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S.I. : ANXIETY IN AUTISM SPECTRUM DISORDERS

No Offense Intended: Fear of Negative Evaluation in Adolescents and Adults with Autism Spectrum Disorder

Nicole N. Capriola[1] · Brenna B. Maddox[1,2] · Susan W. White[1]

Abstract Social anxiety disorder (SAD) is a common comorbidity for individuals with autism spectrum disorder (ASD). The present study examined the cardinal cognitive component of SAD, fear of negative evaluation (FNE), in adolescents and adults with ASD ($n = 44$; 59 % with social anxiety) and those without ASD ($n = 69$; 49 % with social anxiety). Group (ASD or non-ASD) significantly moderated the relationship between social disability, as well as social motivation impairment, and FNE, such that there was a stronger positive relationship for the adolescents and adults without ASD. Few differences emerged between those with and without ASD, with respect to specific indicators of FNE. Clinical implications are discussed, including the importance of assessing FNE among individuals with ASD.

Keywords Autism spectrum disorder · Social anxiety · Fear of negative evaluation · Adolescents · Adults

Introduction

Social anxiety disorder (SAD) affects approximately one in 10 adolescents and adults (Kessler et al. 2012). Characterized by evaluative concerns and fear of possible scrutiny by others, SAD creates significant impairment and often contributes to avoidance of many social situations (APA 2013). In the current DSM-5 (APA 2013), relative to prior versions of the DSM, the cognitive component of SAD, often termed 'fear of negative evaluation' (FNE), has a heightened emphasis (Heimberg et al. 2014). As such, consideration of how FNE might present in individuals with pure (non-comorbid) SAD relative to those with other conditions is timely. In this study, we sought to examine FNE in adolescents and adults with and without autism spectrum disorder (ASD). SAD is often comorbid with ASD (Joshi et al. 2013; Simonoff et al. 2008). However, the cognitive domain of SAD—namely FNE, has received much less empirical study than the behavioral or physiologic domains in individuals with ASD (Tyson and Cruess 2012).

The tripartite model of SAD classifies symptoms along three dimensions: behavioral, physical, and cognitive (Clark and Wells 1995; Mesa et al. 2011). Behaviorally, individuals with SAD tend to avoid social interaction overtly (e.g., refusing invitations to attend social functions) as well as covertly (e.g., avoiding eye contact during social situations). Physical symptoms are somatic or physiological responses to the perceived threat involved with engaging socially with others, including stomachaches, increased heart rate, and blushing. Cognitive symptoms are marked by FNE, as well as fears of being rejected or humiliated, broadly defined and conceptualized as socio-evaluative fears.

Through a meta-analytic review, van Steensel et al. (2011) determined that approximately 16.6 % of youth with ASD have comorbid SAD. However, this rate may be an under-estimate of the true prevalence of SAD comorbid with ASD, due to diagnostic overshadowing. Diagnostic overshadowing can occur when socially anxious behaviors are attributed to the diagnosis of ASD and not recognized as separate SAD symptoms (Grondhuis and Aman 2012; Kreiser and White 2014). In a sample of clinically referred

✉ Nicole N. Capriola
cnicole@vt.edu

[1] Department of Psychology (0436), Child Study Center, Virginia Tech, 460 Turner St., Blacksburg, VA 24060, USA

[2] Present Address: Center for Autism Research, Children's Hospital of Philadelphia, 3535 Market Street, Suite 860, Philadelphia, PA 19104, USA

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adults, those with ASD presented with significant SAD comorbidity, with both lifetime (56 %) and current (40 %) rates being clinically elevated in comparison to the non-ASD group (Joshi et al. 2013). Similar prevalence estimates have been reported among non-referred adults with ASD. In a community sample of non-referred adults, Maddox and White (2015) found that 50 % of their sample met diagnostic criteria for SAD, suggesting that social anxiety symptoms are pervasive problems among adults with ASD. ASD and SAD share several core symptoms including social avoidance, social withdrawal, and physiological hyperarousal in social situations (Beidel and Turner 2007; Kleinhans et al. 2010; Kuusikko et al. 2008). This high degree of symptomatic overlap, along with the lack of measures specifically designed to differentiate between these two conditions, lead to difficulties with disentangling ASD and SAD. Although an atypical social anxiety syndrome (i.e., avoidance and social discomfort in the absence of FNE) in ASD has been proposed (Kerns et al. 2014), current diagnostic and treatment practices consider socio-evaluative fear a cornerstone of SAD. Herein, the cognitive component of the tripartite model of social anxiety is important to examine, as it may help us to parse the symptomatic similarities between the two disorders and inform our understanding of FNE transdiagnostically.

Theory of Mind (ToM) deficits, often associated with ASD, are characterized by difficulties in social perspective taking and understanding the mental states of others (Baron-Cohen et al. 1985; White et al. 2009). These deficits often result in marked difficulties including misinterpretations of social cues, in both naturalistic and traditional settings, and difficulties processing the intentions of others (Baron-Cohen 2008; Klin et al. 2003; Tager-Flusberg 2007). A common misconception is that individuals with ASD do not experience socio-evaluative concerns due to ToM deficits. Similar to adolescents without ASD, however, adolescents with ASD often experience heightened fear of unfavorable judgment from others (Bauminger et al. 2003; Tantam 2003; Westenberg et al. 2007; White and Schry 2011). Individuals with ASD may desire to engage socially, yet experience difficulties in social interaction, loneliness, and social isolation (Attwood 2000; White and Roberson-Nay 2009). As such, social motivation, or the lack thereof, might be difficult to disentangle from active social avoidance when in socially-threatening or socially-evaluative situations. Socio-evaluative concerns among adolescents and adults with ASD might be directly tethered to reality-based concerns and experiences stemming from their social disability (e.g., actual peer rejection and judgment because of social impairments; Bellini 2004), more so than the potential or imagined social rejection that characterizes socially anxious individuals without ASD, and these reality-based fears might affect their motivation to actively seek out social situations. In other words, fear of peers' negative evaluation, be it real or only potential, may mediate or exacerbate social amotivation and avoidance, at least for a subset of adolescents and adults with ASD. Indeed, preliminary research has shown a unique relationship between social anxiety and social deficits, specifically low assertiveness and social skills (e.g., Chang et al. 2012).

