SOCIAL FUNCTIONING AND THE PRESENTATION OF ANXIETY IN CHILDREN WITH AUTISM SPECTRUM DISORDER

by

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Abstract

Social impairment, including deficits in social ability and poorer quality peer relationships, is elevated among children with ASD and anxiety disorders, and may influence the presentation of anxiety symptoms experienced by these children, particularly social anxiety. Most research to date has investigated this topic using only single-informant, broad measures of social functioning, limiting our understanding of how different aspects of social functioning relate to one another and to anxiety in this population. The current study sought to extend prior work by using a novel network analytic approach to examine how different facets of social ability (e.g., social communication, social motivation) and peer relationships (e.g., friendships, bullying) relate to one another and to anxiety severity and comorbidity in a large treatment-seeking sample of children with ASD and anxiety disorders. Additionally, this study sought to clarify the role of social functioning in the presentation of social and non-social anxiety symptoms in children with ASD. A sample of 200 children with ASD and anxiety disorders and their caregivers completed a clinical interview and a multi-informant battery of standard and clinically-informed measures of social functioning. The network analysis demonstrated strong connections among the core social deficits of ASD (i.e., social motivation, social communication), and among measures of social integration (i.e., conflict with peers, bullying), though there was little overlap between these two communities. Theory of Mind (ToM), or the ability to understand the thoughts and feelings of others, was positively associated with nearly every measure of social ability and peer relationships in the network, suggesting that this social-cognitive skill may play a central role in the social well-being of children with ASD and comorbid anxiety. ToM also appeared to play a role in the presentation of anxiety symptoms, whereby greater ToM impairment was associated with a distinct presentation of social anxiety.
(i.e., social fears without fear of negative evaluation). Findings suggest that difficulties in one area of social ability or peer relationships may be associated with difficulties in other, related areas of social functioning—particularly ToM, which may represent an optimal target for psychosocial treatments for children with ASD and anxiety disorders.
Lay Summary

Social problems are elevated among children with ASD and anxiety disorders and may influence the focus of fears experienced by these children, particularly fears related to social situations. The current study sought to understand how different facets of social ability (e.g., social communication skills, perspective-taking) and social relationships (e.g., friendships, bullying) relate to one another, and how they might influence the focus of anxiety symptoms, among a sample of children with ASD and anxiety disorders. Findings suggest that perspective taking, or the ability to understand others’ thoughts and feelings, is related to a range of social skills and the overall quality of peer relationships, and may be associated with a unique presentation of social anxiety. Thus, perspective taking may represent an optimal target for psychosocial treatments for children with ASD and anxiety disorders.
Preface

This thesis is submitted in partial fulfillment of the requirements for Master of Arts in Psychology at the University of British Columbia. My research supervisor is Dr. Connor Kerns, who is the principal investigator of the Autism Stress & Anxiety Program at the University of British Columbia. This thesis is original, unpublished work based on data collected for a multi-site treatment trial, for which Dr. Kerns is a principal investigator (the Treatment of Anxiety in Autism Spectrum Disorders trial) [Kerns, C. M., Wood, J. J., Kendall, P. C., Renno, P., Crawford, E. A., Mercado, R. J., ... Storch, E. A. (2016). The Treatment of Anxiety in Autism Spectrum Disorder (TAASD) study: Rationale, design and methods. Journal of Child and Family Studies, 25(6), 1889-1902. https://doi.org/10.1007/s10826-016-0372-2]. The identification of research questions, the writing of the thesis, and the data analysis has been made solely by the author. Dr. Kerns acted as project supervisor and assisted with study design and interpretation of the data. The project reported in this thesis was approved by the Behavioural Research Ethics Board of the University of British Columbia (approval certificate number: H19-03011).
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Chapter One: Introduction

