GAZE BEHAVIOUR OF INDIVIDUALS WITH AUTISTIC TRAITS
WHILE ASSESSING PEER STATUS

by

LEILANI FORBY

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The following individuals certify that they have read, and recommend to the Faculty of Graduate and Postdoctoral Studies for acceptance, a thesis entitled:

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submitted by Leilani Forby in partial fulfillment of the requirements for the degree of Master of Arts in Psychology

Examining Committee:

Dr. Alan Kingstone, Psychology
Supervisor

Dr. Rebecca Todd, Psychology
Supervisory Committee Member

Dr. Steven J. Barnes, Psychology
Supervisory Committee Member
Abstract

Individuals with autism spectrum disorders have difficulty understanding verbal and non-verbal cues, and display atypical gaze behaviour during social interactions. The aim of this study was to examine differences among groups of individuals with high, medium, and low levels of autistic traits with regard to their gaze behaviour and their ability to assess peers’ social status. 54 university students who completed the short Autism Quotient (AQ10) were eye-tracked as they watched six 20-second video clips of individuals (“targets”) involved in a group decision-making task. The specific experimental instruction to the participants was to "think about who you would want to work with on a subsequent task". The video clips included moments of debate, humour, interruptions, and cross talk, simulating natural, everyday social interactions. Fixations were labelled by region of interest (body, face, or eyes). Participants then completed the Dominance and Prestige Peer Rating Scales, which asked them to rate the video targets in terms of status, prestige, and dominance. High-scorers on the AQ10 (i.e., those with more autistic traits) did not differ from the low- and medium-scorers in the status, prestige, and dominance ratings they gave the video targets. Unlike the low- and medium-scorers, high-scorers attended to the body of high dominance targets significantly more than they attended to the low and medium dominance targets, suggesting high-scorers found the high dominance target far more compelling than the medium and low dominance targets. In all other cases, high-scorers did not differ from low- and medium-scorers in either their ability to evaluate social status or in gaze behaviour. This suggests that deficits exhibited by individuals with autistic traits in reading social cues may be reduced in tasks probing certain social skills abilities. The results are
discussed in terms of their implications towards the Theory of Mind, Weak Central Coherence, and Social Motivation theories of autism.
Lay Summary

Autism spectrum disorders can impact a person’s eye movements during social interactions, and their ability to understand verbal and body language. This study examined looking behaviour and social status assessment abilities in individuals with varying levels of autistic traits. Participants had their eye movements recorded while they watched videos of individuals (“targets”) working together, and were then asked to rate each target’s group standing in terms of status, prestige, and dominance (SPD). Participants with more autistic traits (high-scorers) looked at the body of high dominance targets more than they looked at the medium and low dominance targets, suggesting high-scorers found the high dominance target the most compelling. In all other cases, high-scorers did not differ from low- and medium-scorers in their ability to evaluate SPD, or in looking behaviour. The results suggest that high autistic trait individuals experience fewer difficulties in reading social cues during certain social skills tasks.
Preface

This manuscript is original, unpublished work written by L. Forby, with the editing assistance of supervisor Dr. Alan Kingstone. The study design was based on previous work by Drs. Joey T. Cheng, Tom Foulsham, Joey T. Cheng, Jessica L. Tracy, Joseph Henrich, and Alan Kingstone. Data collection was performed by L. Forby, Jessica Dawson, Bradley Karstadt, and Ari Rotenberg. L. Forby also completed the data analysis under the supervision of Drs. Jason Flindall and Farid Pazhoohi.

The work presented in this study was conducted in the Brain, Attention, and Reality Lab at the Point Grey campus of The University of British Columbia. It was approved by the UBC Behavioral Research Ethics Board under the project “Toward a More Natural Approach to Attention Research 1-200,” certificate number H10-00527.
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<td>AOI</td>
<td>Area of interest</td>
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<tr>
<td>AQ10</td>
<td>Autism Quotient 10</td>
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<td>ASD</td>
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<td>Dominance and Prestige Peer Rating Scales</td>
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<td>ToM</td>
<td>Theory of Mind</td>
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<td>TD</td>
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For all who struggle to understand the social world around them,
but still have the courage to wade into its mystery every day.
Chapter 1: Introduction

Autism spectrum disorders (ASD) are neurodevelopmental disorders characterized by deficits in social interaction, restricted interests, and repetitive behaviours (American Psychiatric Association, 2013) that affect 1 in 66 children in Canada (Ofner et al., 2018). Neither “high-functioning” autism (HFA) nor Asperger’s syndrome (AS) are recognized as official diagnoses in the latest edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), either as part of ASD or as separate diagnoses, however, both HFA and AS share many symptoms with ASD (for review see both Blacher, Kraemer, & Schalow, 2003, and Carpenter, Soorya, & Halpern, 2009). While individuals with HFA/AS display average to above-average intelligence, have the ability to speak, write, read, and can perform daily self-care rituals (e.g., bathing, eating, etc.), they tend to exhibit symptoms such as repetitive behaviours and restricted interests. As in ASD, HFA/AS are also recognized as having the hallmark deficits in social skills such as difficulties in initiating and ending social interactions, making eye contact, respecting personal space, engaging in the typical back-and-forth rhythm of conversation, having odd speech prosody, and forming and maintaining meaningful friendships (Bauminger & Kasari, 2000; Carpenter et al., 2009; for review see Gutstein & Whitney, 2002; Shriberg et al., 2001). Not surprisingly, their social deficits are the root of most of their impairments (Carter, Davis, Klin, & Volkmar, 2013)

1.1 Across the lifespan

Typically developing (TD) infants prefer human faces over other patterns (Gliga, Elsabbagh, Andrivizou, & Johnson, 2009), unlike children with ASD, who prefer objects to people (Kanner, 1943; Osterling & Dawson, 1994). By the age of 2 months, TD infants show
signs of preferring the eye region of human faces (Maurer & Salapatek, 2018). By the time they reach 4 months of age, TD infants spend much of their time engaging in eye contact with their parents. In contrast, eye contact is noticeably less before or by the age of 1 in children who are later diagnosed with ASD (Maestro et al., 2005; Osterling & Dawson, 1994; Osterling, Dawson, & Munson, 2002). Indeed, Osterling et al. (2002) reviewed videos of 1-year-old children and found that children who were later diagnosed with ASD demonstrated less social and joint attention than both TD and children later diagnosed with mental retardation, consistent with the fact that fewer instances of mutual gaze can lead to fewer opportunities of joint attention. Thus, when compared to their TD peers, children with ASD engage less in mutual gaze, and use it less to transmit or receive social information.

Regarding speech, TD infants have been shown to prefer the sound of voices, particularly their mother’s (DeCasper & Fifer, 1980). In contrast, children with ASD do not appear to prefer the sounds of speech over other sounds (Osterling & Dawson, 1994). Additionally, preschoolers with ASD show less interest in listening to speech than their TD counterparts (Kuhl, Coffey-Corina, Padden, & Dawson, 2005). This limited interest in the human voice leads to fewer opportunities to learn how intonation or inflection can carry additional meaning to what is being said. The reduction in both eye contact and attention to human voices early in life has cascading effects on individuals with ASD and their ability to interact with others.

As the child with ASD nears the age of three, their interaction with other children starts to raise red flags for parents and other caregivers. The child does not seek out peers to engage in play, or initiates in ways that are atypical, and does not respond to overtures from peers to engage in play. The result is the child is often on their own, and therefore missing opportunities to learn and practice social engagement. This lack of practice only compounds their social
deficits, such that by the time children with ASD reach six or seven years of age, these differences begin to be detected by peers.

