - d) 35+

6. What is your religious affiliation (please circle one)?
 - a) Agnostic
 - b) Atheist
 - c) Christian
 - d) Hindu
 - e) Jewish
 - f) Muslim
 - g) Sikh

Other: _____

7. What is your first language (please check one)?
 - a) English
 - b) French

Other : _____

Appendix C

Eyes Test-Revised

See attached document.

Appendix D

Dating Success Questionnaire

Please indicate the frequency associated with the following activity. Please answer on a scale of 1 to 7.

1	2	3	4	5	6	7
Never			Sometimes			Always

1. How often do you frequent singles' venues (i.e., where three or more individuals are gathered?) _____

2. What is your current relationship status (please check one)?

- a) Single
- b) Casual dating (e.g., dating people, or dating one person for less than 3 months)
- c) Steady relationship (e.g., dating one person exclusively for 3 months or longer)
- d) Have recently broken up (____ wks ago)
- e) Living with an intimate other
- f) Engaged to be married
- g) Married
- h) Separated/Divorced (____ mths ago)
- i) Widowed

Other : _____

Set A – Nonverbal Flirting Perception Scale

If you go to places where singles meet (e.g. think of a party, night club, bar, or any gathering of three or more people you have recently been to), people may perform any of the following behaviours.

Please indicate the frequency with which you noticed any of the following silent behaviours directed toward yourself of the intention to catch your attention romantically.

Use the following scale:

1 Never	2	3	4 Sometimes	5	6	7 Always
1. Exaggeratedly glance around the room to catch my attention (i.e. when standing relatively far away)						
2. Glance at me before quickly looking away						
3. Fix their gaze on me						
4. Flash their eyebrows						
5. Flip their hair by gently tossing their head						
6. Show their neck						
7. Run their hands through their hair						
8. Nod their head (i.e. when at a very short distance away)						
9. Lick their lips						
10. Apply lipstick						
11. Pout						
12. Smile						
13. Smile coyly (i.e. alluringly)						
14. Laugh						
15. Giggle						
16. Invite me for a kiss by puckering lips (or actually kiss me)						
17. Whisper things to me						
18. Bring their face right up to mine so our noses are almost touching						
19. Gesture for me to come over by waving						
20. Tap some part of my body (e.g. shoulder)						
21. Touch me with their palm (e.g. briefly on the arm)						
22. Gesticulate (talk exaggeratedly with their hands)						
23. Take/hold/grab my hand						
24. Primp clothing (e.g. pat, smooth clothing, maybe bottoms, though it seems unnecessary)						
25. Hike skirt or pants (e.g. raise it so more leg is exposed)						
26. Play with an object (e.g. fondle keys, rings, stroke glass)						
27. Caress my face / tangle fingers in my hair						
28. Stroke my thigh and/or inner leg						

29. Pat my buttocks	____
30. Caress my arm	____
31. Caress my torso	____
32. Caress my back	____
33. Lean in to me (like while seated)	____
34. Gently brush some part of their upper body across my body	____
35. Allow their chest to gently touch my some part of my body	____
36. Touch my knee	____
37. Touch my thigh	____
38. Play footsy	____
39. Place my hand on some part of their body (e.g. lap)	____
40. Give me a side shoulder hug (drape arm around my shoulder)	____
41. Give me a double-arm hug	____
42. Take my arm and place it around their shoulders so we are side to side	____
43. Hold their body against mine (e.g. while waiting for drink or while dancing)	____
44. Hold their body against mine while lifting feet clear off the ground	____
45. Walk paradedly (say like a model)	____
46. Walk right up to me in an obvious way	____
47. Request a dance	____
48. Accept a dance	____
49. Dance solitarily (e.g. dance on the dance floor like in a way to be seen)	____
50. Grant me permission to do something (e.g. have a seat at their table)	____
51. Demand my help for something (e.g. put jacket on them, indicate drink needs to be refilled, wait to pull their seat out for them)	____
52. Play with me (e.g. tickle, pinch me; stick tongue out at me)	____

Set B – Inappropriate Dating Behaviours

Courtship Behaviour Scale

If you have attempted to pursue a relationship (romantic), with what frequency have you engaged in any of the following behaviours in the past:

1 Never	2 Rarely	3 Sometimes	4 Often	5 Always
--------------------------	---------------------------	------------------------------	--------------------------	---------------------------

- | | |
|------------------------------------------------------------------------------------------|------|
| 1. Shown obsessional interest | ____ |
| 2. Displayed a strong belief that the person of interest must reciprocate their feelings | ____ |

