Young Adults' Social Interest in Complex Film Clips:
Impact of Autism Characteristics

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ABSTRACT

Deficits in social functioning in individuals with autism spectrum disorder (ASD) may be explained in part by the limited salience of or reward value associated with the social world, relative to individuals with typical development (e.g., Jones & Klin, 2008; Mundy, 1995; Mundy & Neal, 2005). However, despite many calls for the use of ecologically valid, rich, complex stimuli when investigating deficits in social attention and interest in ASD, few studies have adopted these recommendations. The current study investigated social interest in a non-clinical college student population ($n = 78$; 72% female; M age $= 20.41$ years) by analyzing participants' verbal descriptions of dynamic film clips. It was predicted that as level of self-reported ASD characteristics increased, proportions of verbal descriptions devoted to higher-level social information (e.g., relationships, mental or emotional states) would decrease, while holding self-reported social anxiety, autonomic flexibility (i.e., heart rate variability), and verbal ability constant. In other words, self-reported ASD characteristics were hypothesized to impact social interest above and beyond the effects of other predicted covariates. Results, however, did not reveal significant differences in social interest across varying levels of ASD characteristics, and neither social anxiety nor autonomic flexibility served as a moderator of this association. Variations of the current study and the inclusion of a clinical population are discussed as possible future directions to refine the study and better target intervention efforts aimed at ameliorating social deficits in ASD.

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Introduction

Autism spectrum disorder (ASD) is characterized by deficits in communication, restricted and repetitive behaviors, and wide-ranging, pervasive deficits in the area of social behavior and interaction. Some of the typical deficits in the area of social behavior and interaction include limited social-emotional reciprocity, failure to respond to social interactions, deficits in understanding relationships, and lack of interest in peers (American Psychiatric Association, 2013). Various researchers have posited that deficits in social functioning may be explained by limited salience of the social world, relative to individuals with typical development (e.g., Jones & Klin, 2008), or, similarly, by limited reward value associated with social stimuli for individuals with ASD (e.g., Mundy, 1995; Mundy & Neal, 2005). Assessing social interest is one way in which to investigate salience of social information, and may provide a window into impairments that transpire during real world social situations. For example, failing to attend to individuals' mental states or relationships with other relevant people in interactions may negatively impact one's ability to engage socially with others. Further, studies that have failed to detect a difference in social attention or interest between individuals with ASD and individuals with typical development (TD) have often employed overly simple experimental stimuli that tend to underestimate group differences (e.g., intact laboratory-based gaze following has been observed in individuals with ASD in 10 of 13 studies reviewed by Birmingham, Ristic, & Kingstone, 2012). Additional studies that have detected differences when using naturalistic paradigms, but normal gaze following in laboratory settings in individuals with ASD, suggest that the use of complex, ecologically valid stimuli when assessing social interest is essential. Thus, the current study sought to investigate social interest by using complex, dynamic film clips in individuals with varying levels of ASD characteristics.

One recent study investigated interest in social information in high-functioning adults with ASD by analyzing their verbal descriptions of emotional, static photographs (Fletcher-Watson, Leekam, & Findlay, 2013). Specifically, aspects of verbal descriptions that focused on physical attributes of the individuals in the scene or other directly observable information about individuals ("human" information) were thought to be distinct from more superior, higher-level "social" information that focused on relationships, roles, and mental or emotional states. Results did not indicate differences between individuals with ASD and those with TD in terms of the proportions of verbal descriptions that were devoted to "human" versus social information. However, Fletcher-Watson and colleagues (2013) cautioned that the use of more ecologically valid stimuli is essential to determining the true extent of impairments in ASD.

The aforementioned study attempted to build upon previous social interest research that also demonstrated few group differences between ASD and TD in verbal descriptions of images (Freeth, Ropar, Mitchell, Chapman, & Loher, 2011). Generally, both groups evidenced similar frequencies of references to mental states and gaze direction of the people in the images; however, Freeth and colleagues (2011) pointed to some evidence of reduced social saliency as demonstrated by fewer references to the person in the photograph for participants with ASD. Although Freeth and colleagues classified their experimental stimuli as "complex," their stimuli only consisted of photographs of single individuals that were asked to maintain a neutral facial expression. Thus, it is not clear from the results of this study how more complex, ecologically valid film clips would impact social salience or differential interest in "human" versus "social" information.

Contrasting Findings on Gaze Following/Avoidance in ASD

Gaze following paradigms and measuring attention directed to others' faces and eye regions are common means of studying social attention and interest in ASD. Some evidence has supported the presence of abnormal gaze behavior with regard to social stimuli in ASD (e.g., Hernandez et al., 2009; Jones, Carr, & Klin, 2008; Neumann, Spezio, Piven, & Adolphs, 2006). However, several studies have failed to detect gaze avoidance in ASD when compared to TD, across a range of ages (e.g., Freeth, Chapman, Ropar, & Mitchell, 2010; Sawyer, Williamson, & Young, 2012; van der Geest, Kemner, Camfferman, Verbaten, & van Engeland, 2002). Crucially, studies that have failed to detect a difference between ASD and TD individuals have commonly used static stimuli, as opposed to complex, dynamic stimuli.

Speer, Cook, McMahon, and Clark (2007) attempted to resolve previous discrepant findings by investigating face processing in children with ASD by using four different types of stimuli: 1) social dynamic, 2) isolated dynamic, 3) social static, and 4) isolated static. Interestingly, Speer and colleagues replicated previous research in concluding that participants with ASD only differed from TD peers for social dynamic stimuli, and not for any of the other three categories of stimuli. It is possible that the more realistic that stimuli are to real life situations, the more likely that group differences will emerge. Further extending support for this hypothesis, two studies that have demonstrated normal reflexive laboratory gaze-following in children with ASD did not demonstrate similar results when a more naturalistic paradigm was used (Chawarska, Klin, & Volkmar, 2003; Okada, Sato, Murai, Kubota, & Toichi, 2003).

As noted by Risko, Laidlaw, Freeth, Foulsham, and Kingstone (2012) in a review that investigated different types of stimuli with regard to concerns for ecological validity, "more contrived and less socially realistic stimuli may serve to mask underlying deficits and equate

performance across two groups who, in actuality, perform very differently in everyday social situations" (p. 5). Although many studies have argued for the use of more ecologically valid, complex stimuli, few studies to date have actually employed these stimuli. As such, investigations of social attention and interest in ASD demand the use of complex, dynamic stimuli in order to make accurate conclusions regarding social deficits.

One additional methodological consideration relates to research where eye tracking has failed to detect group differences between ASD and TD, while analysis of verbal descriptions in the same study has, in fact, indicated reduced social interest in ASD (Freeth et al., 2011). A benefit of analyzing verbal descriptions is that social interest can be classified at both lower (e.g., comments on the physical attributes of humans in the scene) and higher (e.g., comments on mental or emotional states of humans in the scene) levels that other methods cannot distinguish. Further, verbal reports can indicate not only what aspects of scenes are noticed and attended to, but also what is seen as relevant and important to the observer. Previous research has documented the value of using open-ended verbal descriptions as a means of assessing inferences that individuals make when attending to real-world scenes (Smilek, Birmingham, Cameron, Bischof, & Kingstone, 2006).

Additional Support for Use of Complex, Dynamic Stimuli

Birmingham and colleagues (2012) have argued that the opportunity for selection and increased complexity or ambiguity are two distinct features of real-world situations that are not present in laboratory tasks. In the real world, individuals must select from a wide range of cues and prioritize what is most salient to attend to, and also regulate when and how much to shift between stimuli. In laboratory settings, cues that are followed or attended to successfully might be ones that would typically be ignored in the real world. It may be that the critical component of

social attention in ASD is not how individuals with ASD process preselected cues, but rather "the likelihood that they will seek out and select such information in the first place" (Birmingham et al., 2012, p. 266). When given the opportunity to select which cues to attend to in a stimulating, complex environment, it seems that individuals with ASD may experience deficits in social attention due to impaired prioritization of social stimuli. This theory as related to impaired prioritization supports the use of rich, complex, dynamic stimuli to the extent possible, as proposed in the current study.