Recent research has suggested that FNE may manifest uniquely in people with ASD. White and colleagues (2015) found that self-reported FNE in adolescents with ASD predicted greater visual attention toward negatively valenced social stimuli, such as faces portraying anger and disgust. This relationship between FNE and gaze toward social threat cues was not found in the comparison sample of adolescents without ASD. Heightened visual attention among those with ASD was most prominent for faces expressing disgust, which may signal negative social evaluation (e.g., rejection, aversion; Amir et al. 2010; Yoon and Zinbarg 2007). In further support of the possibility that FNE may present uniquely within ASD, Pugliese et al. (2013) found a curvilinear relationship between socio-evaluative concerns and aggression in children with ASD, such that both low and high levels of socio-evaluative concerns were predictive of parent-reported aggression, whereas a negative linear relationship was found between socio-evaluative concerns and aggression among children with SAD and no ASD. Collectively, these findings suggest that FNE may operate differently in ASD, with respect to social attention and behavioral problems, relative to peers without ASD.

The goal of the present study was to explore the expression of FNE in the context of ASD. Specifically, we examined the relationship between socio-evaluative fears and social disability in adolescents and adults who have an ASD diagnosis in comparison to controls without ASD. We predicted that FNE would be more strongly associated with social disability for adolescents and adults with ASD, relative to the participants without ASD. In exploratory fashion, we also sought to examine how FNE might be associated with social motivation for individuals with ASD. Diminished social motivation and social anxiety are intricately linked, as they can both precipitate social avoidance. As such, difficulties arise on how to disentangle active social avoidance from social disinterest. Given the lack or prior research on social motivation specifically, however, no specific, directional hypotheses were made between the association between social motivation and socio-evaluative concerns. Furthermore, we analyzed which socio-evaluative fears were most frequently endorsed in adolescents and adults with ASD, compared to the socio-evaluative fears often seen in individuals without ASD.

Method

Procedure

Data were drawn from two completed studies, both of which examined gaze patterns in non-clinically referred individuals with and without ASD (Maddox and White 2015; White et al. 2015a). The institutional review board for human subject research approved both studies. Recruitment advertisements for Study 1 (adolescents) indicated that shy or withdrawn teenagers, typically developing teenagers, and teenagers with ASD (age 12–17) were being enrolled. Study 2 (adults) advertisements recruited older adolescents and adults with ASD, with social anxiety, and without ASD or social anxiety (age 16–45). Participants with ASD were recruited via the institution's disability office, the institution's Center for Autism Research and Autism Clinic and its research registry, a local support group for adults on the spectrum, as well as through general advertisements throughout the community. Typically developing (TD) individuals were recruited through the psychology department's child participant database and online experiment management system, university-affiliated clinics, and advertisements in the community and on campus. For both studies, recruitment also targeted individuals who were shy or socially anxious. As such, the TD group was saturated for social anxiety. In order to compensate participants for their time investment, all participants received a small honorarium or course extra credit (specific to TD participants in Study 2). Upon initial contact, potential participants or the participants' parents (specific to Study 1) completed a brief telephone screen to determine eligibility. For both studies, the screening questions asked about a current ASD diagnosis and/or intellectual disability diagnosis. Although IQ was not formally assessed in Study 1, parents of participants were asked during the telephone screener if their child had ever received a school classification or clinical diagnosis of intellectual disability or mental retardation. The screening questions for Study 2 included five items from the Social Phobia module of the Mini International Neuropsychiatric Interview (MINI; Sheehan and Lecrubier 2006). All eligible participants were emailed or mailed consent forms to review the study's procedures prior to their scheduled session. The research was approved by the institution's human research ethics committee.

All participants provided informed written consent (or assent, if under age 18) at the start of the study session. For Study 1 participants, both parent and adolescent completed questionnaires. In Study 2, the participants completed a brief clinical intake, questionnaires, the Wechsler Abbreviated Scale of Intelligence (WASI; Psychological Corporation 1999), and the SAD section of the Anxiety Disorders Interview Schedule for DSM-IV (ADIS; Brown et al. 1994). The administration of the SAD section of the ADIS was not adapted for the purposes of this study. Although we lack psychometric properties of the ADIS for adults on the spectrum, extant research has demonstrated appropriate reliability and validity for youth with ASD (Lecavalier et al. 2014). For the purposes of the current study, the ADIS was administered by clinicians who were trained in the differential diagnosis of ASD and SAD and were familiar with the important distinctions between ASD features and SAD symptoms. In order for participants to meet diagnostic criteria for SAD on the ADIS, their avoidance of social situations had to be social in nature rather than due to non-social situational aspects (i.e., social disinterest, sensory over arousal), which follows criteria outlined in past studies that distinguished core ASD impairments from SAD symptoms (Kerns et al. 2014; Leyfer et al. 2006). A research reliable clinician assessed participants in the ASD group in order to confirm ASD diagnosis, using the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2; Lord et al. 2012). Further details on the procedures of the original studies can be found in their respective publications.

Participants

For the current study, participants were between the ages of 12–45 and free of a co-occurring intellectual disability. This age range was selected based on evidence that adolescence is characterized by the development of socio-evaluative concerns (Bauminger et al. 2003; Westenberg et al. 2007; White and Schry 2011) and findings from national surveys showing that prevalence of social anxiety symptoms tapers when individuals reach their mid-forties (e.g., Blanco et al. 2011; Ruscio et al. 2008). The present study combines data from Study 1 and Study 2 adolescents ($n = 46$, age 12–17) and Study 2 adults ($n = 67$, age 18–44). The adolescent group included 26 participants with ASD (12 with parent-reported difficulties with social anxiety and 3 with self-reported social anxiety concerns per clinical interview) and 20 participants without ASD (8 with parent-reported difficulties with social anxiety and 1 with self-reported social anxiety concerns per clinical interview). The teens with parent-reported social anxiety will be referred to, for purposes of analyses, as part of the "SAD" group, even though diagnosis was not confirmed as part of Study 1. The adult group included 18 participants with ASD (11 of whom had ADIS confirmed SAD diagnoses) and 49 participants without an ASD diagnosis (25 with ADIS confirmed SAD diagnoses). In order to examine potentially unique manifestations of FNE within the context of ASD, the TD group was saturated with social anxiety to

allow for between-group comparisons of FNE. Both groups were non-treatment seeking. Demographic data from the final sample ($n = 113$) are included in Table 1.