By the time they reach adolescence, the social deficits of youth with ASD become more marked because the social arena has matured. For individuals with HFA/AS, research suggests that peer rejection and neglect happen more frequently (Humphrey & Symes, 2010; Symes & Humphrey, 2010). Indeed, a recent study found that 63% of adolescents with ASD reported they had been bullied at least once in their lives, and 39% reported they had been bullied in the last month, which was 3 times higher than their TD siblings reported (Zablotsky, Bradshaw, Anderson, & Law, 2014). Additionally, adolescents with HFA/AS report being lonely more than their TD peers (Bauminger & Kasari, 2000; Lasgaard, Nielsen, Eriksen, & Goossens, 2010), and the few friendships they might have are typically of poorer quality than the relationships TD adolescents enjoy (Bauminger & Kasari, 2000). Thus, people with HFA/AS find themselves at another stage in life where they are missing out on opportunities to learn how to develop meaningful relationships, or enjoy the benefits that come with them. This has far-reaching impact for people with HFA/AS, as even one or two quality friendships during adolescence can help stave off adult depression (Bauminger & Kasari, 2000).

After high school, the outlook does not improve. A 2012 study found that more than fifty percent of recent high school graduates with ASD had not found employment or had any post-secondary education (Shattuck et al., 2012). Moreover, the researchers found that young adults with ASD had the lowest rates of employment compared to young adults with other disabilities such as intellectual disability, a learning disability, or speech-language impairments. Additionally, few adults with ASD experience marriage, dating, or sexual relationships (for review see Howlin, 2000), despite a desire for such companionship. After a lifetime of struggling
under social deficits, it is no wonder that individuals with ASD are at greater risk for anxiety or depression (American Psychiatric Association, 2013).

1.2 Autism models

Due to the fact that ASD is a multi-faceted condition, with affected individuals exhibiting various deficits and to varying degrees, many models of ASD have been developed. For example, models centered on deficits in theory of mind (ToM) posit that the social challenges individuals with ASD experience are rooted in their limited ability to recognize mental states (e.g., beliefs, desires, thoughts, and intentions) in themselves, or recognize them in others (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001; Baron-Cohen et al., 1985). However, there is yet to be one clear definition of ToM, or model for ASD stemming from it, due in part to several studies showing that some individuals with ASD can pass various ToM tests, depending on severity of ASD (Bowler, 1992; Happé, 1994; Rajendran & Mitchell, 2007). Despite conflicting results from ToM testing, the extant research supports a deficit of knowing mental states in the self and in others as a core component of ASD.

Another model for ASD is the Weak Central Coherence Theory (WCC; Happe, 1999; Happé & Frith, 2006), which posits that individuals with ASD cannot integrate pieces of information into an organized whole, unlike NTs who can do so readily. WCC came about in part due to the results of two studies. The first by Shah and Frith (1983) had participants find small target shapes within larger shapes using the Children’s Embedded Figures Test (Witkin, Oltman, Raskin, & Karp, 1971). They found that children with ASD outperform their NT peers. Shah and Frith (1993) then used the Block Design task of the Wechsler Intelligence Scales (Wechsler, 1999), which requires participants to rearrange patterned cubes to recreate a given
design, and again found autistic individuals outperformed NT counterparts. In both studies, the authors suggested NTs are distracted by the total image created by the combined smaller objects, whereas individuals with ASD are able to focus on the design’s individual components without being distracted by the global whole.

WCC can also account for why autistic individuals have difficulty understanding the subtleties of language. Studies (Frith & Snowling, 1983; cf. Hahn, Snedeker, & Rabagliati, 2015; Lopez & Leekam, 2003; for review see Rajendran & Mitchell, 2007) having autistic individuals read passages of text examined whether or not they would use the correct homograph (a word that has one spelling, but can mean different things depending on its pronunciation, e.g., bass as in fish, or bass as in a deep voice), and found that individuals with ASD did not use the correct pronunciation. That is, they processed each sentence within the passages separately, and did not recognize that previous sentences provided context as to the correct pronunciation of the homograph. WCC argues this failure to connect context with meaning is part of the reason why autistic individuals have a difficult time understanding the more subtle aspects of communication such as “reading between the lines”. While early WCC described ASD as a cognitive dysfunction characterized by a weakness in global processing, it has since evolved to recognize that ASD is a cognitive style characterized by superior local processing (Rajendran & Mitchell, 2007). The current model also proposes that when given explicit instructions, individuals with ASD can process globally to find whole meaning in pieces of information (Happé & Frith, 2006; López, Donnelly, Hadwin, & Leekam, 2004), however, this ability does not always extend to social skills (Happé & Frith, 2006; Morgan, Maybery, & Durkin, 2003).

Social Motivation Theory (SMT; Chevallier, Kohls, Troiani, Brodkin, & Schultz, 2012) proposes that the diminished ability to experience rewards in social interactions causes affected
individuals to not attend to salient social stimuli. Individuals with ASD have atypical reward processing compared to NTs (Kohls et al., 2011), particularly in the case of social interactions (Cox et al., 2015; Dichter, Richey, Rittenberg, Sabatino, & Bodfish, 2012; Scott-Van Zeeland, Dapretto, Ghahremani, Poldrack, & Bookheimer, 2010). There is evidence to suggest that, relative to NTs, autistic individuals have atypical amygdala responses to faces and eye contact (Dichter et al., 2012; Tanaka & Sung, 2016; Tottenham et al., 2014), and that these atypical responses result in reduced association between social interaction and positive reward (Senju & Johnson, 2009). Research also suggests another contributing factor is oxytocin: individuals with ASD have been found to have lower blood levels of oxytocin (Modahl et al., 1998), and lower oxytocin levels were associated with reduced sensitivity to social cues (Bartz, Zaki, Bolger, & Ochsner, 2011). Autistic individuals are also less interested in friendship or even the act of simply engaging with others (Simon Baron-Cohen & Wheelwright, 2003; Chamberlain, Kasari, & Rotheram-Fuller, 2007; Chevallier, Grèzes, Molesworth, Berthoz, & Happé, 2012). SMT posits that the combined result of these differences leads to deficits in social orienting, seeking and enjoying friendships, and engaging in behaviours that maintain social relationships. Under SMT, individuals with ASD might have the ability to recognize social cues, but simply do not prioritize them, are not spontaneously motivated by them, and do not recognize their usefulness in reaching relevant goals (e.g., understanding others’ thoughts, reactions, or intentions, predicting behaviour, fostering friendships, etc.). Indeed, previous research has shown that when social cues prove to be a useful tool for completing a task, children with ASD and neurotypical children will attend to those cues in similar fashion (Ristic et al., 2005).
1.3 Autism and social standing

The challenges in detecting the thoughts and emotions of others put autistic individuals at a great disadvantage when it comes to responding to different social situations. Individuals with HFA/AS have been shown to score lower than neurotypicals (NT) in measures testing theory of mind (ToM; Simon Baron-Cohen, Leslie, & Frith, 1985; Adler, Nadler, Eviatar, & Shamay-Tsoory, 2010; Peterson, Slaughter, & Brownell, 2015; cf. Bowler, 1992; F. G. E. Happé, 1994; Rajendran & Mitchell, 2007), and reading emotions (Montgomery et al., 2016). Thus, although they might appear to have milder deficits than others who are further on the spectrum, HFA/AS continue to struggle to understand incoming signals. Additionally, they may simultaneously broadcast inaccurate or undesirable signals of their own.