Additional support for this notion of the importance of opportunity for selection is emphasized by studies that have attempted to investigate differences in gaze patterns during live social interactions, most commonly with children. The use of wearable camera devices has made it possible to explore related questions. One recent study compared gaze strategies (representing overt social attention) in young children with ASD (3 to 11 years) and TD (2 to 6 years) in naturalistic interactions with adults during a play situation (Magrelli et al., 2014). Through the use of a wearable camera, analyses considered participants' gaze toward the face of an adult examiner by pinpointing participants' visual attention focus. Specifically, analyses differentiated between proportion, frequency, and duration of gaze, targeting times when the adult was speaking as well as times when the adult made an emotional facial expression (without speaking). Magrelli and colleagues concluded that young children with ASD spent significantly less time looking at the face of the adult than did children with TD. Additionally, children with ASD looked significantly less at adults who were speaking as compared to those who were demonstrating a facial expression. As such, this finding highlights potential differences or deficits in multimodal processing (looking at adults speaking involves both visual and auditory information, while looking at adults demonstrating a facial expression involves only visual

information). Similarly, a previous study found that children with ASD in naturalistic interactions overtly oriented less frequently to facial expressions than did children with TD, and children with ASD demonstrated slower latency of orientation to speaking faces (but not to emotional facial expressions without voice) than did children with TD (Magrelli et al., 2013).

The use of naturalistic social scenes in film clips, as in the current study, represents a lesser degree of naturalism when compared to that offered by real-life social interactions (as in Magrelli et al., 2014); however, the increase in standardization gained through the use of film clips is an important benefit, particularly in the early stages of considering questions proposed by the current study. The current study does involve multimodal processing (combined visual and auditory information), which provides a greater and more realistic level of processing demand than that of studies that have employed static photographs or silent film clips. This may be important given potential differences in multimodal processing in individuals with ASD (for review, see Marco, Hinkley, Hill, & Nagarajan, 2011). However, a direct comparison of multimodal and unimodal processing is not a focus of the current study.

Anxiety, ASD, and Social Information Processing

Co-occurring disorders or symptoms may impact the expression of social interest in individuals with ASD. Although estimates of comorbidity range widely, difficulties with anxiety frequently co-occur in children and adolescents with ASD (for review, see White, Oswald, Ollendick, & Scahill, 2009). In a clinically-referred sample of adults with ASD, anxiety also represents one of the more common comorbidities (Joshi et al., 2013). Beyond social difficulties that are inherent to ASD, co-occurring problems with anxiety may contribute to challenges related to social interaction.

Clark and McManus (2002), in a review of information processing related to social phobia, highlighted biases in the interpretation of external social events, detection of negative reactions from others, and the balance of attentional allocation between external information and the self, all of which could theoretically impact social interest in the observation of complex, dynamic social scenes. Other research has suggested that individuals with social anxiety tend to interpret ambiguous facial expressions as negative or threatening (e.g., Winton, Clark, & Edelmann, 1995; Yoon & Zinbarg, 2008). Individuals with social anxiety have also demonstrated unusual amygdala activation in response to neutral faces, relative to control participants, implicating a neural basis for the atypical processing of neutral faces (Cooney, Atlas, Joormann, Eugène, & Gotlib, 2006). Additionally, event-related potential (ERP) evidence has produced similar results with regard to interpreting ambiguous scenarios. In one study, low-anxious individuals demonstrated a positive interpretation bias, while high-anxious individuals failed to demonstrate a positive interpretation bias (Moser, Hajcak, Huppert, Foa, & Simons, 2008). Although fewer studies have specifically investigated social attribution processes in individuals with both ASD and comorbid anxiety, limited research on adolescents with ASD has indicated that comorbid symptoms may impact social perception, understanding, and experience (Meyer, Mundy, Van Hecke, & Durocher, 2006).

Despite the scant research on social interest in individuals with both ASD and anxiety, the Polyvagal Theory may be relevant to investigations of ASD and co-occurring anxiety (Porges, 2001). Evidence of general autonomic hyper-arousal (e.g., higher heart rate; lower heart rate variability) within at least a subset of individuals with ASD has been accumulating, and may be related to social difficulties (e.g., Bal et al., 2010; Klusek, Roberts, & Losh, 2015; Van Hecke et al., 2009). Heart rate variability (HRV), specifically, is a measure of the variability between

individual heartbeats and represents integrity of autonomic nervous system function. HRV is generally indicative of autonomic flexibility and reflects the influences of both the sympathetic and parasympathetic activities that drive the autonomic nervous system. In stressful times, the sympathetic nervous system dominates to create physiological arousal (and increased heart rate, an adaptive response), whereas in calmer or more stable times, the parasympathetic nervous system dominates to promote reduced physiological arousal. Parasympathetically-mediated HRV reflects vagal control of heart rate (HR) that affects these dynamic and interacting functions, and thus provides an index of a person's ability to adapt physiologically to changing situational demands, which also conveys several implications for socialization.

According to the Polyvagal Theory, higher levels of respiratory sinus arrhythmia (RSA; often used to assess HRV) are associated with more flexible, responsive, and advanced social engagement behavior (e.g., eye contact, head nodding, vocalizations) (Heilman, Bal, Bazhenova, & Porges, 2007; Patriquin, Lorenzi, & Scarpa, 2013; Patriquin, Scarpa, Friedman, & Porges, 2013), in concert with more regulated emotional responding (for reviews, see Appelhans & Luecken, 2006; Klusek et al., 2015). Relatedly, children with ASD have shown decreased RSA compared to children with TD, and RSA has been negatively associated with parent-reported symptoms of anxiety but positively associated with socialization skills (Guy, Souders, Bradstreet, DeLussey, & Herrington, 2014). Thus, individuals with lower levels of autonomic flexibility may demonstrate deficits in social interest as assessed through verbal descriptions of complex, dynamic scenes.

Several studies have linked reduced autonomic flexibility with various manifestations of anxiety, including social anxiety (Mezzacappa et al., 1997) and trait anxiety (Fuller, 1992). Although related constructs (and both involving autonomic arousal), anxiety is distinguished

from HRV whereby it is characterized as an emotional (rather than purely physiological) response that generally involves tension and/or distress (Clark & Watson, 1991). Further, the consideration of both HRV and anxiety can be informative in that it provides for both a psychophysiological and a self- or other-report measure of arousal. The differentiability of various manifestations of anxiety may serve helpful in understanding anxiety in response to specific contexts/situations (e.g., social) or more broadly (i.e., generalized). HRV (and physiological responsiveness in general) may be considered either in response to a particular stressor (e.g., physical, psychological) or more broadly, in terms of one's baseline autonomic flexibility.

In children and adolescents with ASD and a comorbid anxiety disorder, psychophysiological evidence has revealed an attenuated HR response to psychosocial stress (using an adaptation of the Trier Social Stress Test; Kirschbaum, Pirke, & Dellhammer, 1993) when compared to those without a comorbid anxiety disorder and those with TD (Hollocks, Howlin, Papadopoulos, Khondoker, & Simonoff, 2014). Additionally, within the comorbid group, higher levels of anxiety were associated with lower cardiac responsiveness to psychosocial stress, potentially indicating difficulties with managing the social-evaluative demands of the stressor, and subsequently leading to a failure to appropriately modulate physiological response (when conceptualizing increased HR as an adaptive response to the stressor). These findings warrant the consideration of anxiety when investigating psychophysiological questions related to ASD, given the unique pattern of responsiveness in the group with comorbid anxiety.