Autism Spectrum Disorder (ASD) is a neurobiological condition characterized by difficulties in social communication and interaction, restricted interests and repetitive behaviours (American Psychiatric Association, 2013). Individuals with ASD tend to experience widespread impairment in social functioning, a broad construct encapsulating distinct but related social skills and experiences. In particular, individuals with ASD demonstrate difficulties with social ability (e.g., understanding social cues, social reciprocity, perspective-taking) (Carter, Davis, Klin, & Volkmar, 2005; Kimhi, 2014; Magiati, Tay, & Howlin, 2014), which often leads to difficulties with peer relationships (e.g., difficulty developing and maintaining friendships, social exclusion, bullying) (Berenguer, Miranda, Colomer, Baixauli, & Roselló, 2018; Rowley et al., 2012; Schroeder, Cappadocia, & Weiss, 2014). Social functioning is particularly impacted in individuals with ASD and co-occurring anxiety disorders, which occur at higher rates in ASD (approximately 40%; Simonoff et al., 2008) compared to the general population (approximately 30%; Merikangas et al., 2010) and compared to individuals with other cognitive and social challenges (e.g., Down syndrome) (Evans, Canavera, Kleinpeter, Maccubbin, & Taga, 2005; Gillot, Furniss, & Walter, 2001; Green, Gilchrist, Burton, & Cox, 2000). In addition to poorer overall physical and mental health outcomes (Ahmedani & Hock, 2012; Chang, Quan, & Wood, 2012; Kerns et al., 2015; White & Roberson-Nay, 2009), individuals with ASD and co-occurring anxiety disorders demonstrate poorer social communication skills and report poorer peer and family relationships than youth with ASD alone (Chang et al., 2012; Kerns et al., 2015; Spain, Sin, Linder, McMahon, & Happé, 2018). However, prior work has examined the association between anxiety and social functioning in ASD in a piecemeal manner. Most studies have examined 1-2 broad measures of social functioning, which limits the ability to understand how
specific social skills might be affected in this population, or how difficulties in one area of social functioning might be related to difficulties in another (e.g., if poor social communication skills might increase risk of bullying or difficulty making friends). A careful examination of the associations among multiple specific measures of social functioning is needed to clarify the pattern of social difficulties in children with ASD and anxiety, as well as to identify whether any specific forms of social functioning might drive difficulties in a number of other areas of social functioning, potentially highlighting important targets for intervention.

**Peer Relationships & Anxiety in ASD**

Though studies are relatively few, evidence suggests that greater anxiety severity is related to fewer and poorer quality friendships and greater risk of negative social experiences (e.g., peer victimization, social exclusion) in those with ASD. As in anxious individuals without ASD (Brumariu, Obsuth, & Lyons-Ruth, 2012; Erath, Flanagan, & Bierman, 2007; Forbes, Fitzpatrick, Magson, & Rapee, 2019), greater anxiety severity among youth with ASD is associated with less support and intimacy in peer relationships, poorer peer acceptance, and greater risk of peer victimization and rejection (Chou et al., 2020; Eussen et al., 2013; Hu et al., 2019; Inderbitzen, Walters, & Bukowski, 1997; La Greca & Lopez, 1998; Mazurek & Kanne, 2010; Ung et al., 2014; Wright & Wachs, 2019). For example, a study involving children with ASD (n = 134, 6–13 years), 43% of whom had clinical anxiety, reported that parent-reported quality of peer relationships (i.e., social support, number of friendships, peer acceptance or rejection) was negatively associated with parent-reported anxiety severity (Eussen et al., 2013). Bullying experiences in the high school years may also be associated with anxiety symptoms in later adolescence among youth with ASD (van Schalkwyk, Smith, Silverman, & Volkmar, 2018). A retrospective study involving youth with ASD in the transition to college (n = 35, M_{Age}}
found that parent report of bullying experiences during the high school years was strongly correlated with self- and parent-reported social anxiety symptoms in early adulthood (van Schalkwyk et al., 2018). However, these studies rely primarily on single informant measures of anxiety and peer relationships, which raises concerns regarding whether this association might be better explained by the response style of the reporter than a truly strong link between anxiety and poor peer relationships (as reported in prior work investigating single- vs. multi-informant assessment of psychosocial outcomes in children; Collishaw, Goodman, Ford, Rabe-Hesketh, & Pickles, 2009; De Los Reyes & Kazdin, 2005). Additionally, though bullying experiences have been linked to poorer friendship quality (Schroeder et al., 2014) and poorer social skills (Cappadocia, Weiss, & Pepler, 2012; Sterzing, Shattuck, Narendorf, Wagner, & Cooper, 2012) among youth with ASD without anxiety, this has not yet been investigated in youth with ASD and anxiety disorders. As such, our understanding of the interactions among different areas of social difficulty in this population remains limited.

**Social Ability & Anxiety in ASD**

Cross-sectional and longitudinal evidence also suggests that anxiety may be related to greater impairment in social ability (i.e., social skills necessary for successful social interaction and relationships) in youth with ASD, though findings are more mixed. The core social communication deficits associated with ASD—such as social reciprocity (i.e., awareness and appropriate responsiveness to socioemotional cues) and social motivation (i.e., interest and engagement in social interactions and relationships)—may be particularly impacted by anxiety (Ginsburg, La Greca, & Silverman, 1998; Johnston & Iarocci, 2017; McVey et al., 2018; Rao et al., 2007; White & Roberson-Nay, 2009). For example, a recent study involving youth with ASD ($n = 113$, 11-16 years) found that youth with clinically-elevated anxiety demonstrated...
significantly higher parent-reported ASD-related social impairment (per the Social Responsiveness Scale-2nd Edition [SRS-2]; Constantino & Gruber, 2005) than youth with ASD alone (McVey et al., 2018). Anxiety symptoms in early childhood may also predict social communication difficulties in middle childhood: In a recent two-year longitudinal study involving children with ASD (n = 79), parent-reported anxiety symptoms at age 6.5 predicted parent-reported social communication difficulties at age 8.5 (Duvekot, der Ende, Verhulst, & Greaves-Lord, 2018). Evidence for the link between social ability and anxiety in ASD can also be found in the treatment literature: Several trials of social skills intervention programs have demonstrated secondary improvement in anxiety symptoms, even though anxiety is not explicitly targeted in these interventions (Ke, Whalon, & Yun, 2018; Laugeson, Ellingsen, Sanderson, Tucci, & Bates, 2014; McVey et al., 2016; Schohl et al., 2014; Spain & Blainey, 2015).