Individuals with autistic traits tend to focus their attention on topics of interest, and can dominate conversations with them (American Psychiatric Association, 2013; Elder, Caterino, Janet, Shacknai, & De Simone, 2006; Laugeson & Ellingsen, 2014). This enthusiasm for a preferred topic may come across as arrogant, or condescending towards others attempting to offer up their opinions (Fast, 2004; Higgins, Koch, Boughfman, & Vierstra, 2008; Telzrow & Koch, 2003), and it can also make them appear to be bragging about their particular knowledge (Fast, 2004). Additionally, they tend to disengage when non-preferred topics are being discussed, and thus appear to be self-centered or disinterested in others (Fast, 2004). This limited ability to demonstrate humility, and to evince either respect towards others, or appreciation for others’ contributions, can result in poorer social standing within a group (Anderson, Srivastava, Beer, Spataro, & Chatman, 2006; Chancellor & Lyubomirsky, 2013; Tangney, 2000; Weidman, Cheng, & Tracy, 2018).
Other ASD-related behaviours can also negatively impact social status: HF/AS individuals can possess excellent verbal recall, which unfortunately can lead them to argue about small or trivial details; their persistence might be interpreted as being stubborn; and their blunt way of speaking may be off-putting to others (Fast, 2004). Individuals who appear to hinder group harmony or negatively impact a group’s activity are seen as disruptive, and they can fall in group status (Anderson et al., 2006). Such a fall in social rank is positively correlated with a decrease in overall health, and access to vital resources (Marmot, 2004; Marmot, Ryff, Bumpass, Shipley, & Marks, 1997). In contrast, high status individuals are those who have an “elevated capacity for social influence” (Maner, 2017). They tend to have greater access to valuable resources, and are typically found to be healthier than lower status individuals (de Waal-Andrews, Gregg, & Lammers, 2015; Gil-White & Henrich, 2001; Marmot et al., 1997; Reyes-García et al., 2008).

### 1.4 Social hierarchy

According to traditional social psychology, there are two primary paths to achieving high status. One is the Conflict-based model, and the other is the Competent-based model. Under the Conflict-based model, high status can be obtained through forceful tactics, such as aggressive or intimidating behaviour. These tactics are typically adopted to accumulate and control resources, and to minimize conflict (for review see Maner, 2017). In this model, lower status individuals succumb to and monitor the aggressor in order to avoid being on the receiving end of intimidating or violent behaviour, and to protect what resources they might currently possess. In short, under this model, status is taken and preserved by the domineering individual (de Waal-Andrews et al., 2015). Given that individuals with autistic traits have greater difficulty in reading
social cues, they would be far less likely to recognize that a message is being sent, which messages are meant for whom, what is being implied, and perhaps worst of all, the signs of imminent danger. Additionally, individuals with ASD who have expertise in a useful area could be seen as a threat to a leader who utilizes dominant tactics, as dominant-styled leaders will demote talented members in order to maintain control over the group (Maner, 2017; Maner & Mead, 2010). Moreover, a person who does not appear to react in fear to cues of intimidation might also be seen as undermining the dominant-styled individual’s authority, and could therefore unknowingly invite harsher dominant tactics.

Contrasting the Conflict-based model is the Competent-based model, where an individual achieves high status by sharing valuable knowledge or skills (Gil-White & Henrich, 2001), or for directing their efforts towards maximizing the overall well-being of the group (Henrich, Chudek, & Boyd, 2015). In this model, lower status individuals track the movements of the respected individuals in order to obtain knowledge or learn skills. Leadership through shared knowledge enhances the feelings of fairness in the group, which in turn minimizes conflict. It also tends to coordinate group members’ skills or knowledge for maximum effect. Under the Competent-based model, high status is given by the group to the most knowledgeable and skilled individuals, and pro-social behaviours are encouraged. HF/AS individuals might be afforded more leeway or more likely forgiven for social gaffs in a Competent-based setting, if their areas of interest are deemed valuable to the group. However, the social status of autistic individuals would be hindered by their perceived lack of both humility, and respect for others, which are key components in a prestige-based group (Weidman et al., 2018).

These two theories of hierarchy, Competent-based model and Conflict-based model, had been the primary competing theories of how humans determine status, each presumed to operate
exclusively within a given group. However, the Dual Model of Social Hierarchy (Gil-White & Henrich, 2001) has become the prominent theory of achieving and maintaining status, and argues that the Prestige (Competent-based) path to status evolved in humans alongside the Dominance (or Conflict-based) path, and, more importantly, that both paths can co-exist (Cheng, Tracy, Foulsham, Kingstone, & Henrich, 2013; Cheng, Tracy, & Henrich, 2010; Reyes-García et al., 2008). It is through the lens of the Dual Model of Social Hierarchy, where both tactics can be deployed concurrently, that the current study examines perceived status by outside observers, be they autistic individuals or neurotypicals. Understanding what college-aged individuals with autistic traits glean from social interactions could inform career counselling for those with social skills deficits, and would be timely and beneficial for a group whose next phase in life is entering the workforce.

Bearing this in mind, the current study examines the “reading the room” skills of university students, and is modeled after studies conducted by Foulsham, Cheng, Tracy, Henrich, and Kingstone (2010), and Cheng, Tracy, Foulsham, Kingstone, and Henrich (2013). In Cheng et al. (2013), individuals were filmed while engaging in a group task, after which they were asked to rate fellow group members on their status, prestige, and dominance. A second group of participants were then asked to view the clips from the videotape of the original group, and rate the onscreen individuals on the same domains. Cheng et al. (2013) found that the status, prestige, and dominance ratings from the original group members matched the ratings given by the participants who watched their interactions via video. This demonstrated that outside observers can accurately assess the status, prestige, and dominance of others, even when those others are on videotape. In Foulsham et al. (2010), participants viewed the video tape interactions from Cheng et al. (2013), and found that participants’ fixation count and dwell times on the high status
people in the videos were greater than for that on the medium status individuals, who were in turn fixated on more frequently and for longer periods of time than the low status individuals.

Unlike Foulsham et al. (2010) or Cheng et al. (2013), the current study will include participants with autistic traits to determine if they differ from NTs in both the ability to interpret social cues (such as facial expressions, tone of voice, or eye contact) as an outside observer, and the ability to then use these cues to ascertain the status conferred to people by their fellow group members. Given that individuals with ASD have difficulty decoding social cues (American Psychiatric Association, 2013; Laugeson & Ellingsen, 2014), I predict that individuals with autistic traits will not be able to discriminate between prestige-styled or dominance-styled tactics employed to attain status, and that they will not be able to determine the status conferred to people by their fellow group members.

In terms of the models for autism, ToM predicts autistic individuals will not be able to infer the intentions behind tactics meant to either persuade or intimidate fellow group members. Additionally, autistic individuals will not be able to deduce the group status, prestige, and dominance conferred onto a target because they have limited “I think she thinks” abilities. Regarding WCC, individuals with autistic traits will have difficulty extrapolating a target’s social standing because they will not piece together relevant information (e.g., getting talked over or cut-off, other targets laughing at their jokes, etc.), and measure such information against the context of all six video clips. In terms of SMT, even if individuals with autistic traits are capable of recognizing social cues, they might not be motivated to attend to these cues, or prioritize them in a manner that helps deduce a target’s group standing. Although for different reasons, all three models for autism predict the ratings by autistic individuals will not be in
agreement with non-autistic individuals on the status, prestige, and dominance ratings given to the targets.

The current study will also examine if individuals with autistic traits differ from NTs in observing dynamic social interactions, in terms of looks to people versus objects. Because the extant research in this area is mixed for adolescents and adults (Dubey, Ropar, & Hamilton, 2015; Sasson, Dichter, & Bodfish, 2012; Unruh et al., 2016; cf. Watson et al., 2015), I make no firm predictions regarding whether or not young adult individuals with autistic traits will behave differently from NTs. However, it follows that if individuals with autistic traits rate people in the video differently than NTs on social status, prestige, and/or dominance, those with autistic traits may also look at those individuals in the video differently. Another reasonable expectation is that even if those with autistic traits rate people in the same way as NTs, it need not follow that they will look at them the same way. Thus, I assessed their looking behaviour with regard to the entire body, head, and eyes of the individuals in the video. Indeed, looks to the eye regions of those in the video are of particular interest. Although research shows that children with ASD make less eye contact (Osterling & Dawson, 1994; Osterling et al., 2002; Senju & Johnson, 2009), results become mixed as the age of participants increases (Dapretto et al., 2006; Rutherford & Towns, 2008; Tanaka & Sung, 2016). Nevertheless, the general weight of empirical evidence supports the prediction that individuals with autistic traits will make fewer looks than NTs to the eye region.
Chapter 2: Methods

2.1 Participants

Using the Fabs package (Biesanz, 2018) in RStudio (RStudio Team, 2020), it was determined that 41 participants were needed to achieve a power of .80 at a significance level of .05. Sixty-four participants were recruited from the Human Subject Pool at the University of British Columbia according to the school’s ethical guidelines.