In the temperament literature, Kagan, Reznick, and Snidman (1988) have demonstrated that children with high levels of inhibition (e.g., quiet, vigilant, restrained) tend to have higher

and more stable HR (e.g., lower HRV). Further, social anxiety in adolescence has also been linked to temperamental inhibition during childhood (Schwartz, Snidman, & Kagan, 1999). Therefore, the aforementioned findings collectively suggest that measuring both social anxiety and autonomic flexibility may be useful when investigating social interest. The focus of this study, however, is on the role of ASD characteristics in social interest, above and beyond the effects of social anxiety and autonomic flexibility.

Alternative Models of Anxiety/Autonomic Flexibility, ASD, and Social Interest

Given the evidence presented that links social anxiety and autonomic flexibility to social difficulties, as well as to characteristics of ASD, it is possible that social anxiety and/or baseline autonomic flexibility may serve as mediators of the relationship between ASD characteristics and social interest. In fact, social anxiety has been demonstrated to mediate various processes in ASD such as face processing (Kleinhans et al., 2010) and self-reported hostility (White, Kreiser, Pugliese, & Scarpa, 2012). Thus, an exploration of the possibility of mediation was warranted in terms of better understanding associations between key variables in the current study. Furthermore, it is also possible that the association between ASD characters and social interest differs depending upon level of social anxiety or baseline autonomic flexibility; as such, an exploration of the possibility of moderation was also worthwhile.

<div align="center">

Statement of the Problem

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Individuals with ASD experience unique difficulties related to social behavior and interaction, which include limited social-emotional reciprocity, failure to respond to social interactions, deficits in understanding relationships, and lack of interest in peers. Further, these difficulties may also be present at the level of social information processing and prioritization of relevant stimuli. Deficits in social functioning may also be explained by limited salience of the

social stimuli, and assessing interest in dynamic scenes is one way of measuring what information observers consider to be most relevant. However, despite many calls for the use of ecologically valid, rich, complex stimuli in paradigms that investigate differences between ASD and TD, relatively few studies to date have adopted these recommendations.

Thus, the current study aimed to use complex, dynamic emotional film clips to investigate young adults' social interest, as represented by their verbal descriptions of the scenes, in relation to ASD characteristics. Additionally, the role of anxiety or hyper-arousal as it specifically relates to social interest is relatively understudied. Therefore, the proposed study sought to clarify these uncertainties by investigating associations between social interest (as reflected by young adults' verbal descriptions of complex emotional film clips), level of ASD characteristics, social anxiety, and autonomic flexibility.

Specific Aims

This study explored one primary multi-faceted aim related to the questions above: The main goal of the study was to examine differences related to interest in social information (as captured by verbal descriptions of complex, dynamic scenes) as a function of level of ASD characteristics, over and above verbal ability, baseline autonomic flexibility (as measured by HRV), and self-reported social anxiety. Further, exploratory analyses sought to examine the plausibility of autonomic flexibility and self-reported social anxiety as mediators or moderators of the association between ASD characteristics and social interest, given that sufficient conditions were met.

Primary Hypotheses

To address the primary aim of the study, there was one corresponding primary hypothesis: As level of ASD characteristics increased, proportion of verbal descriptions of film

clips devoted to "social" information would decrease, while holding verbal ability, baseline autonomic flexibility, and social anxiety constant (gender was also included as a covariate). In other words, ASD characteristics were predicted to detrimentally impact social interest even beyond the effects of gender, verbal ability, baseline autonomic flexibility, and social anxiety.

Hypotheses for the exploratory mediation analyses predicted that heightened social anxiety and reduced baseline autonomic flexibility (i.e., lower HRV) would be associated with reduced interest in complex, dynamic emotional scenes (hypothesizing that social anxiety would be negatively associated with social interest, and baseline autonomic flexibility would be positively associated with social interest), and that these mediators would partially or fully account for the relationship between level of ASD characteristics and social interest. It should be noted that this hypothesis contrasts with what was predicted in the primary hypothesis (which instead controlled for social anxiety and baseline autonomic flexibility), and thus would only be explored in the event that the primary hypothesis was not supported. Finally, hypotheses for the exploratory moderation analyses predicted that the association between ASD characteristics and social interest would be dependent upon self-reported social anxiety and/or baseline autonomic flexibility, whereby the predicted inverse relationship between level of ASD characteristics and social interest would be strongest in individuals with heightened self-reported social anxiety and/or reduced baseline autonomic flexibility (i.e., lower HRV).

Method

Participants

Participants in the primary analyses of this study included college students at Virginia Tech ($n = 78$; 72% female; M age = 20.41 years; age range = 18-36) who were recruited through flyers posted around campus and the surrounding local community, emails sent to various

departments and organizations across the university, and oral announcements in psychology courses. The study was also posted on the Department of Psychology's Sona Experiment Management System, which makes available research studies in which students may participate to earn extra credit for psychology courses, and was advertised as a study on social interest of college students. The first phase of the study involved online data collection ($n = 560$), and a subset of participants went on to complete the laboratory phase of the study ($n = 78$).

The online portion of the study consisted of completing web-based questionnaires and demographic information. Participants were required to have vision corrected to within normal limits and an English language of origin. Vision corrected to within normal limits was a requirement since the stimuli included a visual component. Instructions and stimuli were presented in English, so an English language of origin was essential to ensure that differences in responding were not due to having learned English as a second language.

The online portion of the study consisted of 560 participants (21% male) with complete data and without any exclusionary criteria (i.e., uncorrected vision problems, non-English language of origin). Of these participants, individuals were initially randomly selected (through the use of a random number generator) to receive an invitation to participate in the laboratory portion of the study. About halfway through data collection, eligible males who completed the online survey were oversampled (in terms of receiving invitations) in an attempt to increase the proportion of their representation in the laboratory portion of the study; similarly, efforts were made to enroll participants with particularly high and low scores on the measure that assessed characteristics of ASD (*Autism Spectrum Quotient*). Specific enrollment procedures are detailed in the Procedure section.

At a significance level of α = 0.05 and with a medium effect size (Cohen's f^2 = 0.15), 76 participants in a multiple regression analysis with three predictors provides a power level of 0.8. Thus, a target sample size of 76 laboratory participants was proposed for this study. Final enrollment in the laboratory portion of the study reached *n* = 78.

Measures

Demographics. A brief online questionnaire (Appendix A) gathered information on participants' demographics including gender, age, year in college, major, ethnicity, and primary language.

ASD traits. The *Autism Spectrum Quotient* (AQ; Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001) was administered to all participants in the online portion of the study. The AQ is a self-report questionnaire that assesses traits that are commonly associated with the autism spectrum in adulthood. The questionnaire includes 50 items that assess five different domains: social skill, attention switching, attention to detail, communication, and imagination. Each item is rated as *definitely agree*, *slightly agree*, *slightly disagree*, or *definitely disagree* and respondents score between 0 and 50 depending on the number of atypical or autistic-like behaviors endorsed (half the items are worded whereby a 'disagree' response is considered atypical, and half the items are worded whereby an 'agree' response is considered atypical, so as to avoid a response bias). This questionnaire took participants approximately 10 minutes to complete.

The cutoff score of 32 was not used as a basis for determining eligibility, but was used to characterize the sample by examining how many participants' scores fell in the ASD range (Baron-Cohen et al., 2001). The AQ may provide initial evidence in support of a diagnosis but is not meant to stand alone as a diagnostic tool. Additionally, in order to yield a more dimensional

index of ASD severity, a four-point scoring system can be used (Austin, 2005). In a previous

sample at the same university (*n* = 667), dimensional scoring produced a mean AQ score of

107.66 (*SD* = 14.28) and acceptable internal consistency (White, Ollendick, & Bray, 2011).

Other than when initially characterizing the sample, dimensional scoring will be used for the

remaining analyses in the current study.