Measures

Social Responsiveness Scale (SRS; Constantino and Gruber 2005; SRS-2; Constantino and Gruber 2012)

The SRS as well as its recent revision, the SRS-2, are 65-item measures of ASD-related social impairments including social awareness, social communication, social information processing, social motivation, and restricted interests/repetitive behaviors, with higher scores indicating greater ASD severity. For the purposes of this study, the adult participants completed self-reports of the SRS-2 (Constantino and Gruber 2012). For the adolescent participants, parent reports using the first edition of the SRS (Constantino and Gruber 2005) were used. For the current study, the SRS social communication and social motivation subscale scores were used. The SRS social communication subscale was used as an index of social disability because social communication difficulties serve as a core diagnostic criterion for ASD. Moreover, the SRS social communication subscale has been used to index change in social disability with treatment (e.g., White et al. 2015). The internal consistency of the SRS social communication subscale for the full sample reflected good internal consistency (alpha = .89). For the original SRS, Cronbach's alpha also demonstrated good internal consistency (alpha = .82). For the SRS-2, alpha was .92. For the social motivation subscale of the SRS, alpha was .74, which suggests acceptable internal consistency. The internal consistency for the social motivation subscale of the SRS-2 was good (alpha = .85). In the full sample, alpha was .81.

Brief Fear of Negative Evaluation Questionnaire (BFNE; Leary 1983)

The BFNE serves as an abridged version of the full FNE (Watson and Friend 1969), consisting of twelve items that

Table 1 Group descriptive data

	ASD ($n = 44$)		TD ($n = 69$)		Significant group differences
	Mean (SD)		Mean (SD)		
	Teens ($n = 26$)	Adults ($n = 18$)	Teens ($n = 20$)	Adults ($n = 49$)	
Age (in years)	15.59 (1.64)	24.74 (7.25)	14.62 (1.69)	25.71 (7.11)	ASD versus TD* Adults versus Teens***
Social communication[a]	75.92 (15.41)	67.00 (10.39)	45.70 (7.72)	51.51 (10.61)	ASD versus TD***
Social motivation[b]	71.42 (14.17)	66.83 (11.84)	53.00 (13.44)	58.35 (10.36)	ASD versus TD***
BFNE[c]	21.08 (7.53)	22.72 (8.91)	21.35 (8.05)	23.00 (9.35)	N/A

	n (% of group)		*n* (% of group)	
	ASD ($n = 44$)		TD ($n = 69$)	
	Teens ($n = 26$)	Adults ($n = 18$)	Teens ($n = 20$)	Adults ($n = 49$)
Social anxiety above threshold	15 (57.70)	11 (61.11)	9 (45)	25 (51.02)
Gender				
Male	14 (53.84)	10 (55.56)	11 (55.00)	24 (48.98)
Race				
Caucasian	23 (88.46)	16 (88.89)	18 (90.00)	39 (79.59)
Other (multi-racial)	2 (7.69)	1 (5.56)	0 (0.00)	1 (2.04)
African-American	1 (3.85)	0 (0)	2 (10.00)	2 (4.08)
Asian	0 (0)	1 (5.56)	0 (0.00)	4 (8.16)
Latino/Hispanic	0 (0)	0 (0)	0 (0.00)	3 (6.12)

Social Anxiety above threshold was determined by parent-reported social anxiety for Study 1 participants and ADIS confirmed social anxiety for Study 2 participants

[a] SRS Social Communication Scale T-score

[b] SRS Social Motivation T-score

[c] *BFNE* Brief Fear of Negative Evaluation Questionnaire (straightforward items) total score

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

assess worry or fear about negative evaluation from others. BFNE items are coded on a Likert scale ranging from 1 (not at all characteristic of me) to 5 (extremely characteristic of me). The BFNE correlates highly (.96) with the original FNE and has excellent internal consistency (alpha = .90; Leary 1983). Carleton et al. (2011) found that using only the eight items that have straightforward wording (i.e., not the four reverse-scored items) results in the best diagnostic sensitivity and reliability. In addition, the reverse-coded items are not uniquely tied to social avoidance or social disability. Therefore, only the eight straightforward worded items were summed for the total BFNE score in the present study. The BFNE has been used in past research to examine socio-evaluative fears in adults on the spectrum (North et al. 2008; Top et al. 2016), but not extensively, and its psychometric properties with this population have not been explored. In the present study's full sample, BFNE was assessed solely through the use of self-report (alpha = .93). Alpha was .91 for the adolescents and .94 for the adults.

Analyses

Data were analyzed with IBM SPSS Statistics Version 21. Descriptive analyses of the demographic variables and questionnaire responses were first conducted. In order to investigate whether group differences existed between the ASD and TD groups, as well as between the adolescent and adults samples, we used a series of independent samples *t*-tests (Table 1). In addition, we used a two-way ANOVA (group: ASD, TD) x (age: adolescent, adult) for the SRS social communication and social motivation subscales in order to compare adults and teens, with and without ASD (Table 1). This also allowed us to examine how differences in reporters might have impacted our results. Furthermore, we sought to examine how FNE was related to social anxiety in both the teen and adult groups with and without ASD to help clarify whether FNE reflects the presence of social anxiety across groups or rather the presence of reality-based social fears in the ASD group and social anxiety in the non-ASD group. In order to do so, we used a two-way ANOVA (group: ASD, TD) × (SAD: present, not present) for the BFNE-straightforward items.