All participants completed the Autism Quotient 10 (AQ10; Allison, Auyeung, & Baron-Cohen, 2012) prior to the experiment. The AQ10 is a self-report measure that includes 10 items from the 50-item Autism Quotient (AQ; Baron-cohen, Wheelwright, Skinner, Martin, & Clubley, 2001), which is used on adults with typical intellectual functioning. The AQ10 was designed for clinicians who needed a less time-consuming screening method for ASD, and has been shown to perform comparably to the full AQ (Booth et al., 2013). Allison et al. (2012) found the AQ10 scored reliably in sensitivity (0.88), specificity (0.91), and positive predictive value (0.85), and yielded mean scores of 7.93 in individuals with ASD, and 2.77 in NTs. Additionally, the AQ10 has been used to identify people with autistic traits in previous studies (Kristensen & Broome, 2015; Rhind et al., 2014; Tchanturia et al., 2013). An individual who scored 6 or higher on the AQ10 would be referred for a full diagnostic assessment.

Participants’ individual AQ10 scores, and the mean AQ10 score for all responses to the survey, were calculated once a school term for three terms. Each school term had a mean score of 3.5. No participants received an AQ score of 0 or 10. Twenty-six participants (16 females, 9 males, 1 other) had high scores (HAQ) of 6 (n = 1), 7 (n = 15), 8 (n = 7), and 9 (n = 3). Twelve (11 females, 1 male) had low scores (LAQ) of 1 (n = 5), and 2 (n = 7). Sixteen participants (10
females, 6 males) fell in the medium range (MHQ), 3 \( (n = 8) \), 4 \( (n = 7) \), and 5 \( (n = 1) \). Results from 10 individuals were not used in the analysis because they did not complete the AQ10, or because their eyes could not be calibrated properly, leaving 54 participants in total. (A participants’ eyes were calibrated before each video clip. If at any point during the study a participants’ eyes could not be calibrated after repeated attempts, the experiment was ended early, and their data were not used.)

2.2 Stimuli

The stimuli were videos used in a previous investigation (Cheng et al., 2013), and filmed with unconcealed video cameras while six unacquainted undergraduates completed a group decision-making task called the Lost on the Moon task (Bottger, 1984). Each group was given a list of 15 items, and asked, “Which items would your group need to survive if marooned on the moon?” The groups were then seated around a table (three participants on each side), and given 20 minutes to discuss and rank the items. To encourage participation, participants were told a monetary bonus would be given to the group whose rankings were closest to the correct answer. The videos used in the present study consisted of four sets, each containing six 20-second clips featuring one side of a table in a group (see Figure 1). These particular video clips were selected because they captured moments of debate, negotiation, persuasion, or conflict that led to a group decision. In short, the clips featured instances where dominant or prestige tactics were utilized by targets. These clips were also chosen because there was a significant difference in prestige scores between the highest rated individual \( (M = 5.76) \) and the lowest rated \( (M = 4.45) \), \( d = 2.40, t(6) = 3.40, p = 0.02 \), as well as in dominance scores, where the highest score \( (M = 4.77) \) was significantly different from the lowest score \( (M = 2.04) \), \( d = 4.59, t(6) = 6.49, p = 0.00064 \).
(Cheng et al., 2013). Per the original studies, participants were instructed to watch the videos and “think about who you would want to work with on a subsequent task.” This directive was part of the instructions given to observers of the video clips in order to maximize the feeling of being in the room with the targets. Participants’ eyes were calibrated before each clip began.

![Figure 1. Example of the view of the targets in the video clips presented to participants. After viewing the clips, and before completing the Dominance and Prestige Peer Rating Scales (DPPRS; Cheng et al., 2010) for each target, participants were given a screenshot from the videos that identified the targets as A, B, or C. Adapted from “Gaze Allocation in a Dynamic Situation: Effects of Social Status and Speaking,” by T. Foulsham, J.T. Cheng, J.L. Tracy, J. Henrich, and A. Kingstone, 2010. Cognition, 117(3), p. 319-331.](image)

The videos were digital film files with dimensions of 1024 by 768 pixels, and a frame rate of 30 fps. Because the aspect ratio of the original film was 16:9, the clips were presented
onscreen with a black border above and below their image. Sound was played through wired headphones.

The set of videos presented for each participant was randomized. To minimize the participants’ capabilities of deducing a target’s status through the unfolding of the group’s discussions, the order of the 6 video clips within each video set was also randomized (i.e., not in chronological order).

2.3 Measuring peer assessment of others

Using a 7-point Likert scale ranging from 1- not at all, to 7- very much, participants were asked to rate each target using the Dominance and Prestige Peer Rating Scales (DPPRS; Cheng et al., 2010). The key elements are described below.

**Dominance vs Prestige.** Seven questions are used to measure Dominance (e.g., “He/she often tries to get his/her own way regardless of what others in the group may want”), and 8 questions were used to measure Prestige (e.g., “His/her unique talents and abilities are recognized by others in the group”). Target scores for all seven Dominance items are combined to calculate a target’s composite Dominance score. The same calculation is done for the eight Prestige items.

**Perceived influence.** Participants also rate targets on the target’s ability to influence the group with three items: “led the task”, “was paid attention”, and “had high status”. Scores for these items are combined to calculate a target’s overall perceived status within their group.

The DPPRS was used in a study by Cheng et al (2013) to assess what the targets in the video thought about the other members of their group (i.e., the other targets), in terms of Prestige and Dominance. Cheng et al. (2013) also presented the videos of the targets completing their task...
to a second round of participants, who were then asked to rate the targets with the DPRRS. The two groups’ assessments (targets of each other, and participants of targets) aligned well in their ratings of the targets’ Dominance and Prestige ($rs = 0.79$ for Dominance, $0.66$ for Prestige, $p < .05$; Cheng et al., 2013).

Using these measures and the video clips, Foulsham et al. (2010) found that perceived status impacted the gaze behaviour of participants watching the video of the targets. Foulsham et al. (2010) found that targets rated as “high” status were fixated more often and longer than targets who were rated as “medium”, and the medium targets were fixated more often and longer than targets rated as “low”.

### 2.4 Equipment

Stimuli were controlled by the SensoMotoric Instruments (SMI) Experiment Center 3.4 and displayed on the SMI-issued 22” Dell color monitor. Eye tracking was done with the SMI iViewX 2.8 Red to synchronize data collection with the videos being played through Experiment Center. Pupil data was taken from the left eye at 500 Hz, using velocity ($30^\circ$/s) and acceleration thresholds ($8000^\circ$/s). While the SMI equipment does not use a head rest to standardize participants’ distance from the screen, its program provides clear, onscreen cueing to ensure participants are seated within a target range to the sensors. The average distance from the screen for participants was 53 cm.

The DPRRS was completed on a Dell Latitude E6530 laptop with a 15.6” display.
2.5 Procedure

The experiment began with on-screen instructions that explained the format of the study (e.g., a series of videos will be followed by questionnaires), and that participants were to watch the videos, and to “think about who you would want to work with on a future task”. Before each clip was shown, a 5-point eye calibration was performed. The volume was adjusted according to participant preference.