Social anxiety measure. The abbreviated *Social Phobia and Anxiety Inventory* (SPAI-

23; Roberson-Nay, Strong, Nay, Beidel, & Turner, 2007) was also administered during the

online portion of the study. The SPAI-23 is a 23-item self-report questionnaire that assesses

social and agoraphobic anxiety. Respondents rate each item as how frequently they experience

anxiety in a range of specified social situations (*never*, *very infrequent*, *sometimes*, *very*

infrequent, *always*), which leads to an overall score between 0 and 92 (higher scores indicate

more anxiety). Scoring of the SPAI-23 produces subscales of Social Phobia and Agoraphobia, as

well as a Difference score that subtracts an individual's Agoraphobia score from his or her Social

Phobia score in order to produce a more "pure" measure of social anxiety (Turner, Beidel, &

Dancu, 1996). For the current study, the primary variable of interest for social anxiety was the

SPAI-23 Difference score. Previous research has demonstrated excellent internal consistency and

test-retest reliability of the SPAI-23 in studies with college students (Schry, Roberson-Nay, &

White, 2012).

Cognitive measure. The *Kaufman Brief Intelligence Test, Second Edition* (KBIT-2;

Kaufman & Kaufman, 2004) was used to assess both verbal and nonverbal intelligence of

participants who accepted the invitation to participate in the laboratory portion of the study. The

KBIT-2 also provides a composite IQ score with a mean of 100 and standard deviation of 15 and

takes approximately 15-30 minutes to complete, making it a brief though valid measure of IQ.

The KBIT-2 is acceptable for individuals between the ages of four and 90 and has good reliability (internal consistency = .93, test-retest reliability = .90) (Kaufman & Kaufman, 2004). This measure was used to determine participants' verbal intelligence, which was used as a covariate.

Caffeine/exercise questionnaire. A brief questionnaire was administered to laboratory participants to verify compliance with instructions to refrain from vigorous exercise and consumption of caffeine/nicotine products (Appendix B). This questionnaire took participants less than 5 minutes to complete.

Film viewing task. Participants observed a series of 12 brief (i.e., mean duration = 1.85 minutes) film clips during the laboratory portion of the task. Film clips portrayed complex scenes involving varying levels of emotionality and social information. Standardized clips consisted of scenes from commercially available films that have been used previously in other studies with college student participants (Gross & Levenson, 1995; Hewig et al., 2005; Jenkins & Andrewes, 2012; Rottenberg, Ray, & Gross, 2007; Schaefer, Nils, Sanchez, & Philippot, 2010; Stephens, Christie, & Friedman, 2010). Half of the film clips targeted a specific emotion (amusement, anger, disgust, fear, sadness) and are generally viewed as being high in emotionality (Gross & Levenson, 1995; Hewig et al., 2005), whereas the other half were less emotional but still involved social scenes (Hewig et al., 2005; Jenkins & Andrewes, 2012; Schaefer, Nils, Sanchez, & Philippot, 2010). See Appendix C for a list of film clips and descriptions, and primary studies from which they were derived.

After each clip was shown, participants were instructed: "Describe the film clip you just watched in as much detail as you can, and pretend that you are describing the film clip to someone outside the room." Participants' verbal responses were documented verbatim (from an

audio recording of the session), and after the completion of each verbal response, the next film clip was presented immediately. Participants who said very little for the first two film clips were encouraged by the experimenter to say more, using up to three neutral prompts (e.g., "Anything else?" "Can you say any more?"). During the task itself, there was no communication between the experimenter and the participant with the exception of the prompts described above.

HR measurement. During the laboratory portion of the study, HR data were collected using a Polar Heart Rate Monitor (Model RS800sd). This device is an ambulatory monitor that generates a continuous recording of HR. An elastic band is attached to the sensor/transmitter and is strapped around the participant's chest, while a receiver that resembles a wristwatch is worn on the participant's wrist. HR is derived from the interbeat interval (IBI) of the cardiac electric impulses detected by the sensor. Following data collection, Kubios HRV Analysis Software (Tarvainen & Niskanen, 2012) was used to prepare data for analyses. Variables of interest for the current study included HR and square root of the mean squared differences of successive heart periods (RMSSD), the latter of which represents a valid measure of parasympathetic HRV as a time-domain measure that reflects changes in IBI related to respiration (Task Force, 1996).

Procedure

Study procedures were approved in advance by Virginia Tech's Institutional Review Board (IRB; see Appendix D for approval documentation). Informed consent was presented online for participants to review prior to their completion of the online questionnaires. The experimenter then reviewed exclusionary criteria to determine whether an invitation to the laboratory portion of the study was warranted. Target laboratory enrollment aimed to reach 76 individuals; thus, every individual who completed the online portion of the study was initially designated a random probability of 1 in 5 of being invited to participate in the laboratory portion

of the study. A random number generator selected a number between 1 and 5 with 1 designated as triggering an invitation to the laboratory portion, and numbers 2 through 5 as those that did not trigger an invitation to the laboratory portion. Halfway through online data collection (~250 online participants), recruitment sought to target males and those with particularly high and low AQ scores in order to increase the representativeness of the sample. Participation in the laboratory portion of the study lasted approximately one hour. Prior to attending the laboratory session, participants were instructed to refrain from vigorous exercise for at least one hour prior to the session, and to abstain from consuming caffeine and nicotine products on the day of the session.

Participants who accepted the laboratory invitation were greeted and presented with an overview of the tasks, which included cognitive testing, baseline HR data collection, measurement of height/weight, a questionnaire on caffeine/exercise, and the film viewing task. Upon providing informed consent (see Appendix E), participants attached the Polar Heart Rate Monitor in order to begin the process of accommodating to the monitor prior to measuring baseline HR. The experimenter answered any questions prior to beginning testing, and then administered the KBIT-2 before allowing a short break.

Next, the experimenter measured baseline HR during two separate 3-minute intervals. In accordance with research supporting the use of "vanilla baseline" tasks when gathering baseline cardiovascular data (Jennings, Kamarck, Stewart, Eddy, & Johnson, 1992), participants viewed a series of low arousal, neutral valence images from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2001) during the two baseline intervals. Participants were seated in front of a computer monitor and were asked to relax while viewing the images for a period of three minutes. After only the first three-minute interval, participants were asked to

remain in a seated position, as still and quiet as possible, for a recovery period of the same duration. Then, the second 3-minute baseline period transpired, following the same procedure as listed above, with a different yet comparable set of images from the IAPS.

After the two 3-minute baseline intervals, the Polar Heart Rate Monitor was removed by participants, as it was not meant to be worn for the remainder of the study. Height and weight of participants were collected and participants completed a brief questionnaire on caffeine/exercise. Finally, the experimenter administered the film viewing task, which was audio recorded. Participants were then debriefed and thanked for participating. Participants who enrolled via the Sona Experiment Management System received one credit for participating in the online portion of the study and one additional credit for laboratory participation (as applicable); laboratory participants who enrolled independently of the Sona Experiment Management System were offered the option of entering into a raffle for a $25 gift card to a local restaurant. Early in laboratory data collection, funding from a Virginia Tech Center for Autism Research student award made available to participants an honorarium of $10 as an option for laboratory participation.

Data Reduction

To prepare data for analyses, participants' descriptions of the film clips were transcribed verbatim, and each participant generated one full script that included descriptions from all clips viewed. All scripts were divided into phrases (i.e., divided at points where the principal subject of information being imparted changed; see Appendix F for examples). Each phrase was coded as *human*, *social*, or *neither*, using a coding system described in Fletcher-Watson et al., 2013.

Briefly, "human" information was defined as "any phrase referring directly to individuals, including descriptions of their actions, posture, physical characteristics, location in

the scene, and so on" (examples: "He's very tall" and "They're holding hands") (Fletcher-Watson et al., 2013, p. 4). "Social" information was defined as "any phrase containing social information or requiring social knowledge – including descriptions of people's relationships, roles, thoughts, and emotions – and social comments about objects and the setting" (examples: "She's pretty pleased with herself," "They look like good friends," and "He's in charge") (Fletcher-Watson et al., 2013, p. 4). According to Fletcher-Watson and colleagues (2013), the ultimate distinction between human and social information "is the level of inference or extrapolation from the directly observable scene content" (p. 4). Additionally, phrases could simultaneously be designated as both human and social if the information referred directly to individuals in the scene and contained social information or knowledge (e.g., "They're in a relationship"). More specifically, phrases that were considered both human and social consisted of references to people that involved more than simply physical descriptions or descriptions of their actions, and involved a higher level of social understanding or extrapolation (e.g., emotions, thoughts, relationships). Definitions of the codes, as well as examples of coded scripts, are provided in Appendix F.