- | | |
|-------------------------------------------------------------------------------------------|-----|
| 3. Made contact with the person's friends or family | ___ |
| 4. Made gestures someone saw as inappropriate | ___ |
| 5. Made comments someone saw as inappropriate | ___ |
| 6. Touched inappropriately (e.g. Try to kiss or fondle) | ___ |
| 7. Stolen or damaged their property | ___ |
| 8. Made threats | ___ |
| 9. Threatened to hurt self | ___ |
| 10. Ever persistently pursued a person in a way that could be
perceived as threatening | ___ |
| 11. Other more serious behaviours | ___ |

Appendix E

Theory of Mind Covariates Questionnaire

Set A - Attachment

Experiences in Close Relationship Scale

Please answer the following questions on a scale of 1 to 7.

1	2	3	4	Sometimes	5	6	7
Never				Sometimes			Always

1. I prefer not to show a partner how I feel deep down. _____
2. I worry about being abandoned. _____
3. I am very comfortable being close to romantic partners. _____
4. I worry a lot about my relationships. _____
5. Just when my partner starts to get close I find myself pulling away. _____
6. I worry that romantic partners won't care about me as much as I care about them. _____
7. I get uncomfortable when a romantic partner wants to be very close. _____
8. I worry a fair amount about losing my partner. _____
9. I don't feel comfortable opening up to romantic partners. _____
10. I often wish that my partner's feelings for me were as strong as my feelings for him / her. _____
11. I want to get close to my partner, but I keep pulling back. _____
12. I often want to merge completely with romantic partners, and this sometimes scares them away. _____
13. I am nervous when partners get too close to me. _____
14. I worry about being alone. _____
15. I feel comfortable sharing my private thoughts and feelings with my partner. _____
16. My desire to be very close sometimes scares people away. _____
17. I try to avoid getting too close to my partner. _____
18. I need a lot of reassurance that I am loved by my partner. _____
19. I find it relatively easy to get close to my partner. _____
20. Sometimes I feel that I force my partners to sow more feeling, more commitment. _____
21. I find it difficult to allow myself to depend on romantic partners. _____
22. I do not often worry about being abandoned. _____
23. I prefer not to be too close to romantic partners. _____

24. If I can't get my partner to show interest in me, I get upset _____
or angry.
25. I tell my partner just about everything. _____
26. I find that my partner(s) don't want to get as close as I
would like. _____
27. I usually discuss my problems and concerns with my
partner. _____
28. When I'm not involved in a relationship, I feel somewhat
anxious and insecure. _____
29. I feel comfortable depending on romantic partners. _____
30. I get frustrated when my partner is not around as much as I
would
like. _____
31. I don't mind asking romantic partners for comfort, advice,
or help. _____
32. I get frustrated if romantic partners are not available when I
need them. _____
33. It helps to turn to my romantic partner in times of need. _____
34. When romantic partners disapprove of me, I feel really
bad about myself. _____
35. I turn to my partner for many things, including comfort
and reassurance. _____
36. I resent it when my partner spends time away from me. _____

Set B - Intimacy

Adapted From The Perceived Relationship Quality Component Inventory

Please answer the following questions on a scale of 1 to 7.

1	2	3	4	Neutral	5	6	7
Not at all							A lot

e.g. How important is it to learn? _____ 7

1. How intimate is your relationship? _____
2. How close is your relationship? _____
3. How connected are you to your partner? _____
4. To what extent does your relationship lack intimacy? _____
5. How distant do you feel from your partner? _____
6. To what extent do you feel disconnected from your partner? _____

Set C - Responsiveness

Perceived Partner Responsiveness

Think of a recent issue, or major, or recurring issue(s) discussed by you and your partner. Common examples are handling of finances, matters of recreation, religious matters, conventionality (correct or proper behaviour), philosophy of life, ways of dealing with parents (or in-laws); aims, goals, and things believed important; amount of time spent together, making major decisions, household tasks, leisure time interests and activities, career decisions, etc...

Please answer the following questions on a scale of 1 to 7.

1	2	3	4	5	6	7
Not at all			Neutral			A lot

e.g. How important is it to learn? 7

1. To what degree were you able to ensure your partner felt that they _____ or what they had to say was accepted by you?
2. To what degree were you able to ensure your partner felt that they _____ or what they had to say was understood by you?
3. To what degree were you able to ensure your partner felt that they _____ or what they had to say was cared for?
4. To what extent did your partner feel you did not accept them or _____ what he/she had to say?
5. To what extent did your partner feel misunderstood on the whole _____ or by what they had to say?
6. To what extent did your partner feel you did not care for them or _____ what they had to say?