After watching all six clips, participants then completed the DPRRS on the laptop. For the questionnaires, participants were given a printed screen shot of the targets they had watched, with each target identified as “A”, “B”, or “C” (Figure 1). The items within each questionnaire were randomized, as was the order of the targets (e.g., some participants answered randomized questions related to target A first, others answered randomized questions related to target C first, etc.).
Chapter 3: Results

3.1 General viewing

General viewing patterns of the video clips were analyzed first. The average number of fixations for each 20 second video clip was 46 fixations ($SD = 10.1$). A one-way ANOVA was conducted to compare the effect of AQ10 scores on fixations. Among the three AQ10 groups, high (HAQ; 6 or higher), medium (MAQ; score of 3, 4, or 5), and low (LAQ; score of 1 or 2), there were no significant differences in fixations [$F(2, 51) = 0.52, p = .597$]. These results suggest that HAQ, MAQ, and LAQ share a similar general viewing behaviour of a filmed dynamic social interaction.

Next analyzed were the fixations to the people (“targets”) in the video clips. An individual area of interest (AOI) was created for each target’s entire body (including the head). Due to the fact that targets often moved during the video clips, dynamic, rather than fixed, body AOIs were created to follow each target’s movements (see Figure 2). All body AOIs in each video clip were measured as a percentage ($M = 10.2, SD = .42$) of the total onscreen image, and were not significantly different across all targets in all video clips, [$F(2,6) = .43, p = .670$]. A fixation that landed within a body AOI of a target was assigned to that target. Fixations to the three body AOIs in each video clip amounted for 82% of the fixations. Given the body AOIs amounted to roughly 30% ($M = 30.5, SD = 2.53$) of the total screen image, the data suggest the targets attracted more attention than the background objects.

3.2 Status

To determine if status had an effect on viewing behaviour, participants were asked to rate the targets on their level of status using the Dominance and Prestige Peer Rating Scales (DPPRS; Cheng et al., 2010). Targets that averaged the highest rating on status were ranked as “high”, and targets who averaged the lowest status rating were ranked as “low”, with “medium” being the target whose rating fell between low and high.

A mixed model ANOVA was conducted, all with Bonferroni-corrected pairwise comparisons unless otherwise noted, to determine if there was an effect of AQ10 score on the status scores of the targets, with AQ10 score (HAQ, MAQ, and LAQ) as a between-group factor, and target ratings (low, medium, and high) as a within-group factor. No significant effect was observed for the interaction of AQ10 score and target ratings, \[F(4,18) = 1.71, p = .190\], and there was no main effect of AQ10 score \[F(2,9) = 1.05, p = .389\]. However, there was a significant difference in the status ratings themselves \[F(2,18) = 50.72, p < .001\]: the low status
target \( (M = 2.58, SEM = .15) \), was rated significantly lower in status than the medium status target \( (M = 4.01, SEM = .19, p = .001) \), which was in turn rated significantly lower than the high status target \( (M = 5.01, SEM = .14, p = .014) \). Taken together, the data suggest that HAQ, MAQ, and LAQ agreed on the status rankings of the targets. Table 1 presents these ratings.

<table>
<thead>
<tr>
<th></th>
<th>STATUS</th>
<th></th>
<th>PRESTIGE</th>
<th></th>
<th>DOMINANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td><strong>Overall</strong></td>
<td>Mean</td>
<td>2.58</td>
<td>4.01</td>
<td>5.01</td>
<td>3.47</td>
</tr>
<tr>
<td></td>
<td>Std. Error</td>
<td>0.15</td>
<td>0.19</td>
<td>0.14</td>
<td>0.11</td>
</tr>
<tr>
<td><strong>LAQ</strong></td>
<td>Mean</td>
<td>2.02</td>
<td>4.08</td>
<td>5.27</td>
<td>3.18</td>
</tr>
<tr>
<td></td>
<td>Std. Error</td>
<td>0.27</td>
<td>0.32</td>
<td>0.33</td>
<td>0.18</td>
</tr>
<tr>
<td><strong>MAQ</strong></td>
<td>Mean</td>
<td>2.81</td>
<td>3.89</td>
<td>4.60</td>
<td>3.48</td>
</tr>
<tr>
<td></td>
<td>Std. Error</td>
<td>0.30</td>
<td>0.30</td>
<td>0.24</td>
<td>0.21</td>
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<tr>
<td><strong>HAQ</strong></td>
<td>Mean</td>
<td>2.90</td>
<td>4.05</td>
<td>5.16</td>
<td>3.74</td>
</tr>
<tr>
<td></td>
<td>Std. Error</td>
<td>0.20</td>
<td>0.37</td>
<td>0.10</td>
<td>0.16</td>
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</tbody>
</table>

Table 1. Target ratings. Results from the Dominance and Prestige Peer Rating Scales (DPPRS; Cheng et al., 2010) determined high, medium, and low targets in terms of Status, Prestige, and Dominance.

Using these rankings, fixation data were then organized such that if an AQ10 group had given a specific target the highest status rating, all fixations to that target were marked as fixations to the “high” status target. The same was done for the low and medium ranked targets. This was done for each AQ10 group across all four video batches.¹ Table 2 presents the fixation data for the three AQ10 groups as a function of AOI.

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¹ By using AQ10 group means to determine “high”, “medium”, and “low” rankings for the onscreen targets, some participants’ ratings did not fully align with their group’s average. Another approach to determining target ranking could have been based on individual participant ratings.
Table 2. Proportions of fixations to body, head, and eyes areas of interest (AOIs) for Status, Prestige, and Dominance by AQ10 group.

<table>
<thead>
<tr>
<th></th>
<th>Body Low</th>
<th>Body Medium</th>
<th>Body High</th>
<th>Head Low</th>
<th>Head Medium</th>
<th>Head High</th>
<th>Eyes Low</th>
<th>Eyes Medium</th>
<th>Eyes High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>Mean</td>
<td>0.156</td>
<td>0.292</td>
<td>0.357</td>
<td>0.065</td>
<td>0.209</td>
<td>0.243</td>
<td>0.029</td>
<td>0.065</td>
</tr>
<tr>
<td></td>
<td>Std. Error</td>
<td>0.009</td>
<td>0.011</td>
<td>0.014</td>
<td>0.006</td>
<td>0.013</td>
<td>0.015</td>
<td>0.004</td>
<td>0.007</td>
</tr>
<tr>
<td>LAQ</td>
<td>Mean</td>
<td>0.136</td>
<td>0.284</td>
<td>0.38</td>
<td>0.069</td>
<td>0.232</td>
<td>0.263</td>
<td>0.029</td>
<td>0.078</td>
</tr>
<tr>
<td></td>
<td>Std. Error</td>
<td>0.019</td>
<td>0.024</td>
<td>0.031</td>
<td>0.013</td>
<td>0.028</td>
<td>0.032</td>
<td>0.008</td>
<td>0.015</td>
</tr>
<tr>
<td>MAQ</td>
<td>Mean</td>
<td>0.187</td>
<td>0.276</td>
<td>0.342</td>
<td>0.114</td>
<td>0.203</td>
<td>0.205</td>
<td>0.042</td>
<td>0.062</td>
</tr>
<tr>
<td></td>
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<td>0.021</td>
<td>0.027</td>
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<td>0.024</td>
<td>0.028</td>
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<td>0.013</td>
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<tr>
<td>HAQ</td>
<td>Mean</td>
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<td>0.355</td>
<td>0.356</td>
<td>0.081</td>
<td>0.201</td>
<td>0.258</td>
<td>0.02</td>
<td>0.055</td>
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<tr>
<td></td>
<td>Std. Error</td>
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<td>0.016</td>
<td>0.021</td>
<td>0.009</td>
<td>0.019</td>
<td>0.022</td>
<td>0.005</td>
<td>0.01</td>
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</table>