Interrater agreement (intraclass correlation) was calculated from two independent coders' ratings on 30% of transcripts for the key codes (i.e., "human" phrases, "social" phrases, "non-human"/"non-social" phrases). Following the process of coding all phrases in participants' scripts, proportion of social phrases, proportion of human phrases, and proportion of phrases that were neither social nor human were computed for each participant (i.e., number of phrases in specified category divided by total number of phrases generated by the participant). Since phrases could simultaneously be designated as human and social, it was possible that the sum of proportions for an individual participant exceeded 1.0. Intraclass correlation (ICC) for codes of

"social" phrases, "human" phrases, and "non-social"/"non-human" phrases (with "both" collapsed into "social") was moderately high (ICC for two-way random average measures = 0.8). According to guidelines set forth by Cicchetti (1994) that distinguished levels of "poor," "fair," "good," and "excellent" ICC, an ICC of 0.8 falls in the highest possible range ($< 0.75 =$ "excellent"). HR data were prepared for analyses using Kubios HRV Analysis Software (Tarvainen & Niskanen, 2008). Using this software, HRV was quantified as RMSSD, and served as a marker of autonomic flexibility. Overall baseline HRV was computed by averaging across the two 3-minute baseline periods so as to minimize the potential for error associated with short segments of time.

Results

Demographics

The majority of the sample of 78 laboratory participants was female (72%) and the sample ranged in age from 18 to 36 years, although the majority of participants' ages (96%) fell between 18 and 22 years ($M = 20.41$, $SD = 2.28$). Participants self-reported one or more ethnicities, which included Caucasian (n = 65), African-American ($n = 3$), Asian ($n = 11$), Hispanic ($n = 5$), and other ($n = 2$). With regard to year in college, over half of laboratory participants were in their first ($n = 23$; 30%) or second year ($n = 24$; 31%), with the remaining participants in their third ($n = 18$; 23%), fourth ($n = 10$; 13%), or beyond fourth ($n = 3$; 4%) year. Participants were able to endorse one or more declared or expected college majors, and the most common majors endorsed included psychology ($n = 27$), liberal arts/human sciences ($n = 19$), biological sciences ($n = 19$), and agriculture/life sciences ($n = 17$), with other endorsed majors consisting of business ($n = 6$), engineering ($n = 6$), computer science ($n = 1$), physical sciences ($n = 1$), and other ($n = 1$).

Descriptive Statistics of Key Variables

Descriptive statistics for key variables of interest (e.g., AQ score, SPAI-23 score, KBIT-2 scores, baseline HRV, proportion of social phrases) are presented in Table 1. Of the 78 participants, three (4%) had total binary AQ scores that fell at or above 32, which is generally regarded as the cutoff that warrants possible need for further diagnostic evaluation for ASD (Baron-Cohen et al., 2001). Additionally, 23 participants (29%) obtained a SPAI-23 score at or above 28, which indicates a clinical level of elevation related to social anxiety.

Inter-Correlations and Gender Differences

For the remainder of analyses, and given the overlap between AQ and SPAI-23 items, overlapping items were removed from total AQ score according to guidelines in White, Bray, and Ollendick (2012). Thus, excessive multicollinearity was avoided and total AQ score (with eight overlapping items removed) represented a construct distinct from social anxiety, as reflected uniquely by the SPAI-23.

Intercorrelations among key variables revealed no significant correlations other than between SPAI-23 and AQ total score (after overlapping items were removed); see Table 2 for more information. Further, baseline HRV was not significantly correlated with height, weight, age, or IQ scores (Full Scale, Verbal, Nonverbal).

When considering gender differences among key variables (conducted using independent samples *t*-tests), males and females differed significantly with regard to percentage of social phrases, but did not differ with regard to level of ASD characteristics, self-reported social anxiety, cognitive ability (FSIQ, Verbal, Nonverbal), or autonomic flexibility. Interestingly, where males and females differed with regard to percentage of social phrases, males produced a

significantly greater proportion of social phrases. More information on gender differences is presented in Table 2.

Given that there were no significant correlations between predicted covariates of verbal ability, baseline autonomic flexibility (i.e., baseline HRV), or self-reported social anxiety (i.e., score on SPAI-23) and either level of ASD characteristics or proportion of social phrases generated, these variables were not retained as covariates in the primary regression model. However, independent samples t-tests indicated that males and females differed with regard to proportion of social phrases generated. Thus, gender was retained as the sole covariate in the model.

Predicting Social Interest

The hypothesized relationships were investigated in a hierarchical multiple regression analysis that predicted social interest (e.g., proportion of total phrases coded as social) from level of ASD characteristics (score on AQ, without overlapping items), with gender as the sole covariate. Gender was entered in the first step, and level of ASD characteristics was entered in the second (i.e., final) step. This allowed for the determination of whether the subsequent step made a significant contribution to the proportion of variance explained. It was predicted that level of ASD characteristics would make a significant contribution to proportion of variance in social interest explained, over and above the effects of the covariate (i.e., gender). After controlling for the effect of the covariate, an inverse relationship was expected between level of ASD characteristics and proportion of social information generated.

In the hierarchical multiple regression described above, the first step (containing the covariate of gender) explained 7% of the variance in social interest (F change $= 5.34$, $p = .02$), although only gender was included in this step, $B = 5.20$, $p = .02$. The second and final step,

which added level of ASD characteristics as a predictor, overall change in variance in social interest explained was not significant, F change = 1.20, p = 0.28. Likewise, the individual predictor of level of ASD characteristics was not significant (see Table 3 for specific statistics). Overall, the second and final step contributed little in its ability to explain additional variance in social interest.

Exploratory analyses. Potential mediation analyses were also considered. Given that level of ASD characteristics was not significantly correlated with social interest (r = .16, p = .18), which is the first necessary step in establishing justification for a mediation analysis (see Baron & Kenny, 1986), the consideration of social anxiety and autonomic flexibility as mediators of this relationship was not warranted. Additionally, neither social anxiety nor autonomic flexibility was significantly correlated with social interest, further indicating that a mediation analysis was not appropriate.

Exploratory analyses also considered social anxiety and baseline autonomic flexibility as moderators of the relationship between ASD characteristics and social interest. The PROCESS Procedure for SPSS (Hayes, 2013) was used to test these effects. When including gender and verbal ability as covariates, results indicated that the interaction terms (social anxiety X ASD characteristics; autonomic flexibility X ASD characteristics) were not significant in either model (social anxiety X ASD characteristics B = 0.01, SE B = 0.01, p = .53; autonomic flexibility X ASD characteristics B < 0.01, SE B < 0.01, p = .99), and the addition of interaction terms did not produce a significant R^2 change in either model (social anxiety X ASD characteristics R^2 change < .01, F = 0.39, p = .53; autonomic flexibility X ASD characteristics R^2 change < .01, F < .01, p = .99). This suggests that the effect of social interest on ASD characteristics is not dependent upon either social anxiety or baseline HRV levels.

Of note, separate regression models testing outcomes of proportion of phrases coded as "human" and as "non-social"/"non-human," with level of ASD characteristics again the primary predictor of each, also revealed that level of ASD characteristics did not explain a significant proportion of variance (no covariates were included in these models due to lack of significant correlations with or gender differences in the outcomes). Results were similar for the model predicting proportion of phrases coded as "human," $R^2 < 0.01$, $F(1, 76) = 0.09$, $p = .76$, and for the model predicting proportion of phrases coded as "non-social"/"non-human," $R^2 = 0.01$, $F(1, 76) = 0.83$, $p = .37$. Specific predictions regarding these two additional codes were not indicated a priori, but results may provide a more full characterization of the data.