Set D – Self-Disclosure

Adapted From The Self-Disclosure Index

Please indicate the frequency associated with the following activities. Please answer on a scale of 1 to 7.

1 Never	2 Rarely	3 Sometimes	4 Often	5 Almost always
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1. I talk to my partner about my health. _____
2. I talk to my partner about my finances. _____
3. I talk to my partner about positive things that Happened during the day. _____
4. I talk to my partner about disappointments and setbacks _____
5. I talk to my partner about other family members _____
6. I talk to my partner about future plans _____
7. I talk to my partner about my friends _____
8. I talk to my partner about secrets I am keeping _____
9. I talk to my partner about my fears and insecurities _____

Set E – Trust

Trust in Close Relationships Scale

Please answer on a scale of 1 to 7, how much you agree with the following statements.

1 Strongly disagree	2	3	4 Neutral	5	6	7 Strongly agree
------------------------	---	---	--------------	---	---	---------------------

e.g. *I am currently filling out a questionnaire* _____ 7

1. My partner has proven to be trustworthy and I am willing to let him/her engage in activities which other partners find too threatening. _____
2. Even when I don't know how my partner will react, I feel comfortable telling him/her anything about myself, even those things of which I am ashamed. _____
3. Though times may change and the future is uncertain, I know my partner will always be ready and willing to offer me strength and support. _____
4. I am never certain that my partner won't do something that I _____

dislike or will embarrass me.

5. My partner is very unpredictable. I never know how he/she is ____ going to act from one day to the next. ____
6. I feel very uncomfortable when my partner has to make decisions which will affect me personally. ____
7. I have found that my partner is unusually dependable, especially when it comes to things which are important to me. ____
8. My partner behaves in a very consistent manner. ____
9. Whenever we have to make an important decision in a situation we have never encountered before, I know my partner will be concerned about my welfare. ____
10. Even if I have no reason to expect my partner to share things with me, I still feel certain that he/she will. ____
11. I can rely on my partner to react in a positive way when I expose my weaknesses to him/her. ____
12. When I share my problems with my partner, I know he/she will ____ respond in a loving way even before I say anything. ____
13. I am certain that my partner would not cheat on me, even if the opportunity arose and there was no chance that he/she would get caught. ____
14. I sometimes avoid my partner because he/she is unpredictable ____ and I fear saying or doing something which might create conflict. ____
15. I can rely on my partner to keep the promises he/she makes to ____
16. When I am with my partner, I feel secure in facing unknown ____ new situations. ____
17. Even when my partner makes excuses which sound rather unlikely, I am confident that he/she is telling the truth. ____

Appendix F

Personality and Romance Study Battery

Thesis measures are italicised.

- Autism Quotient (Baron-Cohen et al., 2001b) measure of autism symptom severity*
- Background Questionnaire from the Parlow Lab*
- Eyes-Test Revised (Baron-Cohen et al., 2001a) measure of theory of mind eye-reading*
- Dating Success Questionnaire*
 - Motivation Subscale of the Social Responsiveness Scale (Constantino & Gruber, 2012) measure of social motivation
 - Compiled Exploratory Social Functioning Scale (La Greca & Lopez, 1998; Stokes & Kaur, 2005; Stokes et al., 2007) measure of social functioning
 - Frequency of attending singles' venues item from the Parlow Lab*
 - Relationship status item from the Parlow Lab*
 - Survey of Heterosexual Interactions – General (adapted from Korman, 1983; and Twentyman, Boland, & McFall, 1981) measure of dating initiation experience
 - Dating Questionnaire (Connolly et al., 2004) measure of dating initiation experience
 - Compiled Exploratory Dating Initiation Experience Scale (adapted from Glickman & La Greca, 2004; Leary, 1983; Ousley & Mesibov, 1991; Stokes et al., 2007; Watson & Friend, 1969) measure of dating initiation experience
 - Survey of Heterosexual Interactions – Specific (adapted from Korman, 1983; Twentyman et al.. 1981) measure of dating confidence
 - Dating in the Eyes measure of theory of mind eye-reading in dating contexts from the Parlow Lab
 - Dating Anxiety Scale (Glickman & La Greca, 2004) measure of dating anxiety
 - Nonverbal Flirting Perception Scale (adapted from Moore, 1985) measure of nonverbal flirting perception*
 - Courtship Behaviour Scale (adapted from Stokes et al., 2007) measure of dating behaviours*
 - Strivings Assessment Scale - Dating (adapted from Emmons, 1986) measure of dating motivation
 - Sex knowledge item (Stokes & Kaur, 2005)
 - Couple Satisfaction Index (Funk & Rogge, 2007) measure of relationship satisfaction
 - Strivings Assessment Scale – Marriage (adapted from Emmons, 1986) measure of self-perceived marriage prospects
 - Compiled Exploratory Marriage Confidence Subscale (Stokes & Kaur, 2005) measure of self-perceived marriage prospects
 - Dating History Questionnaire (Urbaniak & Kilmann, 2006) measure of sexual activity experience