To determine if the relationship between FNE and social disability and between FNE and social motivation varied by group, we used hierarchical multiple regression with group (TD coded as "0" and ASD coded as "1"), SRS social communication or SRS social motivation T-score, and their interaction, to predict FNE. In order to formally test for moderation, we used the PROCESS macro (Hayes 2012) within SPSS for both models. To avoid multicollinearity with the interaction terms, SRS scores were centered (Aiken et al. 1991). Based on a post hoc power analysis for a multiple regression model with three predictors ($n = 113$, $\alpha = .05$), we had sufficient power (.94) to detect a medium (Cohen's $f^2 = .15$) effect. Pearson's Chi square analyses were conducted in order to examine which BFNE items were 'rarely' versus 'frequently' endorsed by participants with ASD versus TD controls as well as between the adolescent and adult groups. Items were grouped with responses "1" and "2" being coded as not endorsing the specific item and responses "3-5" being coded as an endorsement of the item. We also calculated the mean responses for each BFNE item across the four groups (ASD vs. TD) and (adolescents vs. adults). The present analyses solely focused on the straightforward items of the BFNE.

Results

Group descriptive statistics were computed to characterize the sample (see Table 1). Skewness and kurtosis for all variables were within acceptable ranges. The ASD group (24 males) and the TD group (35 males) did not differ in gender composition, $\chi^2(1) = 1.57$, $p = .692$. Neither participant sex nor age were significantly associated with our variables of interest (SRS social communication T-score, BFNE straightforward items, SRS social motivation T-score), *ps* = .088–.959. Furthermore, we did not find reporter differences when comparing adults and teens, with and without ASD (Table 1).

Using a two-way ANOVA to examine the FNE-social anxiety relationship across our two groups (ASD, TD), we found a statistically significant main effect for the presence of SAD, $F(1, 109) = 39.60$, $p < .001$ (partial eta squared = .27). The main effect for group was not significant, $F(1, 109) = 1.13$, $p = .289$. Furthermore, the interaction effect between group and the presence of social anxiety was not statistically significant, $F(1, 109) = 1.34$, $p = .250$.

In the first step of the hierarchical multiple regression, group and the SRS social communication T-score were entered (Table 2). Significant main effects emerged for both group ($\beta = -.422, p = .001$) and social disability ($\beta = .555$, $p < .001$), such that overall social disability was positively related to FNE. These variables accounted for a significant amount of variance in FNE, $R^2 = .17$, $F(2, 110) = 11.04$, $p < .001$. These main effects should be interpreted in the context of the significant interaction between group and social disability, $\Delta R^2 = .041$, $F(1, 109) = 9.53$, $p = .020$ (Fig. 1). The simple slope for the TD group was significantly different from zero ($p < .001$), whereas the simple slope for the ASD group was not ($p = .053$).

In the second hierarchical multiple regression model, the first step included group and the social motivation T-score,

Table 2 Hierarchical regression models: predictors of fear of negative evaluation

Predictors	*B*	*SE*	*F*	*t*	R^2	Adjusted R^2	ΔR^2
Step 1			11.04***		.167	.152	
Group	−.422**	2.087		−3.553			
SRS social communication	.555***	.063		4.672			
Step 2			9.53***		.208	.186	.041
Group	−.400**	2.051		−3.424			
SRS social communication	.861***	.093		4.949			
Group × SRS social communication	−.379*	.125		−2.364			
Step 1			17.742***		.244	.230	
Group	−.296**	1.635		−3.178			
Social motivation	.553***	.553		5.933			
Step 2			14.241***		.282	.262	.038
Group	.701	7.497		1.642			
Social motivation	.754***	.078		6.076			
Group × social motivation	−1.121*	.115		−2.391			

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

which accounted for a significant amount of variance in FNE, $R^2 = .24$, $F(2, 110) = 17.74$, $p < .001$ (Table 2). Significant main effects emerged for group ($\beta = -.296$, $p = .002$) as well as social motivation ($\beta = .553$, $p < .001$), such that social motivation was positively related to FNE. These main effects should be interpreted in the context of the significant interaction between group and social motivation, $\Delta R^2 = .038$, $F(1, 109) = 5.72$, $p = .019$ (Fig. 2). Like the first model, the simple slope for the TD group was significantly different from zero ($p < .001$). In this model, however, the simple slope for the ASD group was also significantly different from zero ($p = .021$).

With respect to group differences on the BFNE (Leary 1983) items, participants with ASD differed significantly from participants without ASD on only one item: "I often worry that I will say or do the wrong thing," $\chi^2(1) = 4.7$, $p = .030$. This specific socio-evaluative fear was endorsed by 73 % of the participants with ASD, whereas 52 % of the TD group endorsed the socio-evaluative preoccupation regarding saying or doing the wrong thing. The between-group difference approached statistical significance for the item: "I am afraid that people will find fault with me," $\chi^2(1) = 3.7$, $p = .055$. Less than half (41 %) of participants with ASD endorsed this item, whereas 59 % of the participants within the TD group endorsed this fear. No additional significant group differences existed across the ASD and TD groups, nor the adolescent and adult groups. To compare the distribution of item responses between

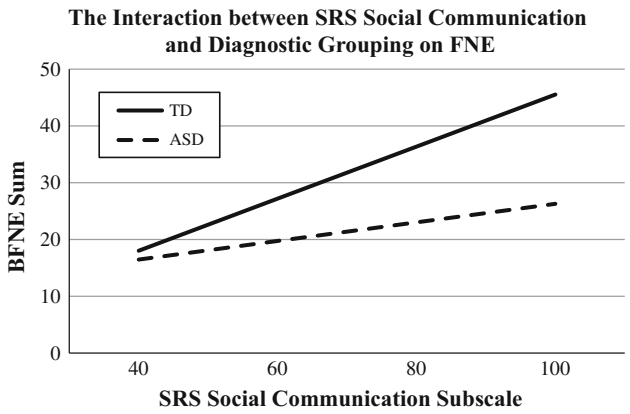

Fig. 1 The interaction between SRS social communication and diagnostic grouping on socio-evaluative concerns