Discussion

The current study sought to use dynamic, complex film clips to investigate the association between ASD characteristics, social interest, social anxiety, and autonomic flexibility in young adults by examining college students' verbal descriptions of complex social scenes. Given that individuals with ASD experience unique difficulties related to social behavior and interaction, which may be present at the level of social information processing and prioritization of relevant stimuli, a better understanding of social interest in relation to ASD characteristics is important.

Thus, the study considered social interest through differences in the proportions of verbal descriptions of complex scenes devoted to "social" (i.e., higher level) versus "human" (i.e., lower level) information according to a system set forth by Fletcher-Watson and colleagues (2013). The stimuli employed by the current study provided an opportunity for selection (as recommended by Birmingham and colleagues, 2012), which has been absent from studies that have used static photographs or other more basic stimuli. As such, the primary goal was to

determine whether self-reported ASD characteristics contributed to level of social interest above and beyond the roles of self-reported social anxiety and autonomic flexibility. Additionally, exploratory analyses sought to determine whether social anxiety or autonomic flexibility would serve as a mediator or moderator of an association between ASD characteristics and social interest. However, results revealed few significant associations among key variables, and regression models did not provide support for the prediction that level of ASD characteristics would make a significant contribution to proportion of variance in social interest explained. Moderation analyses, likewise, did not indicate that the association between ASD characteristics and social interest was dependent upon level of social anxiety or baseline autonomic flexibility.

The preceding literature review suggests that the current study represents a worthwhile avenue of research. In studies that have failed to detect differences in social attention or processing between ASD and TD, a lack of necessity to prioritize relevant stimuli has been cited as an explanation. Further, in studies that have revealed differences in social processing between ASD and TD, reduced salience of social stimuli may be to blame. The combination of these conclusions suggests that social salience or interest should be investigated with the use of complex, dynamic, emotional stimuli that are representative of real-world social interactions. Additionally, differences with regard to social interpretation in individuals with anxiety, and deficits in social engagement in individuals with limited autonomic flexibility indicate that self-reported anxiety and level of physiological arousal should not be overlooked as potentially important covariates in related studies. However, the current study did not find support for the roles of self-reported anxiety or autonomic flexibility in predicting social interest.

Despite the overall lack of significant findings in the current study, several points of discussion persist. Although a previous study used the same coding system to characterize

participants' verbal descriptions of static photographs, and did not find differences in proportions of human versus social information as described by individuals with ASD and those with TD (Fletcher-Watson et al., 2013), differences were hypothesized in the current study due to the use of more ecologically valid stimuli. The current study presented stimuli consisting of film clips with varying degrees of emotionality and complexity of social interactions as might be encountered in the real world. Given the considerable improvement in ecological validity, but without significant findings, it is possible that the coding system did not sufficiently differentiate between degrees of social interest. Thus, in order to fully determine whether hypothesized associations may exist, other approaches to viewing and coding the data may prove fruitful. For example, a qualitative approach to analyzing the data (i.e., participants' verbal descriptions of film clips) may reveal differences not detected by the current coding system. Additionally, analyzing gaze patterns while viewing complex, dynamic stimuli may be another way of detecting subtle differences, although it should be noted that some studies have failed to find group differences in tracking data when comparing individuals with ASD to those with TD (mostly involving the use of simple or static stimuli; e.g., Freeth et al., 2010; Sawyer et al., 2012). Further, this level of analysis does not allow for a consideration of interest in "lower" versus "higher" level social information. Ultimately, however, it is possible that the predicted associations between level of ASD characteristics and social interest in complex, dynamic film clips do not exist as measured, at least not in the non-clinical population of young adults investigated in the current study.

Observed effect size (Cohen's f^2 for the hierarchical multiple regression) indicated that the addition of ASD characteristics to a model with gender predicting social interest produced a small effect of 0.02 (where "small" = 0.02, "medium" = 0.15, and "large" = 0.35; Cohen, 1988).

At this effect size, with 78 participants, and at a significance level of $\alpha = .05$, observed power for the addition of ASD characteristics was only 0.23. This effect size (0.02) was much smaller than the medium effect size that was initially predicted (0.15, which required a sample of $n = 76$ to produce a power level of 0.8), and thus the current study was underpowered to detect the smaller than anticipated effect. However, beyond simply limitations in power, the current study would also benefit from improvements to its design. A re-conceptualization of the primary outcome, social interest, would be worthwhile since the 95% confidence interval of the regression coefficient for the primary predictor (ASD characteristics) contained zero [-0.08, 0.27]; thus, from the current results, it is not clear whether the impact of ASD characteristics fell in the predicted direction.

Broadly, neither level of ASD characteristics, self-reported social anxiety, nor baseline autonomic flexibility emerged as a significant predictor of social interest as indicated by verbal descriptions generated upon viewing complex, dynamic film clips. It may be that the selected film clips did not produce sufficient variability in terms of types of phrases generated (although there was a range in proportions of different types of phrases generated across participants), or that the task did not adequately capture social differences that would be predicted by ASD characteristics, social anxiety, and autonomic flexibility. Alternatively, although the use of film clips represents an increase in complexity over studies that use static photographs or other simplistic stimuli, verbal descriptions of social scenes may not necessarily correspond with what individuals deem as most salient or relevant in real-world social interactions. Further, even if differences were detected, it does not necessarily imply that similar differences in social interest must be present in real-world social situations as well.

Findings do not provide evidence in support of impaired prioritization of relevant stimuli for individuals with higher levels of ASD characteristics. Rather, using verbal descriptions of complex scenes as a measure of social interest, individuals with both lower and higher levels of ASD characteristics appeared to similarly prioritize relevant stimuli. Verbal descriptions of scenes indicate that what an individual deems relevant or salient after viewing a complex dynamic scene is not related to level of ASD characteristics. This is somewhat of a surprising null result, given that the impaired prioritization hypothesis appears to support both studies that have found and those that have failed to find differences in social interest in individuals with ASD (depending on the complexity of the stimuli employed). However, future studies that explore social interest and attention should continue to provide an opportunity for selection in order to better reflect the degree of complexity afforded by real-world social interactions.

In order to make firm conclusions about whether the lack of significant findings holds true in a clinical population, this study would need to be repeated with a sample of individuals with an ASD diagnosis. Further, the current study sought to explore ASD characteristics and social interest in a high functioning, verbal population, so results do not necessarily generalize to individuals at relatively low levels of functioning or verbal ability. Overall, the current study seems to indicate that level of ASD characteristics in a non-clinical population does not impact whether higher-level social information is noticed or emphasized. Future research should clarify this null finding and continue to construct the body of literature investigating social differences.

It should also be noted that the current sample appeared to have been affected more by difficulties with social anxiety than by social difficulties more generally (i.e., characteristics of ASD). This is reflected by the fact that only 4% of the sample had total binary AQ scores that fell at or above the cutoff that warrants need for further evaluation (Baron-Cohen et al., 2001),

whereas 29% of the sample evidenced clinically elevated scores on the SPAI-23. Thus, it is possible that difficulties with social anxiety, which impacted nearly one third of the sample to a clinically significant degree, may have masked the effect of or made it more difficult to determine the impact of more general social difficulty. Even though self-reported anxiety was not retained in the primary analysis due to its lack of correlation with the primary outcome (i.e., proportion of social phrases generated), it remains important to be mindful of this distinctive characteristic of the sample, given its role in social perception and interpretation of facial expressions/social events (e.g., Clark & McManus, 2002; Winton, Clark, & Edelmann, 1995).