- Relationship Experience Index (Lemus, Moya, & Glick, 2010) measure of committed relationship experience
- Compiled Exploratory Relationship Experience Scale (Stokes et al., 2007) measure of committed relationship experience
- Experiences in Close Relationships Scale (Brennan et al., 1998) measure of attachment
- Perceived Relationship Quality Component Inventory (adapted from Fletcher et al., 2000) measure of intimacy
- Perceived Partner Responsiveness (adapted from Manne, Ostroff, Rini, Fox, Goldstein, & Grana, 2004; Laurenceau et al., 1998) measure of responsiveness
- Self-Disclosure Index (Finkenauer et al., 2004) measure of self-disclosure
- Trust in Close Relationships Scale (Rempel et al., 1985) measure of trust
- Empathy Quotient-Short (EQ-S Baron-Cohen & Wheelwright, 2004) measure of empathy
- Dating in the Eyes measure of theory of mind eye-reading in dating contexts – words control task from the Parlow Lab.

Appendix G

Online Recruitment System Ad

Study Name: Personality and Romance

Description: This study is about personality and romance. You will be asked questions about your personality and your experiences with romantic and sexual relationships. You will also be asked to view pictures of eyes and determine the emotional expression they depict. Due to the nature of the topic, some questions are sensitive in nature.

Eligibility Requirements: We are looking for men and women of any/all ages (i.e. minimum 13 years of age).

Duration and Locale: The study takes approx. 75 minutes and you have the option to participate in person or online.

Researcher: Kojo Mintah in the Parlow lab. Phone (leave message): 613 520-2600 ext. 2691. Email: kmintah@connect.carleton.ca.

This study has been approved by the Carleton University Psychology Research Ethics Board (13-181).

Appendix H



Informed Consent

An informed consent is a document agreement between a researcher and a participant that protects the participant's rights. The idea behind an informed consent is to ensure that you understand the purpose of the study and that you agree to allow your data to be used for research and teaching purposes.

Study Title: Personality and Romance

Purpose: The purpose of this study is to investigate the relationship between personality and romance in a university student population.

Description of your participation. This study takes approximately 75 minutes to complete. If you agree to participate in this study, you will be asked to either come to our lab and fill out a series of questionnaires or fill them out online. The questions will ask about demographic information, your personality, and about your social and romantic experiences. In addition, you will look at photos of eyes and be asked about what they convey about the emotional state of the individual. Some questions are sensitive in nature (e.g., about sexual knowledge, dating anxiety, etc).

Remuneration. Students enrolled in PSYC 1001/1002/2001/2002 and NEUR 2001/2002 at Carleton University who participate in person are eligible to earn up to 1.5% credit towards their course. Students opting to participate on-line can earn up to .75%. If not receiving credit you can participate in a draw for a \$40 Coles bookstore gift (odds of winning are about 1:5 or better).

Anonymity/Confidentiality. The responses you provide are confidential. The only people who have access to this data are the researchers associated with the study. Your signed consent form will be stored in a secure location within our lab and separately from your questionnaire responses. Your responses will be associated only with an anonymous code number. Your identity will not be revealed in any report, thesis, or other publication and there will be no way for anyone other than the researchers to identify individual participants. In this way you are ensured anonymity in participating in this study.

Right to withdraw your participation. You may withdraw from this study at any time without penalty, or loss of your credit, or other reward. Furthermore, if you feel uncomfortable with a specific question and do not wish to answer it, you may skip it and move on to the next question. If after completing the study you subsequently decide to withdraw, you can still contact us and we will delete your responses.

Risks. Reflecting on social and romantic relationships is an interesting and compelling activity for most young adults. However, for some, such reflection may result in

discomfort or self-doubt. In this study we will ask you to fill out several questionnaires including questions about your personality, how you perceive your romantic life and about good and bad incidents from your romantic life history. You can opt to skip questions that make you feel uncomfortable. We will provide contact numbers for resources in the community and on campus in the circumstance that your participation results in anxiety or concerns about your well-being.