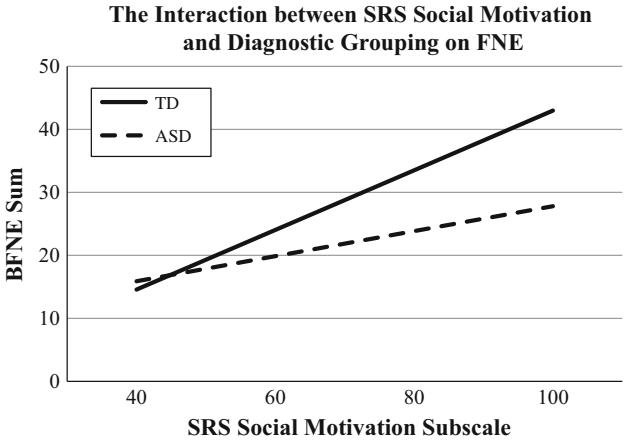

Fig. 2 The interaction between SRS social motivation and diagnostic grouping on socio-evaluative concerns

groups, we calculated the mean responses for each of the straightforward BFNE items (Table 3). The BFNE item with the highest average rating for both adolescents and adults in the ASD group reflects fear of doing or saying the wrong thing, whereas the highest average ratings for the TD group reflect concerns about what others are thinking.

Discussion

The current study sought to examine the expression of FNE in adolescents and adults with ASD. We found that group (ASD or non-ASD) moderated the relationship between social disability and FNE such that there was a stronger positive relationship for the adolescents and adults without ASD. Although the moderation was significant, it was in the unexpected direction from that which was hypothesized. This finding warrants further exploration. One possible explanation is that yet another process augments the effect of social communication difficulties on the experience of FNE.

Theory of Mind (ToM), or the ability to recognize the thoughts, feelings, and intentions of other people, is a candidate process. There is evidence that ToM deficits share little variance with ASD severity as measured by the SRS (Scheeren et al. 2013), suggesting they are separable processes. Additionally, there is variability in the presence of ToM deficits in children with ASD (Baron-Cohen et al. 1985; White et al. 2009), and evidence for diminished ToM impairment among adolescents and young adults with ASD, relative to younger children with ASD (e.g., Scheeren et al. 2013). However, ToM deficits may be present even among higher functioning adolescents and adults with ASD, relative to peers without ASD. As such, the preserved ToM likely present in the adolescents and adults without ASD in this study may have augmented the effect of ASD social disability on FNE. For example, having social and communication difficulties may be more predictive of socio-evaluative fear when one tends to deliberate on what others think about self. This is, of course, speculative as we did not assess ToM in this study. Further research to elucidate the pathways to FNE in 'pure' SAD and FNE in SAD that is comorbid with ASD is needed to better understand this finding. It is also important to consider how other core ASD impairments, such as social cognition (e.g., the ability to interpret social cues) deficits, might affect our findings. Extant research suggests that social cognition may be linked to anxiety for individuals with ASD (Mazurek and Kanne 2010; Niditch et al. 2012). For individuals on the spectrum who have greater ToM and insight into their impairments, they may be acutely aware of their social difficulties, resulting in heightened anxiety (Mazurek and Kanne 2010). However, we currently do not find consistent support for how social cognition and anxiety are associated with one another (Hollocks et al. 2014). Therefore, more research is needed to examine social

Table 3 Mean and modal BFNE responses

	Mean			
	ASD ($n = 44$)		TD ($n = 69$)	
	Teens (n = 26)	Adults (n = 18)	Teens (n = 20)	Adults (n = 49)
BFNE 1[a]	2.73	2.89	2.75	3.10
BFNE 3[b]	2.35	3.06	2.65	3.00
BFNE 5[c]	2.65	2.61	2.55	2.73
BFNE 6[d]	2.46	2.56	2.30	2.69
BFBE 8[e]	2.42	2.44	2.20	2.76
BFNE 9[f]	2.31	2.83	3.00	3.02
BFNE 11[g]	2.96	2.83	3.05	2.96
BFNE 12[h]	3.19	3.50	2.85	2.73

1 = Not at all characteristic of me; 2 = Slightly characteristic of me; 3 = Moderately characteristic of me; 4 = Very characteristic of me; 5 = Extremely characteristic of me

[a] I worry about what other people will think of me even when I know it doesn't make any difference

[b] I am frequently afraid of other people noticing my shortcomings

[c] I am afraid that others will not approve of me

[d] I am afraid that people will find fault with me

[e] When I am talking to someone, I worry about what they may be thinking about me

[f] I am usually worried about what kind of impression I make

[g] Sometimes I think I am too concerned with what other people think of me

[h] I often worry that I will say or do the wrong thing

cognition in relation to anxiety, specifically to social anxiety and its cognitive features.

We also explored potential associations between FNE and social motivation. For both the TD and ASD groups, as social motivation impairments increased, so did socio-evaluative concerns. Although decreased social motivation (higher SRS Social Motivation score) had a significant effect for both groups, the relationship between impaired social motivation and FNE was stronger for the TD participants. This may reflect, in part, the nature of the Social Motivation subscale of the SRS, which is heavily based on behaviors reflecting social avoidance, rather than intrinsic social motivation, or lack thereof, per se (e.g., Swain et al. 2015). As such, this moderation effect may suggest that the behavioral and cognitive domains of SAD (Mesa et al. 2011) hang together more tightly among adolescents and adults who do not have ASD. It is possible that there is less coherence between social avoidance and socio-evaluative fear among people with ASD because behavioral avoidance in ASD is more multi-determined (e.g., diminished intrinsic desire or social salience, experience with peer rejection).

Few differences emerged between those with and without ASD, with respect to specific indicators of FNE. Group status (ASD, TD), for instance, did not moderate the effect of presence or absence of social anxiety on FNE. However, significantly more participants with ASD endorsed one of the BFNE (Leary 1983) items, "I often worry that I will say or do the wrong thing." This item was positively endorsed by 73 % of the participants with ASD, and had the highest mean of all the scale's items for the ASD group. For adolescents and adults with ASD, socio-evaluative concerns can be directly related to reality-based experiences (e.g., being teased, bullied, or rejected by peers), given their core social impairment (Bellini 2004). Thus, concerns about saying or doing the wrong thing may reflect awareness that individuals with ASD often do struggle with navigating social situations.