Other limitations include the limited ethnic diversity and disproportionate gender balance of the sample. Of note, males unexpectedly generated a significantly greater proportion of social phrases per script than did females; it is not clear whether this may have been due to males enjoying the film clips more, or whether some other explanation might account for this. Although efforts were made to increase gender balance and to specifically oversample high and low scorers in the online survey, the low rate of acceptance of invitations to the laboratory portion of the study limited these efforts. Additionally, though the dynamic, complex social film clips employed by the current study varied in emotionality and represented an improvement over previous static or simplistic stimuli, they are still not as naturalistic to real life as a real-world social interaction. Finally, while the self-report measure assessing characteristics of ASD has been well validated and used in many other studies with adult participants, the current study may have benefited from the addition of an other-report or observational measure of ASD characteristics in order to capture aspects of social difficulty that self-report methodology might not fully detect.

Despite these limitations, the research question remains an important one, and it remains critical to develop a better understanding of the social difficulties inherent to ASD. Difficulties related to social behavior and interaction can range from mild to debilitating but often prevent individuals with ASD from achieving their true potential. Future research should continue to investigate similar questions in an attempt to better inform intervention efforts aimed at reducing social disability, with the goal of improving quality of life for individuals on the autism spectrum.

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Table 1

Descriptive Statistics for Key Variables of Interest (*n* = 78)

Variable	*M* (*SD*)	Range
AQ Total Binary Score	18.94 (7.11)	5-39
AQ Total Continuous Score	111.17 (16.01)	74-148
SPAI-23 Difference Score	21.81 (11.21)	0-46
KBIT-2 Full-Scale IQ (*n* = 77)	107.08 (11.34)	86-130
KBIT-2 Verbal IQ	108.30 (10.28)	87-132
KBIT-2 Nonverbal IQ (*n* = 77)	103.34 (13.12)	74-130
RMSSD (ms)	42.65 (25.10)	8.48-117.86
Percentage of Social Phrases	27.35 (9.19)	11.90-55.74

Table 2

Intercorrelations Among Key Variables ($n = 78$) *and Independent Samples T-Tests for Gender Differences* ($df = 76$)

Variable	1	2	3	4	Male M (SD) ($n = 22$)	Female M (SD) ($n = 56$)	t
1. AQ Total Continuous Score (no overlapping items)	--				96.18 (13.23)	92.73 (10.82)	-1.19
2. SPAI-23 Difference Score	.43**	--			20.50 (10.72)	22.32 (11.45)	0.64
3. Verbal IQ	.15	.17	--		111.41 (10.28)[+]	107.07 (10.12)[+]	-1.70[+]
4. RMSSD (ms)	-.10	-.09	-.12	--	45.55 (25.38)	41.52 (25.12)	-0.64
5. Percentage of Social Phrases	.16	.03	-.13	-.18	31.09 (10.55)[*]	25.89 (8.25)[*]	-2.31[*]

Note. ** $p < .01$ (2-tailed). * $p < .05$ (2-tailed). + $p < .1$ (2-tailed).

Table 3

Hierarchical Multiple Regression Analysis Predicting Social Interest

	Model 1		Model 2	
Variable	*B*	*SE B*	*B*	*SE B*
Gender	5.20[*]	2.25	4.86[*]	2.27
AQ Total Continuous Score (no overlapping items)	--	--	0.10	0.09
R^2	.07		.08	
F for change in R^2	5.34[*]		1.21	

Note. [*] $p < .05$ (2-tailed).

Appendix A

Demographics Questionnaire

INSTRUCTIONS: For each item, please indicate which response best describes you.

Gender:
_____ Male
_____ Female

Age:
Please provide your age in years and months (e.g., 21 years, 1 month, if you are 21 years of age and had a birthday last month).
_____ Years
_____ Months

Class year in college:
_____ First
_____ Second
_____ Third
_____ Fourth
_____ Fifth
_____ Sixth or beyond

College major(s) (expected major(s), if not yet declared):
_____ Agriculture and life sciences (e.g., agricultural science, dairy science, horticulture, human nutrition)
_____ Architecture and urban studies (e.g., graphic design, studio art)
_____ Biological sciences (e.g., biochemistry, biology)
_____ Business, accounting, economics, finance, marketing, or hospitality
_____ Computer science
_____ Engineering (e.g., aerospace engineering, chemical engineering)
_____ Liberal arts and human sciences (e.g., history, human development, sociology, theatre)
_____ Mathematics (e.g., mathematics, statistics)
_____ Natural resources and environment (e.g., forestry, geography)
_____ Physical sciences (e.g., physics, chemistry, geology)
_____ Psychology
_____ Other (please specify: _____)

Ethnicity:
_____ Caucasian
_____ African-American
_____ Asian
_____ Hispanic
_____ Other (please specify: _____)

Language of origin (i.e., first language learned):

_____ English

_____ Spanish

_____ Chinese

_____ French

_____ Hindi, Urdu, or other Indic

_____ Other (please specify: _____)

Appendix B

Food, Exercise, and Caffeine Questionnaire

1) Have you eaten today? □ No □Yes
   1a) If yes, what have you eaten today?

   _____
   _____
   _____
   1b) If yes, what time did you last eat?

   _____

2) Have you consumed caffeinated beverages today? □ No □Yes
   2a) If yes, what caffeinated beverages did you have today?

   _____
   _____
   2b) If yes, what time did you have these beverages?

   _____

3) Have you smoked cigarettes or cigars, used snuff, or another tobacco product today?
        □ No □Yes
   3a) If yes, what tobacco product did you use?

   _____
   3b) If yes, what time did you last use the tobacco product?

   _____

4) Have you exercised today? □ No □Yes
   4a) If yes, what exercise activities did you do today?

   _____
   _____
   4b) If yes, what time did you exercise?

   _____

5) What time did you fall asleep last night? _____

6) What time did you wake up this morning? _____

Appendix C

List of Films and Previous Studies in which Clips Were Used

Specific Emotions:

Amusement – *An Officer and a Gentleman* (Tomarken et al, 1990) [a soldier reunites with lover and carries her out of a factory]

Amusement – *When Harry Met Sally* (Gross & Levenson, 1995) [man and woman converse in café]

Anger – *Bodyguard* (Gross & Levenson, 1995) [bullying scene of teenagers in urban park]

Disgust – *Pink Flamingoes* (Gross & Levenson, 1995) [person eats dog feces]

Fear – *Silence of the Lambs* (Gross & Levenson, 1995) [investigator questions dangerous murder suspect, chases him through house, and loses sight of him]

Sadness – *The Champ* (Gross & Levenson, 1995) [young boy and other individuals communicate last goodbyes before dying boxer passes away]

Less Emotional:

Hannah and Her Sisters (Hewig et al., 2005) [friends shop for clothes]

Crimes and Misdemeanors (Hewig et al., 2005) [two older men converse in garden]

All the President's Men (Jenkins & Andrewes, 2012) [two professional men converse during court proceedings]
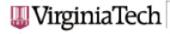
Open Water (Jenkins & Andrewes, 2012) [man packs car with luggage, makes phone calls; woman inside house also talks on phone]

Blue (Schaefer, Nils, Sanchez, & Philippot, 2010) [man clears out desk; woman arrives at and approaches house]

The Lover (Schaefer, Nils, Sanchez, & Philippot, 2010) [girl exits school, is driven to a different part of town, and walks through busy alley to knock on door]

Appendix D

IRB Approval Memorandum

VirginiaTech

MEMORANDUM

DATE:	February 2, 2015
TO:	Angela Scarpa-Friedman, Jill Lorenzi
FROM:	Virginia Tech Institutional Review Board (FWA00000572, expires April 25, 2018)
PROTOCOL TITLE:	Social Interest of College Students
IRB NUMBER:	14-002

Effective January 30, 2015, the Virginia Tech Institution Review Board (IRB) Chair, David M Moore, approved the Continuing Review request for the above-mentioned research protocol.