Qualtrics responses are stored in servers located in the United States. Data stored on servers based in the USA are subject to the United States Patriot Act that permits US law enforcement officials, for the purpose of an anti-terrorism investigation, to seek a court order that allows access to the personal records of any person without that person's knowledge. Given this, we cannot absolutely guarantee the full confidentiality and anonymity of your data. With your consent to participate in this study you acknowledge this.

Investigators. If you have any concerns about this study you may direct these concerns either to the student investigator, Kojo Mintah (email: kmintah@connect.carleton.ca or T. 613-520-2600 ext.1448), or Dr. Shelley Parlow, the faculty supervisor (shelley_parlow@carleton.ca or T. 613-520-2600).

If you have any ethical concerns about this study, please direct them to Dr. Shelley Brown, Chair of the Carleton University Ethics Committee for Psychological Research (520-2600 ext 1505).

If you have any other questions outside concerns regarding this study, or regarding the ethics behind the research, please contact the Chair of the Department of Psychology, Dr. Anne Bowker (520-2600 ext 8218).

Signatures:

I have read the description of the study on page 1 concerning its purpose. The data in the study will be presented as summary statistics and examples in a master's thesis and may also be used in research publications or for teaching purposes. I am aware that my identity will not be disclosed as a participant in this study. My signature, as indicated by clicking "I agree" indicates that I consent to participate in this study and agree to allow the data I provide to be used for the described purposes.

This study has received clearance by the Carleton University Psychology Research Ethics Board (13-181)

[This question is mandatory]

I agree

I disagree

Appendix I

Debriefing and Informed Consent to the Use of Data

The purpose of this informed consent is to ensure that you now understand the true purpose of the study and that you agree to allow your data to be used for research and teaching purposes.

In the Consent Form you agreed to participate in a personality study. At this time, we are able to disclose more specifically the nature of our research interests. Please read this revised Consent Form and decide, once you are more fully informed, whether you wish to allow us to retain your data and use it for research and teaching purposes.

Purpose. The true purpose of this study was to compare the performances on the face recognition task and romance measures of individuals who varied on certain personality traits such as systematizing and preference for sameness. These traits are sometimes observed among individuals with autism. In particular, we wanted to investigate whether such traits are predictive of certain romantic challenges, such as being less confident that one will be successful in procuring a date. Systematizing refers to a tendency to perceive logical patterns in the environment. We did not disclose this before because we did not want participants to worry about whether they are autistic or that this study was looking at symptoms of autism. Having these traits or not, does not speak to whether a particular individual has Autism.

We hypothesized that a preference for sameness and routine would not prevent individuals from forming and maintaining intimate relationships. However, it would be associated with more dating anxiety and more difficulties in reading facial expressions. The latter skill is related to the concept of *theory of mind* (ToM), or the ability to imagine what others are thinking and feeling.

In a previous study, we observed that university students who liked sameness and routine were less confident in their dating skills although they were as motivated to find a romantic partner as other students. It is not known why this should be so. A number of factors have been suggested by researchers, including attachment, trust, social responsiveness, intimacy, and self-disclosure. In the present study, we are investigating whether differences in Theory of Mind and/or the ability to read facial expressions may play a role in dating abilities independently of these other factors. If successful, our research will validate the theoretical importance of ToM in romantic success. Our findings may also suggest a different direction for helping individuals with autism develop better dating skills. To example, they may need to practise reading facial expressions.

To learn more about the relationship between romance, theory of mind, and how these concepts connect with the traits of interest in this study, and about the Eyes Test used in the study, you can read a research study by Simon Baron-Cohen and his colleagues called, “The ‘Reading the Mind in the Eyes’ test revised version: A study with normal

adults, and adults with Asperger syndrome or high-functioning autism.” This study was published in 2001 in the *Journal of Child Psychology and Psychiatry*, volume 42, pp. 241-251.

Anonymity/Confidentiality. The data collected in this study are kept anonymous and confidential. The consent forms are kept separate from your responses.

Right to withdraw data. You have the right to indicate that you do not wish your data to be used in this study. If you indicate this is your choice, then all measures you have provided will be immediately destroyed or deleted from the datafile.

Signatures: I have read the above description of the study investigating whether autistic traits are associated with certain but not all aspects of romantic relationships.

The data in the study will be used in research publications or for teaching purposes. My signature, as indicated by clicking “I agree” indicates that I agree to allow the data I have provided to be used for these purposes. Clicking “I disagree” will result in the elimination of my data from the study.

[Answering this question will be mandatory before participants will be shown a page to submit answers]

I agree

I disagree