The primary limitation of the present study was sample size, particularly for the comparisons between adolescents and adults across both groups. Although we had adequate power to detect a medium effect for a multiple regression model (Cohen 1992), we lacked sufficient power to detect smaller, yet potentially meaningful, effects as often represented in moderation analyses (Cohen 1992; Frazier et al. 2004). Though our primary aim was to examine socio-evaluative fear broadly, rather than SAD specifically, we lack a consistent index of social anxiety across both samples. Additionally, both the ASD and TD groups were predominantly Caucasian, which limits the ability to generalize the results across diverse races and ethnicities. There were no significant differences between the ASD and TD groups in terms of self-reported FNE, which allowed us to examine the effects of socio-evaluative concern, distinct from ASD. However, our analyses relied on parent-report of social disability for the adolescent participants and self-report for the adult participants. Although use of different reporters is common when studying mixed-age samples, we cannot definitively know that we have construct equivalence in the present sample. We were also limited by a lack of established measures of social motivation and as such we used the SRS and SRS-2, despite work by Constantino et al. (2004), which warned against using the SRS subscales as an attempt to identify underlying multifactor structures. However, we want to acknowledge that this issue is one endemic to our field because we currently lack appropriate indices to properly assess social motivation, or the lack thereof, transdiagnostically (Elias et al. 2015). Future, longitudinal research with large and well-characterized samples, perhaps from multiple sites, should explore these issues as well as the role that other processes, such as ToM, may play in the development and expression of social motivation and FNE within ASD.

Despite these limitations, to our knowledge, this study is one of the first to quantitatively assess associations between ASD, as a diagnostic category and dimensionally with respect to core social disability, and the cognitive domain of SAD. Our preliminary findings suggest that FNE is related to overall social disability and that there are both similarities and differences between adolescents and adults diagnosed with ASD and those without ASD, with respect to how FNE is manifest. Assessment of SAD in people with ASD, with recognition that FNE may manifest uniquely in ASD, is important in informing best practice guidelines for the differential or dual diagnosis of SAD and ASD.

As we await more research to better understand the processes underlying FNE in people with ASD, we suggest that social anxiety treatments for individuals with ASD should be individualized to address potentially unique processes. For example, limited social interaction can stem from social avoidance (as in SAD) or from social amotivation or disinterest (as in some cases of ASD). Likewise, FNE may be more pronounced in clients with a history of aversive social experiences and those with intact ToM. More research on the cognitive components of social anxiety in the context of ASD is needed. These findings suggest that socio-evaluative fears are related to social anxiety in ASD, but there may be subtle distinctions that warrant further investigation.

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Author Contributions NC cleaned the data, performed the statistical analysis, interpreted the data, and drafted the manuscript. BM conceived the study, participated in its design and coordination, collected the data, assisted with interpretation of the data, and revised the manuscript critically. SW participated in the design and coordination of the study, assisted with interpretation of the data, and revised the manuscript critically. All authors read and approved the final manuscript.

Compliance with Ethical Standards

Conflict of interest The authors have no conflicts of interest.

Human and Animal Rights All study procedures were approved by the institutional review board for human subject research.

Informed Consent All participants provided informed consent.

References

Aiken, L. S., West, S. G., & Reno, R. R. (1991). *Multiple regression: Testing and interpreting interactions*. Thousand Oaks, CA: Sage Publications Inc.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author.

Amir, N., Najmi, S., Bomyea, J., & Burns, M. (2010). Disgust and anger in social anxiety. *International Journal of Cognitive Therapy, 3*, 3–10. doi:10.1521/ijct.2010.3.1.3.

Attwood, T. (2000). Strategies for improving the social integration of children with asperger syndrome. *Autism, 4*(1), 85–100. doi:10.1177/1362361300004001006.

Baron-Cohen, S. (2008). *Autism and asperger syndrome*. New York, NY: Oxford University Press.

Baron-Cohen, S., Leslie, A. M., & Frith, U. (1985). Does the autistic child have a "theory of mind?". *Cognition, 21*, 37–46. doi:10.1016/0010-0277(85)90022-8.

Bauminger, N., Shulman, C., & Agam, G. (2003). Peer interaction and loneliness in high-functioning children with autism. *Journal of Autism and Developmental Disorders, 33*(5), 489–507. doi:10.1023/A:1025827427901.

Beidel, D. C., & Turner, S. M. (2007). Behavioral and cognitive-behavioral treatment of social anxiety disorder in adults. In D. C. Beidel & S. M. Turner (Eds.), *Shy children, phobic adults: Nature and treatment of social anxiety disorders* (2nd ed., pp. 201–260). Washington, DC: American Psychological Association.

Bellini, S. (2004). Social skill deficits and anxiety in high functioning adolescents with autism spectrum disorders. *Focus on Autism and Other Developmental Disabilities, 19*, 78–86. doi:10.1177/10883576040190020201.

Blanco, C., Xu, Y., Schneier, F. R., Okuda, M., Liu, S., & Heimberg, R. G. (2011). Predictors of persistence of social anxiety disorder: A national study. *Journal of Psychiatric Research, 45*, 1557–1563. doi:10.1016/j.jpsychires.2011.08.004.

Brown, T. A., DiNardo, P. A., & Barlow, D. H. (1994). *Anxiety disorders interview schedule for DSM-IV (ADIS-IV)*. New York, NY: Oxford University Press.

Carleton, R. N., Collimore, K. C., McCabe, R. E., & Antony, M. M. (2011). Addressing revisions to the Brief Fear of Negative Evaluation scale: Measuring fear of negative evaluation across anxiety and mood disorders. *Journal of Anxiety Disorders, 25*, 822–828. doi:10.1016/j.janxdis.2011.04.002.

Chang, Y. C., Quan, J., & Wood, J. J. (2012). Effects of anxiety disorder severity on social functioning in children with autism spectrum disorders. *Journal of Developmental and Physical Disabilities, 24*(3), 235–245. doi:10.1007/s10882-012-9268-2.

Clark, D. M., & Wells, A. (1995). A cognitive model of social phobia. In R. G. Heimberg, M. R. Liebowitz, D. A. Hope, & F. R. Schneier (Eds.), *Social phobia: Diagnosis, assessment, and treatment* (pp. 69–93). New York, NY: Guilford Press.