However, contrary findings have also emerged, indicating that the link between anxiety and social ability in this population may be complex. In a study involving adolescents with ASD (n = 126, 9.5–13 years), a network analysis of items on a standard parent- and child-report questionnaire of anxiety symptoms and an observational measure of autism-related social communication deficits (i.e., the Autism Diagnostic Observation Schedule-2nd Edition [ADOS-2]; Lord et al., 2012) found that anxiety symptoms and social communication skills formed distinct subnetworks, indicating strong independent associations within symptom domains, and weak or absent associations across symptom domains (Montazeri, de Bildt, Dekker, & Anderson, 2019). In other words, clinically-observed social communication skills were not significantly linked to parent- and child-reported anxiety symptoms in adolescents with ASD. In another study involving children with ASD with and without anxiety disorders (n = 59, 7–17 years), clinical ratings of anxiety severity were not significantly associated with parent-reported social
assertiveness or ASD-related social impairment (Kerns et al., 2015). However, a study involving children with ASD with clinical anxiety \((n = 53, 7–11 \text{ years})\) that assessed a range of anxiety disorders via clinical interview found that only social anxiety was associated with poorer parent-reported social skills, perhaps explaining some of the inconsistencies reported here (Chang et al., 2012). A commonality among these studies is the use of multi-informant assessment strategies, which may provide a more objective account of a child’s social ability (De Los Reyes & Kazdin, 2005; McConnell & Odom, 1999). By contrast, most studies that report an association between social ability and anxiety in ASD primarily rely on self- or parent-report measures, which are often discrepant and may not fully represent a child’s social ability across different contexts (Collishaw et al., 2009; Moskowitz, Rosen, Lerner, & Revine, 2017; De Los Reyes et al., 2015; De Los Reyes & Kazdin, 2005). Additionally, most of these studies primarily involve single, broad measures of social ability rather than specific social skills (e.g., assertiveness, social reciprocity), which may be differentially related to anxiety severity and to one another (e.g., poor social communication skills may be associated with poor social reciprocity, but not low social motivation). As such, further research incorporating the perspective of multiple informants and targeted measures of specific social skills is needed to clarify the interaction between anxiety symptoms and social ability in ASD.

**The Role of Theory of Mind**

As noted above, different facets of social ability may have different associations with anxiety. One key social skill that may play a particularly influential role in the link between poor social functioning—including poor social ability and poor peer relationships—and anxiety symptoms in individuals with ASD is Theory of Mind (ToM), or the ability to infer the thoughts, emotions, and intentions of others (Baron-Cohen, Leslie, & Frith, 1985; Happé & Frith, 1994;
A wealth of evidence over the past 40 years has pointed to ToM as a key social deficit in ASD, suggesting that individuals with ASD tend to have greater difficulty understanding and interpreting the emotional expressions of others, inferring their beliefs and perspectives, and detecting and understanding “higher-order” social cues (e.g., sarcasm, deception) (Gaigg, 2012; Isaksson et al., 2019; Kimhi, 2014; Schaller & Rauh, 2017; Uljarevic & Hamilton, 2013; Wellman, Cross & Watson, 2001; Yirmiya, Erel, Shaked, & Solomonica-Levi, 1998). Recent findings suggest that difficulties interpreting the thoughts and feelings of others may also be linked to difficulties with social communication and peer relationships seen in youth with ASD and anxiety. In one study involving children with ASD ($n = 32$, 4–8 years), early indicators of social cognition (e.g., joint attention, social referencing) mediated the association between parent-reported social communication difficulties and anxiety symptom severity (Lei & Ventola, 2018). A parent-report measure of ToM that assesses a range of basic to complex social-cognitive skills (e.g., joint attention, false belief understanding, understanding of sarcasm and deception) was also negatively associated with both social communication difficulties ($r = -.72$) and anxiety severity ($r = -.50$), whereby more developed ToM skills were associated with less severe social communication difficulties and anxiety symptoms. In another study involving adolescents with ASD ($n = 90$, 14–16 years), false belief understanding assessed via interactive behavioural tasks was negatively correlated with anxiety symptom severity ($r = -.24$), suggesting that more severe anxiety symptoms are associated with greater difficulty distinguishing between one’s own mental state (i.e., thoughts, beliefs) and the mental states of others (Hollocks et al., 2014). Taken together, these findings suggest that youth with ASD with more severe anxiety symptoms may have greater difficulty distinguishing between their own mental states and others’ mental states, which may then contribute to social communication difficulties (e.g., poor social
reciprocity) that can cause difficulties in peer relationships. In this way, ToM may be central to both social ability and peer relationship challenges experienced by youth with ASD and anxiety disorders.