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

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

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

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

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

PROTOCOL INFORMATION:

Approved As:	**Expedited, under 45 CFR 46.110 category(ies) 4,6,7**
Protocol Approval Date:	**February 18, 2015**
Protocol Expiration Date:	**February 17, 2016**
Continuing Review Due Date*:	**February 3, 2016**

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

FEDERALLY FUNDED RESEARCH REQUIREMENTS:

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

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

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Appendix E

Informed Consent

INFORMED CONSENT FOR RESEARCH PROJECT
Project Title: *Social Interest of College Students*
Phase II: Laboratory Session

<u>Investigators</u>
Principal Investigator: Angela Scarpa, Ph.D., Associate Professor
Co-Investigator: Jill Lorenzi, M.S., Graduate Student
Psychology Department, Virginia Tech

<u>Purpose of the Study</u>
The purpose of this study is to better understand college students' personality characteristics in relation to how they describe emotional film clips. Additionally, information on cognitive ability, heart rate, and gaze patterns will also be collected from participants in order to better understand the relationship between personality characteristics and descriptions of film clips. You are being asked to participate in this phase of the study following your completion of the online surveys. We hope to enroll approximately 76 Virginia Tech undergraduate students in this phase of the study, all of whom must have an English language of origin and vision that is normal or corrected to within normal limits.

<u>Procedures</u>
If you choose to participate in this part of the study, you will attend an hour-long session at Williams Hall, located on Virginia Tech's campus. It is important that laboratory participants refrain from exercising, smoking, and consuming caffeine on the day of the session, as these activities interfere with the collection of heart rate data. At the session, you will first meet with a study investigator to further discuss study procedures and address any questions. If you wish to continue, you will sign the consent form before proceeding. First, the experimenter will provide instructions on how you will put on the heart rate monitor and will give you privacy in order to allow you to do so. The experimenter will measure your height and weight, and you will complete a brief questionnaire. Next, you will answer some riddles, look at pictures, and define some words to complete the cognitive testing. Your heart rate will be measured while you are in a seated position, viewing images of faces. Following this task, you will remove the heart rate monitor. For the final part of the session, you will first be provided with instructions on the film viewing portion of the study. The brief film clips will be presented on a computer monitor that records movements of your eyes while you complete the task. You will be asked to watch several short film clips, and describe each one after it is presented to you. This part of the study will be taped so that the experimenter can go back to review your responses.

<u>Risks and Benefits</u>
One possible risk is experiencing one of several negative emotions (e.g., disgust, anger) during the film viewing task. These emotions could possibly be upsetting to some people. Additionally, wearing the heart rate band might be slightly uncomfortable for a brief period of time. It may also be frustrating to be unsure of the correct answers to the riddles, picture puzzles, and word definitions. However, you will be allowed to take breaks or discontinue participation at any time. Another risk relates to confidentiality. Every effort will be made to protect your personal information, but the risk of compromised confidentiality is not completely avoidable.

There is no immediate, direct benefit of your participation in this study. No promise or guarantee of benefits has been made to encourage you to participate. However, we hope that the results of this study will inform future research and programs that benefit college students.

Costs and Payment for Participation
There is no cost to participate in this study. For payment, you have the option of receiving either a small honorarium of $10.00 or one Sona credit (granted for participation in psychology research studies) as a token of appreciation for your time. For information about how Sona credit will affect your grade and alternative ways to earn extra credit, please speak with your class instructor. Please refer to the Sona system to receive your extra credit: https://vt-psyc.sona-systems.com/. Even if you do not complete the whole session, you will still keep the $10.00 or Sona credit.

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

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

The film viewing task will be recorded for purposes of coding the data. All video files of these sessions are stored on a password protected computer in a locked laboratory. All identifying information will be destroyed within five years of data collection.

Freedom to Withdraw
It is important for you to know that you are free to withdraw from this study at any time without penalty. You are free not to answer any questions that you choose or respond to what is being asked of you without penalty.

Please note that there may be circumstances under which the investigator may determine that a subject should not continue as a subject.

Should you withdraw or otherwise discontinue participation, you will be compensated for the portion of the project completed in accordance with the Compensation section of this document.

Questions
Please feel free to ask about anything that you do not understand. Feel free to review this consent form until you are ready to make a decision about whether to participate. If you would like to speak with a member of this research team, please call Jill Lorenzi or Dr. Angela Scarpa at (540) 231-2053 or email: lorenzi@vt.edu.

Should you have any questions or concerns about the study's conduct or your rights as a research subject, or need to report a research-related injury or event, you may contact the VT IRB Chair, Dr. David M. Moore, at moored@vt.edu or (540) 231-4991 or Dr. David W. Harrison, Chair Departmental Institutional Review Board, at dwh@vt.edu or (540) 231-4422.

Subject's Responsibility
As a participant in this study, you are volunteering to participate in this study. You have the following responsibilities:
1. Ask any questions you have about the study and the consent process.
2. Complete the tasks to the best of your ability.

Subject's Consent
I have read the Consent Form and conditions of this project. I have had all my questions answered. I acknowledge the above and give my voluntary consent.

_____   _____
Subject signature   Date

_____   _____
Investigator name   Date

_____   _____
Investigator signature   Date

Appendix F

Definitions of Codes (Fletcher-Watson et al., 2013) and Examples of Coded Scripts

HUMAN = Any phrase *referring directly to individuals*, including descriptions of their <u>actions</u>, <u>posture</u>, <u>physical characteristics</u>, <u>locations in the scene</u>, etc.). Almost anything involving a personal pronoun (e.g., he, she, they) or a direct observation or quotation.
> • Oftentimes, including physical characteristics (e.g., "He's tall," "He's wearing a t-shirt"; but NOT "He looks like a professor") and actions (e.g., "He's pointing," "They're hugging," but NOT "She's thinking").

SOCIAL = Any phrase *containing social information* or *requiring social knowledge*, including descriptions of people's <u>relationships</u>, <u>roles</u>, <u>thoughts</u>, and <u>emotions</u> – and social comments about objects and setting.
> • Higher level of inference or extrapolation from directly observable scene content.
> • Oftentimes involving hypothetical comments relating to information not directly observed (e.g., "They're having a graduation," "He looks like a professor" but NOT "It's a crowd of people), comments about emotions (e.g., "She's unhappy" but NOT "She's crying"), or hypothesizing about a person's thoughts/character/role (e.g., "He's sort of thinking 'oh well, never mind'").

Human = <u>underline</u>
Social = **bold**
Both human and social = **<u>bold and underline</u>**
Neither = unformatted

This looked like a very sad movie, / maybe it's, I hope it's not the ending, / I hope it didn't end like that. / <u>The little boy,</u> / **it might have been his father** / <u>who passed away,</u> / **in a boxing match it looked like.** / I believe / <u>the little boy was calling him Jab,</u> / **so maybe he wasn't his father,** / **maybe he was just an idol that the little boy had** / **that he grew close to.** / **But it was a sad movie,** / **or a sad part.**

<u>A detective</u> / <u>walks into a house</u> / <u>and she's talking to a man</u> / **who I guess she suspects** / **as a murderer,** / <u>and then she asks to use the phone,</u> / <u>and the guy runs downstairs</u> / <u>with a gun.</u> / <u>She follows him</u> / <u>with another gun</u> / into the basement / <u>and walks into a room</u> / <u>where there's a dead body</u> / in the bathtub.

<u>So it starts with this young girl,</u> / <u>and she's in white dress</u> / <u>and almost everybody in the background is wearing white,</u> / <u>including the car driver.</u> / <u>She walks up to this very sleek buggy, cab,</u> / <u>and it's a black bug,</u> / <u>and she sits in it,</u> / <u>she promptly gets in,</u> / <u>and closes the door,</u> / <u>the driver gets in the front seat</u> / <u>and drives off from the town</u> / and it cuts to another scene / of the same bug, / driving into a different town, / **and it seems like a little city,** / <u>she gets out of the cab</u> / <u>and walks up to this door,</u> / <u>and she has what looks like a briefcase</u> / <u>in her hand,</u> / <u>and before she can knock the door opens -</u> / it's a little shutter door - / <u>and you see a figure in the background,</u> / <u>you can't really tell any emotion</u> / <u>or facial expressions</u> / <u>or exactly what the person looks like,</u> / <u>but she walks in</u> / and then it cut out.