Prestige

<table>
<thead>
<tr>
<th></th>
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<th>Body Medium</th>
<th>Body High</th>
<th>Head Low</th>
<th>Head Medium</th>
<th>Head High</th>
<th>Eyes Low</th>
<th>Eyes Medium</th>
<th>Eyes High</th>
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<tbody>
<tr>
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<td>0.317</td>
<td>0.323</td>
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<td>0.222</td>
<td>0.223</td>
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<td>0.067</td>
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<tr>
<td></td>
<td>Std. Error</td>
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<td>0.013</td>
<td>0.017</td>
<td>0.008</td>
<td>0.016</td>
<td>0.016</td>
<td>0.005</td>
<td>0.009</td>
</tr>
<tr>
<td>LAQ</td>
<td>Mean</td>
<td>0.136</td>
<td>0.333</td>
<td>0.332</td>
<td>0.089</td>
<td>0.238</td>
<td>0.256</td>
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<td></td>
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<td>0.033</td>
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<td>0.032</td>
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<tr>
<td>MAQ</td>
<td>Mean</td>
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<td>0.014</td>
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<tr>
<td>HAQ</td>
<td>Mean</td>
<td>0.152</td>
<td>0.349</td>
<td>0.296</td>
<td>0.103</td>
<td>0.226</td>
<td>0.211</td>
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<td>0.011</td>
<td>0.021</td>
<td>0.022</td>
<td>0.007</td>
<td>0.011</td>
</tr>
</tbody>
</table>

Dominance

<table>
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<tr>
<th></th>
<th>Body Low</th>
<th>Body Medium</th>
<th>Body High</th>
<th>Head Low</th>
<th>Head Medium</th>
<th>Head High</th>
<th>Eyes Low</th>
<th>Eyes Medium</th>
<th>Eyes High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>Mean</td>
<td>0.157</td>
<td>0.314</td>
<td>0.336</td>
<td>0.106</td>
<td>0.216</td>
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<tr>
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<tr>
<td>LAQ</td>
<td>Mean</td>
<td>0.136</td>
<td>0.348</td>
<td>0.317</td>
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<td>0.077</td>
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<tr>
<td></td>
<td>Std. Error</td>
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<td>0.029</td>
<td>0.021</td>
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<td>0.03</td>
<td>0.027</td>
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<td>0.016</td>
</tr>
<tr>
<td>MAQ</td>
<td>Mean</td>
<td>0.188</td>
<td>0.32</td>
<td>0.287</td>
<td>0.148</td>
<td>0.198</td>
<td>0.217</td>
<td>0.034</td>
<td>0.068</td>
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<tr>
<td></td>
<td>Std. Error</td>
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<td>0.024</td>
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<td>0.387</td>
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<td>0.202</td>
<td>0.258</td>
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<td>0.064</td>
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<tr>
<td></td>
<td>Std. Error</td>
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<td>0.019</td>
<td>0.014</td>
<td>0.011</td>
<td>0.017</td>
<td>0.019</td>
<td>0.005</td>
<td>0.011</td>
</tr>
</tbody>
</table>

A mixed model ANOVA was then performed to determine the effect of status on fixations, with AQ10 score (HAQ, MAQ, and LAQ) as a between-group factor, and target status (low, medium, and high) as a within-group factor. There was a significant effect of status on fixation proportions \(F(2, 102) = 51.75, p < .001\), such that high status individuals \(M = .36, SEM = .01\) had a higher proportion of fixations than medium status individuals \(M = .29, SEM = .01, p <\).
and medium status individuals, in turn, had a higher proportion of fixations than low status individuals \((M = 0.16, SEM = .01, p < .001)\.\) However, there was no main effect of AQ10 score \([F(2, 51) = .03, p = .974]\), and no significant interaction between AQ10 groups x target status \([F(4,102) = 1.04, p = .391]\). These results suggest that while the targets attracted distinct levels of attention (i.e., high status attracted the most, low status attracted the least), the three AQ10 groups allotted their attention to high, medium, and low status targets similarly. (See Appendix A for status results for body, head, and eyes.)

The body AOIs were then broken down further into two more AOIs, one for the head, and one for the eyes of each target, as shown in Figure 2. Similar to the body AOIs, the head and eyes AOIs were dynamic, rather than fixed, to accommodate for target movement. AOIs for the head \((M = 7.78, SD = 1.16)\) and eyes \((M = 1.33, SD = .14)\) were calculated as a percentage of the video image, and were not significantly different in size across all targets in all video clips (head, \([F(2,6) = .97, p = .431]\); eyes, \([F(2,6) = .14, p = .873]\)).

A 3 (AQ10 score) x 3 (target status) mixed model ANOVA was then performed to measure the effect of target status on fixations to targets’ heads, with AQ10 score (HAQ, MAQ, and LAQ) as a between-group factor, and target status (low, medium, and high) as a within-group factor. This analysis returned a significant main effect of status, \([F(2,102) = 45.62, p < .001]\): the head of the low status targets \((M = .10, SEM = .01)\) had a significantly lower proportion of fixations than both the medium \((M = .21, SEM = .01, p < .001)\) and high \((M = .24, SEM = .02, p < .001)\) status targets. And although the high status targets attracted numerically more fixations than medium status targets, the difference in proportion of fixations between the two was not significant \((p = .188)\). Additionally, there was no main effect of AQ10 score \([F(2, 51) = .43, p = .656]\), and no significant interaction between AQ10 scores x status, \([F(4,102) = 1.73, p = .15]\).
Together, these data suggest that the heads of low status individuals attract less attention than the heads of medium or high status targets, and that such viewing behaviour is similar across HAQ, MAQ, and LAQ individuals.

Next, a 3 x 3 mixed model ANOVA was performed with the same between (AQ10 scores) and within (status) factors as before to determine the effect of target status on fixations to the eyes. A significant difference was returned for status, \(F(2,102) = 18.87, p < .001\): low status targets (\(M = .03, SEM = .004\)) garnered a significantly lower proportion of fixations than both the medium (\(M = .07, SEM = .01, p < .001\)) and high (\(M = .08, SEM = .01, p < .001\)) status targets. While high status individuals attracted a numerically higher proportion of fixations than medium status targets, the difference between the two ranks was not significant (\(p = .189\)). There was no main effect of AQ10 score \(F(2, 51) = .75, p = .477\), and no significant interaction between AQ10 scores x targets status, \(F(4,102) = 1.34, p = .261\).

Combining the above results, the data indicate that while the status of an individual can impact the gaze behaviour of spectators, HAQ spectators will watch low, medium, and high status actors in similar fashion to MAQ and LAQ.

### 3.3 Prestige

Following status, the prestige scores of the targets were analyzed. A mixed model ANOVA was performed to determine the effect of AQ10 score on the prestige score of the targets, with AQ10 score (HAQ, MAQ, and LAQ) as a between-group factor, and targets’ prestige rating (low, medium, and high) as a within-group factor. There was no significant interaction between AQ10 score x prestige rating \(F(4,18) = 1.46, p = .256\), and no main effect of AQ10 score \(F(2, 9) = 1.08, p = .380\). However, there was a significant difference in the prestige scores of the
targets \( F(2, 18) = 25.73, p < .001 \): the low prestige target \((M = 3.47, SEM = .11)\) was rated significantly lower than the medium prestige target \((M = 4.43, SEM = .14, p = .003)\), which was rated lower than the high prestige target \((M = 4.98, SEM = .18, p = .05)\). Collectively these data suggest the three AQ10 groups rated the targets similarly in terms of their prestige.

To discover if prestige had an effect on fixations to targets, the same method for organizing the status fixation data was used for organizing the prestige fixation data (e.g., fixations made to the highest rated target for prestige were considered fixations to the “high prestige” target). Accordingly, a 3 x 3 mixed model ANOVA, with AQ10 score (HAQ, MAQ, and LAQ) as a between-group factor, and targets’ prestige rank (low, medium, and high) as a within-group factor, was then conducted to determine the effects of prestige on fixations. There was a significant effect \([F(2,102) = 33.02, p < .001]\), such that the low prestige body AOIs \((M = 0.16, SEM = 0.01)\) had a significantly lower proportion of fixations than the body AOIs of both medium prestige \((M = 0.32, SEM = 0.01, p < .001)\), and high prestige \((M = 0.32, SEM = 0.02, p < .001)\) body AOIs. However, there was no significant difference in fixation proportions between the medium and high prestige body AOIs \((p = 1.00)\). Additionally, there was no main effect of AQ10 score \([F(2, 51) = .02, p = .979]\), and no significant interaction between AQ10 scores x prestige \([F(4,102) = 2.34, p = .060]\). (See Appendix B for prestige results for body, head, and eyes.)