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*, 155–159. doi:10.1037/0033-2909.112.1.155.

Constantino, J. N., & Gruber, C. P. (2005). *Social responsiveness scale (SRS)*. Los Angeles, CA: Western Psychological Services.

Constantino, J. N., & Gruber, C. P. (2012). *Social responsiveness scale, second edition (SRS-2)*. Torrance, CA: Western Psychological Services.

Constantino, J. N., Gruber, C. P., Davis, S., Hayes, S., Passanante, N., & Przybeck, T. (2004). The factor structure of autistic traits. *Journal of Child Psychology and Psychiatry, 45*, 719–726. doi:10.1111/j.1469-7610.2004.00266.x.

Corporation, Psychological. (1999). *Manual for the Wechsler Abbreviated Scale of Intelligence*. San Antonio, TX: Author.

Elias, R., Capriola, N., White, S. W., & Ollendick, T. H. (2015). *Adolescents' social motivation: A comparison between autism spectrum disorder and social anxiety disorder*. Poster presented at the Association for Behavioral and Cognitive Therapies 49th Annual Convention, Chicago, IL.

Frazier, P. A., Tix, A. P., & Barron, K. E. (2004). Testing moderator and mediator effects in counseling psychology research. *Journal of Counseling Psychology, 51*(1), 115–134. doi:10.1037/0022-0167.51.2.157.

Grondhuis, S. N., & Aman, M. G. (2012). Assessment of anxiety in children and adolescents with autism spectrum disorders. *Research in Autism Spectrum Disorders, 6*, 1345–1365. doi:10.1016/j.rasd.2012.04.006.

Hayes, A. F. (2012). PROCESS: A versatile computational tool for observed variable mediation, moderation, and conditional process modeling. http://www.afhayes.com/public/process2012.pdf.

Heimberg, R. G., Hofmann, S. G., Liebowitz, M. R., Schneier, F. R., Smits, J. A. J., Stein, M. B., & Craske, M. G. (2014). Social anxiety disorder in DSM-5. *Depression and Anxiety, 31*, 472–479. doi:10.1002/da.22231.

Hollocks, M. J., Jones, C. R., Pickles, A., Baird, G., Happé, F., Charman, T., & Simonoff, E. (2014). The association between social cognition and executive functioning and symptoms of anxiety and depression in adolescents with autism spectrum disorders. *Autism Research, 7*(2), 216–228. doi:10.1002/aur.1361.

Joshi, G., Wozniak, J., Petty, C., Martelon, M. K., Fried, R., Bolfek, A., et al. (2013). Psychiatric comorbidity and functioning in a clinically referred population of adults with autism spectrum disorders: A comparative study. *Journal of Autism and Developmental Disorders, 43*, 1314–1325. doi:10.1007/s10803-012-1679-5.

Kerns, C. M., Kendall, P. C., Berry, L., Souders, M. C., Franklin, M. E., Schultz, R. T., et al. (2014). Traditional and atypical presentations of anxiety in youth with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 44*(11), 2851–2861. doi:10.1007/s10803-014-2141-7.

Kessler, R. C., Petukhova, M., Sampson, N. A., Zaslavsky, A. M., & Wittchen, H. U. (2012). Twelve-month and lifetime prevalence and lifetime morbid risk of anxiety and mood disorders in the United States. *International Journal of Methods in Psychiatric Research, 21*, 169–184. doi:10.1002/mpr.1359.

Kleinhans, N. M., Richards, T., Weaver, K., Johnson, L. C., Greenson, J., Dawson, G., & Aylward, E. (2010). Association between amygdala response to emotional faces and social anxiety in autism spectrum disorders. *Neuropsychologia, 48*, 3665–3670. doi:10.1016/j.neuropsychologia.2010.07.022.

Klin, A., Jones, W., Schultz, R., & Volkmar, F. (2003). The enactive mind, or from actions to cognition: Lessons from autism.

Philosophical Transactions of the Royal Society B, 358, 345–360. doi:10.1098/rstb.2002.1202.

Kreiser, N. L., & White, S. W. (2014). Assessment of social anxiety in children and adolescents with autism spectrum disorder. *Clinical Psychology: Science and Practice, 21*, 18–31. doi:10.1111/cpsp.12057.

Kuusikko, S., Pollock-Wurman, R., Jussila, K., Carter, A. S., Mattila, M.-L., Ebeling, H., & Moilanen, I. (2008). Social anxiety in high-functioning children and adolescents with autism and Asperger syndrome. *Journal of Autism and Developmental Disorders, 38*, 1697–1709. doi:10.1007/s10803-008-0555-9.

Leary, M. R. (1983). A brief version of the fear of negative evaluation scale. *Personality and Social Psychology Bulletin, 9*, 371–375. doi:10.1177/0146167283093007.

Lecavalier, L., Wood, J. J., Halladay, A. K., Jones, N. E., Aman, M. G., Cook, E. H., & Scahill, L. (2014). Measuring anxiety as a treatment endpoint in youth with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 44*, 1128–1143. doi:10.1007/s10803-013-1974-9.

Leyfer, O. T., Folstein, S. E., Bacalman, S., Davis, N. O., Dinh, E., Morgan, J., et al. (2006). Comorbid psychiatric disorders in children with autism: Interview development and rates of disorders. *Journal of Autism and Developmental Disorders, 36*(7), 849–861. doi:10.1007/s10803-006-0123-0.

Lord, C., Rutter, M., DiLavore, P. C., Risi, S., Gotham, K., & Bishop, S. L. (2012). *Autism diagnostic observation schedule* (2nd ed.). Torrance, CA: Western Psychological Services.

Maddox, B. B., & White, S. W. (2015). Comorbid social anxiety disorder in adults with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 45*, 3949–3960. doi:10.1007/s10803-015-2531-5.

Mazurek, M. O., & Kanne, S. M. (2010). Friendship and internalizing symptoms among children and adolescents with ASD. *Journal of Autism and Developmental Disorders, 40*(12), 1512–1520. doi:10.1007/s10803-010-1014-y.

Mesa, F., Nieves, M. M., & Beidel, D. C. (2011). Clinical presentation of social anxiety disorder in adolescents and young adults. In C. A. Alfano & D. C. Beidel (Eds.), *Social anxiety in adolescents and young adults: Translating developmental science into practice* (pp. 11–27). Washington, DC: American Psychological Association.

Niditch, L. A., Varela, R. E., Kamps, J. L., & Hill, T. (2012). Exploring the association between cognitive functioning and anxiety in children with autism spectrum disorders: the role of social understanding and aggression. *Journal of Clinical Child & Adolescent Psychology, 41*(2), 127–137. doi:10.1080/15374416.2012.651994.

North, A. S., Russell, A. J., & Gudjonsson, G. H. (2008). High functioning autism spectrum disorders: An investigation of psychological vulnerabilities during interrogative interview. *The Journal of Forensic Psychiatry & Psychology, 19*(3), 323–334. doi:10.1080/14789940701871621.

Pugliese, C. E., White, B. A., White, S. W., & Ollendick, T. H. (2013). Social anxiety predicts aggression in children with ASD: Clinical comparisons with socially anxious and oppositional youth. *Journal of Autism and Developmental Disorders, 43*, 1205–1213. doi:10.1007/s10803-012-1666-x.

Ruscio, A. M., Brown, T. A., Chiu, W. T., Sareen, J., Stein, M. B., & Kessler, R. C. (2008). Social fears and social phobia in the USA: Results from the National Comorbidity Survey Replication. *Psychological Medicine, 38*, 15–28. doi:10.1017/S0033291707001699.

Scheeren, A. M., de Rosnay, M., Koot, H. M., & Begeer, S. (2013). Rethinking theory of mind in high-functioning autism spectrum disorder. *Journal of Child Psychology and Psychiatry, 54*(6), 628–635. doi:10.1111/jcpp.12007.

Sheehan, D. V., & Lecrubier, Y. (2006). *The Mini International Neuropsychiatric Interview (M.I.N.I.) English Version 5.0.0*. http://www.nccpsychiatry.info/File/MINI500.pdf.

Simonoff, E., Pickles, A., Charman, T., Chandler, S., Loucas, T., & Baird, G. (2008). Psychiatric disorders in children with autism spectrum disorders: Prevalence, comorbidity, and associated factors in a population-derived sample. *Journal of the American Academy of Child and Adolescent Psychiatry, 47*, 921–929. doi:10.1097/CHI.0b013e318179964f.

Swain, D., Scarpa, A., White, S., & Laugeson, E. (2015). Emotion dysregulation and anxiety in adults with ASD: Does social motivation play a role? *Journal of Autism and Developmental Disorders, 45*(12), 3971–3977. doi:10.1007/s10803-015-2567-6.

Tager-Flusberg, H. (2007). Evaluating the theory-of-mind hypothesis of autism. *Current Directions in Psychological Science, 16*(6), 311–315. doi:10.1111/j.1467-8721.2007.00527.x.

Tantam, D. (2003). The challenge of adolescents and adults with Asperger syndrome. *Child and Adolescent Psychiatric Clinics of North America, 12*(1), 143–163.

Top, D. N., Stephenson, K. G., Doxey, C. R., Crowley, M. J., Kirwan, C. B., & South, M. (2016). Atypical amygdala response to fear conditioning in autism spectrum disorder. *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging*. doi:10.1016/j.bpsc.2016.01.008. **(Advance online publication)**.

Tyson, K. E., & Cruess, D. G. (2012). Differentiating high-functioning autism and social phobia. *Journal of Autism and Developmental Disorders, 42*, 1477–1490. doi:10.1016/j.rasd.2011.01.023.

van Steensel, F. J. A., Bögels, S. M., & Perrin, S. (2011). Anxiety disorders in children and adolescents with autistic spectrum disorders: A meta-analysis. *Clinical Child and Family Psychology Review, 14*, 302–317. doi:10.1007/s10567-011-0097-0.

Watson, D., & Friend, R. (1969). Measurement of social-evaluative anxiety. *Journal of Consulting and Clinical Psychology, 33*, 448–457. doi:10.1037/h0027806.

Westenberg, P. M., Gullone, E., Bokhorst, C. L., Heyne, D. A., & King, N. (2007). Social evaluation fear in childhood and adolescence: Normative developmental course and continuity of individual differences. *British Journal of Developmental Psychology, 25*, 471–483. doi:10.1348/026151006X173099.

White, S., Hill, E., Happé, F., & Frith, U. (2009). Revisiting the strange stories: Revealing mentalizing impairments in autism. *Child Development, 80*(4), 1097–1117. doi:10.1111/j.1467-8624.2009.01319.x.

White, S. W., Maddox, B. B., & Panneton, R. K. (2015a). Fear of negative evaluation influences eye gaze in adolescents with autism spectrum disorder: A pilot study. *Journal of Autism and Developmental Disorders, 45*, 3446–3457. doi:10.1007/s10803-014-2349-6.

White, S. W., & Roberson-Nay, R. (2009). Anxiety, social deficits, and loneliness in youth with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 39*, 1006–1013. doi:10.1007/s10803-009-0713-8.

White, S. W., & Schry, A. R. (2011). Social anxiety in adolescents on the autism spectrum. In C. A. Alfano & D. C. Beidel (Eds.), *Social anxiety disorder in adolescents and young adults: Translating developmental science into practice* (pp. 183–201). Washington, DC: American Psychological Association.

White, S. W., Schry, A. R., Miyazaki, Y., Ollendick, T. H., & Scahill, L. (2015b). Effects of verbal ability and severity of autism on anxiety in adolescents with ASD: One-year follow-up after cognitive behavioral therapy. *Journal of Clinical Child &*

Adolescent Psychology, 44(5), 839–845. doi:10.1080/15374416.2014.893515.

Yoon, K. L., & Zinbarg, R. E. (2007). Threat is in the eye of the beholder: Social anxiety and the interpretation of ambiguous facial expressions. *Behaviour Research and Therapy, 45*(4), 839–847. doi:10.1016/j.brat.2006.05.004.