Next analyzed were fixation proportions to the head AOIs of each target. A 3 x 3 mixed model ANOVA with the same between and within factors as before was performed, and returned a significant effect of prestige on fixation proportions \([F(2,102) = 27.60, p < .001]\): the heads of low prestige targets \((M = .10, SEM = .01)\) garnered a significantly lower proportion of fixations than the heads of both medium prestige \((M = .222, SEM = .02, p < .001)\) and high prestige \((M = .32, SEM = .02, p < .001)\) targets.
26, $SEM = .02, p < .001$) targets. There was no significant difference in fixation proportions to the heads between the medium and high prestige targets ($p = 1.00$). Additionally, there was no main effect of AQ10 score [$F(2, 51) = .42, p = .657$], and no significant interaction between AQ10 score x targets’ prestige [$F(4,102) = .84, p = .502$].

Following the head analysis, a 3 x 3 mixed model ANOVA with the same between and within factors as before was completed to determine the effect of prestige on fixations to the eyes, and found a significant effect [$F(2,102) = 11.60, p < .001$]. Similar to the body and head results, the eyes of low prestige targets ($M = .03, SEM = .01$) garnered a significantly lower proportion of fixations than the eyes of both medium prestige ($M = .067, SEM = .01, p < .001$) and high prestige ($M = .074, SEM = .01, p = .001$) targets, but no significant difference between medium and high prestige targets ($p = 1.00$). Additionally, there was no main effect of AQ10 score [$F(2, 51) = .81, p = .451$], and no interaction between AQ10 scores x prestige rank [$F(4,102) = .68, p = .605$].

In sum, the prestige results suggest that low prestige targets attract less attention than both medium and high prestige targets, but that HAQ, MAQ, and LAQ allocate their attention to low, medium, and high prestige targets in similar fashion.

3.4 Dominance

Finally, participant gaze behaviour was examined for effects of dominance. Similar to both status and prestige, participants were asked to rate targets for their dominance during the video clips. These data were analyzed as before. There was no main effect of AQ10 score [$F(2, 9) = .474, p = .637$]. There was, however, a significant difference in target dominance ratings [$F(2,18) = 81.44, p < .001$]: the low dominance target ($M = 1.71, SEM = .12$) was rated lower
than the medium dominance target \((M = 2.94, \text{SEM} = .15, p < .001)\), which was rated lower than the high dominance target \((M = 3.65, \text{SEM} = .21, p = .005)\). There was also a significant interaction between AQ10 score x dominance rating \([F(4,18) = 2.98, p = .048]\), reflecting the fact that unlike the LAQ group, the numerical difference between medium and high dominance ratings did not reach statistical significance for MAQ and HAQ. Taken together, the data suggest the three AQ10 groups rated the targets on dominance similarly.

Using these ratings, fixation data for dominance was organized the same way (e.g., fixations made to the highest rated target for dominance were considered fixations to the “high dominance” target). A 3 x 3 mixed model ANOVA was then performed to determine if dominance had an effect on fixations to the body, with AQ10 score (HAQ, MAQ, and LAQ) as a between-group factor, and targets’ dominance rating (low, medium, and high) as a within-group factor. A significant effect of dominance on fixation proportions was returned, \([F(2,102) = 47.77, p < .001]\): the low dominance body AOIs \((M = .16, \text{SEM} = 0.01)\) garnered a significantly lower proportion of fixations than both medium dominance body \((M = 0.31, \text{SEM} = 0.01, p < .001)\) and high dominance \((M = .33, \text{SEM} = .01, p < .001)\) body AOIs. There was no significant difference between the medium and high dominance body AOIs \((p = 1.00)\). And while there was no main effect of AQ10 score \([F(2, 54) = .10, p = .903]\), there was a significant interaction between AQ10 scores x dominance, \([F(4,108) = 4.88, p = .001]\). Looking at Table 2 one sees that while all AQ groups looked at the lowest dominant individual the least, only HAQ looked at the highest dominant person the most. This was confirmed statistically, with only the proportion of HAQ fixations on the high dominance body target \((M = .39, \text{SEM} = .01)\) being significantly higher than the proportion of HAQ looks to the medium dominance target \((M = .27, \text{SEM} = .02, p < .001)\). (See Appendix C for dominance results for body, head, and eyes.)
Next, the heads of the targets were examined. A 3 x 3 mixed model ANOVA with the same between (AQ10 scores) and within factors (targets’ dominance rank) as before found a significant effect of dominance on fixations \( [F(2,102) = 29.54, p < .001] \): the head of the low dominance target \( (M = .11, SEM = .02) \) acquired a significantly lower proportion of fixations than the head of the medium \( (M = .22, SEM = .02, p < .001) \) and high \( (M = .24, SEM = .01, p < .001) \) targets, however, there was no significant difference between medium and high \( (p = .304) \). Additionally, there was no main effect of AQ10 score \( [F(2, 51) = .21, p = .811] \), and no interaction between AQ10 scores x targets’ dominance rank \( [F(4,102) = 2.35, p = .059] \).

Finally, a 3 x 3 mixed model ANOVA with the same between and within factors as before was performed to determine the effect of dominance on fixations to the eyes, and a significant effect was returned, \( [F(2,102) = 22.64, p < .001] \). Similar to findings on the body and the head, the eyes of the low dominance target \( (M = .03, SEM = .004) \) collected the lowest proportion of fixations compared to medium \( (M = .07, SEM = .01, p < .001) \) and high \( (M = .08, SEM = .01, p < .001) \) targets’ eyes. There was no significant difference between medium and high dominance eyes \( (p = .437) \). Additionally, there was no main effect of AQ10 score \( [F(2, 51) = .86, p = .430] \), and no interaction between AQ10 scores x dominance, \( [F(4,102) = .19, p = .943] \).

The total dominance results show that while targets lower in dominance drew consistently less attention in the body, head, and eyes from the three AQ10 groups, the body of high dominance targets attracted more attention from HAQ than from LAQ and MAQ.
Chapter 4: Discussion

The current study compared neurotypicals with individuals with autistic traits on two fronts: their gaze behaviour while viewing filmed social interactions during a group task, and their ability to assess peers’ social standing within a group. The video clips of this task completion, which included moments of debate, humor, interruptions, and cross talk, simulated a natural social interaction an individual would likely experience during any given day. It also presented an opportunity to examine the gaze behaviour and subsequent interpretations of these interactions by individuals with autistic traits, providing insight into how these individuals observe social interactions, and what they glean from them.

The first goal of the current study involved comparing the social observational skills of the AQ10 groups, low (LAQ; score of 1 or 2), medium (MAQ; score of 3, 4, or 5), and high (HAQ; score of 6, 7, 8, and 9), to determine if they differed in their ability to ascertain the levels of status targets had attained within their groups. I also wanted to determine if HAQ would identify which targets had taken the prestige or dominance path to attain that status. Given that previous research has found that individuals with autistic traits have difficulty with understanding non-verbal cues, such as body language, facial expressions, tone of voice, and eye contact (American Psychiatric Association, 2013; Laugeson & Ellingsen, 2014), I predicted that HAQ would not be able to accurately ascertain the perceived status of an individual within a group, or which tactics (prestige or dominance) had been utilized to attain status.

The results showed however that HAQ did not differ significantly from MAQ and LAQ in identifying which targets were considered low, medium, and high status. Also counter to my predictions, HAQ did not differ from MAQ and LAQ on the prestige and dominance ratings given to the targets. Recall that prestige on the DPPRS was probed with questions such as,
“His/her unique talents and abilities are recognized by others in the group”, and that dominance was probed with questions such as, “He/she often tries to get his/her own way regardless of what others in the group may want.” The results from the DPPRS suggest HAQ recognized both prestige-styled and dominance-style tactics, and perhaps more importantly, the impact such tactics had on the rest of the group. Because HAQ were capable of integrating and translating prestige and dominance information into an overall picture of status, such results are not consistent with Weak Central Coherence Theory (WCC; Happe, 1999; Happé & Frith, 2006), which posits that individuals with ASD have deficits in integrating pieces into a coherent whole. Additionally, HAQ understood the intentions behind a target adopting prestige-style versus dominance-style tactics, as well as the group members’ reactions to these tactics. This is not consistent with Theory of Mind (ToM; Baron-Cohen et al., 1985), which posits individuals with ASD have deficits in recognizing beliefs, desires, thoughts, and intentions in themselves and others.

These results could be due to the fact that HAQ participants attended to and understood the verbal and non-verbal reactions to the onscreen individuals, although this would be in contrast to much of the literature regarding the socials skills of autistic individuals (Fast, 2004; Gutstein & Whitney, 2002; Howlin, 2000; Humphrey & Symes, 2011; Laugeson & Ellingsen, 2014). Consideration, then, should be given to the design of the study, itself: “Think about who you would like to work with on a subsequent task”. This directive, given before watching the video clips, provided a specific reason to attend to social interactions, which may have aided HAQ more than MAQ and LAQ individuals. Specifically, whereas MAQ and LAQ may have attended to the social interactions spontaneously, it is possible that HAQ did so because of the task instruction. This interpretation would dovetail with Social Motivation Theory (SMT;
Chevallier et al., 2012) which proposes that when given an explicit instruction, individuals with autistic traits can attend to verbal and non-verbal social cues. The results thus can be reconciled with SMT; though it also begs that the present study be repeated without providing the participants with a viewing instruction.

After establishing that HAQ did not differ significantly from MAQ and LAQ in their ability to judge others’ group member status, the next goal of the current study was to compare the viewing behaviour of LAQ, MAQ, and HAQ to determine if there were differences in gaze behaviour while viewing dynamic social scenes. The data suggest that all three AQ10 groups found the targets more compelling than the backgrounds, and attended to the targets to a similar degree. Because the literature is mixed on whether adolescent and adult autistic individuals differ from NTs with respect to their tendency to attend to objects more than people (Dubey et al., 2015; Sasson et al., 2012; Unruh et al., 2016; cf. Watson et al., 2015), I made no firm predictions on this point. Looking closer, the overall findings as displayed in Table 2 were that HAQ average fixation proportions to targets’ bodies, heads, and eyes were similar to MAQ and LAQ, and statistical analyses confirmed this. This was also true regardless of the domain (status, prestige, and dominance) or rank (e.g., low, medium, and high) being probed. In other words, HAQ gaze behaviour while watching dynamic social interactions was very similar to the gaze behaviour of both MAQ and LAQ.

There was only one significant difference, and that occurred while HAQ observed the high dominance target: HAQ did look at the body significantly more than MAQ (and numerically more than LAQ). Furthermore, while the proportion of looks to the high and medium dominance body were relatively the same for both MAQ and LAQ, only HAQ looked at the high dominance body significantly more than they looked at the medium dominance body. In
other words, unlike LAQ and MAQ, for HAQ the high dominance target’s body was far more compelling than both the medium and low dominance target bodies. In terms of the Conflict-based component of the Dual Model of Social Hierarchy (Gil-White & Henrich, 2001), lower status individuals track high dominance individuals in order to monitor for incoming threatening behaviour. This would explain HAQ’s extra attention given to the body of the high dominance target, specifically when coupled with autistic individuals’ tendency to engage in less eye contact than NTs (Maestro et al., 2005; Osterling & Dawson, 1994; Osterling et al., 2002; Speer, Cook, McMahon, & Clark, 2007; Spezio, Adolphs, Hurley, & Piven, 2007; cf. Bar-Haim, Shulman, Lamy, & Reuveni, 2006), and to find direct gaze particularly threatening (Tanaka & Sung, 2016; Tottenham et al., 2014).

Regarding looks to the head and eyes, while the differences among the groups were not significant, the trend I observed was in line with my prediction that HAQ would make fewer looks than MAQ and LAQ to the eye region. Interestingly, HAQ participants had a numerically higher proportion of looks to the eyes than did MAQ for only the high status and high prestige targets. Although individuals with ASD have been shown to display elevated threat responses to faces and eyes (Hadjikhani et al., 2018; Tanaka & Sung, 2016; Tottenham et al., 2014; Trevisan, Roberts, Lin, & Birmingham, 2017), high prestige individuals do not engage in threatening tactics to attain status (Gil-White & Henrich, 2001); thus HAQ might have found it easier to look at the eyes of high status and high prestige targets.

However, once again, it could be possible that the directive to find “who you would like to work with on a subsequent task”, provided HAQ with a task that could be solved by attending to social cues. Under SMT, this directive created a specific need to ascertain which targets were leading the task (status) or having useful knowledge (prestige), and thus provided motivation to
override a natural tendency to avoid attending to the social environment. As alluded to previously, the current study’s outcome might have been different had the participants been allowed to freely view the video clips, with no thought to future hypothetical work partners. Future studies could examine if HAQ perform comparably to LAQ and MAQ when no directive is given before viewing the video clips.

One potential limitation to the present study was using the AQ10, rather than an official ASD diagnosis, to identify participants with autistic traits. However, the AQ10 has been shown to be comparable to the full-length AQ in identifying individuals with autistic traits (Allison et al., 2012; Booth et al., 2013). It has also been used in previous studies where identifying autistic trait levels was a key component of the study (Kristensen & Broome, 2015; Rhind et al., 2014; Tchanturia et al., 2013). Thus the results here suggest HAQ participants were accurately identified, and that they could attend to and properly decode social cues. Another potential limitation might be the participants, themselves. As they were all university students, one could argue that admission into university implies a higher level of functioning, and thus their performance level would be expected to mimic their neurotypical peers. Future studies should consider diversifying the sample. Another possible limitation was the sample size. Given more participants in the study, an exploration of any correlation between AQ10 scores and the peer assessment domains would have adequate statistical power. Nevertheless, to my knowledge, this is the first study to examine the ability of individuals with autistic traits to assess the group status of others; and it is the first to investigate the way that they assess others (e.g., prestige vs. dominance) in attaining that status. With a larger sample size, a future study could probe further and examine if HAQ correlate status with dominance or prestige, and whether or not that differs from MAQ or LAQ.
The current study examined the gaze behaviour of individuals with autistic traits while viewing dynamic social interactions, and their ability to assess others’ social standing within a group. The results indicate that the individuals who scored high on the AQ10, and individuals who did not, performed similarly in terms of gaze behaviour and peer assessment. In short, high autistic trait individuals are remarkably similar to neurotypicals in how and where they look during social interactions, and in how they interpret their observations. Although this was not predicted and conflicts with much of the extant research on autism, it is perhaps an indication that university-aged individuals with autistic traits have the ability to “read the room”. Whether this ability is related to age and natural development, or being given a motive for attending to social interactions, is not clear and will need to be addressed by a future investigation; but the overall findings add to knowledge that should help to inform techniques for teaching, counselling, and parenting individuals with ASD.
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Appendix A

Figure A. Status: Effects of AQ10 score and status on fixations to targets. Bars indicate means with standard error bars.
Appendix B

Figure B. Prestige: Effects of AQ10 score and prestige on fixations to targets. Bars indicate means with standard error bars.
Appendix C

Figure C. Dominance: Effects of AQ10 score and dominance on fixations to targets. Bars indicate means with standard error bars.