These social difficulties may also contribute to greater risk of negative social experiences (e.g., awkward social interactions, negative peer responses, social rejection), which could further exacerbate anxiety symptoms. However, youth with ASD with poor ToM may be more likely to misperceive instances of bullying as neutral or non-threatening (van Roekel, Shcolte, & Didden, 2010). In a study involving youth with ASD attending special education schools ($n = 230$, 12–19 years), participants were shown video clips of social situations containing bullying and positive peer interactions and asked to categorize whether the clip involved any incidents of bullying (van Roekel et al., 2010). A battery of ToM tasks was also completed by participants, including classic false belief tasks as well as measures of higher-order ToM (e.g., the Strange Stories task; Happé, 1994). Poorer performance on higher-order measures of ToM was associated with a higher number of ‘false negatives’, or identifying a bullying situation as non-bullying. A tendency to misinterpret hostile or rejecting social responses from peers as neutral or ambiguous may protect against immediate negative psychosocial outcomes, yet the social consequences that often follow peer victimization (e.g., social exclusion; Kochel, Ladd, & Rudolph, 2012; Scholte, Engels, Overbeek, Kemp, & Haselager, 2007) may lead to confusion and similar psychosocial consequences (e.g., poor self-esteem, poor social skills, reduced peer acceptance) as peer victimization that is accurately perceived as bullying, as is the case in youth with social anxiety without ASD (Erath et al., 2007; van Niekerk et al., 2017; Wang et al., 2016).

Given the potential mediating role of ToM in the association between anxiety and social communication skills and peer relationships in individuals with ASD, ToM may represent an
optimal treatment target for both anxiety and social intervention programs. In a study evaluating the efficacy of a ToM training intervention and a social skills intervention on parent- and self-reported bullying experiences of youth with ASD \((n = 56, M_{\text{Age}} = 13.7)\), the ToM intervention led to significantly greater improvements in parent-reported bullying experiences compared to a social skills intervention \(\text{(ES not reported)}\) (Liu et al., 2018). Both interventions appeared to be equally effective in reducing self-reported bullying experiences. In another study involving children with ASD \((n = 52, 3.7–7.6\text{ years})\), a ToM training intervention and a social skills intervention both led to improvements in teacher-reported social skills (i.e., ability to initiate social interactions) and peer acceptance, though the social skills program led to greater improvement in social skills than the ToM intervention (Szumski, Smogorzewska, Grygiel, & Orlando, 2019). If improvements in ToM lead to increased peer acceptance in youth with ASD, it is possible that targeting this social-cognitive skill in youth with ASD and anxiety disorders, who appear to be particularly vulnerable to the social consequences of poor ToM (Hollocks et al., 2014; Lei & Ventola, 2018), may also lead to benefits in other domains of social functioning \(\text{(e.g., social communication)}\) and psychological well-being \(\text{(e.g., anxiety)}\), though this has not yet been directly tested.

Social Functioning in ASD & Comorbid Social Anxiety

Among studies of social functioning in individuals with ASD and anxiety, social anxiety has received significant research attention in recent years and appears to be associated with elevated social maladjustment (Spain et al., 2018). Social anxiety disorder is one of the most common anxiety disorders in ASD, occurring in approximately 4.5–35% of children with ASD (Gadow, DeVincen, Pomeroy, & Azizian, 2004; Mattia et al., 2010; Simonoff et al., 2008; van Steensel, Bögels, & Perrin, 2011) compared to 2.3–10% of neurotypical children (Costello et al.,...
A recent review conducted by Spain et al. (2018) identified ten studies that examined the relationship between social anxiety and social skills (e.g., cooperation, assertiveness), social competence (e.g., social information processing), and social motivation in youth with ASD. Among these studies, all but one (White & Roberson-Nay, 2009) reported poorer social ability among children with ASD and social anxiety.

Of the forms of social impairment that have been linked to social anxiety in ASD, social motivation—i.e., the desire or willingness to engage in social situations—has received the most empirical interest (Spain et al., 2018). Studies have consistently reported that youth with ASD and social anxiety demonstrate greater impairment in social motivation than youth with ASD alone (Chang et al., 2012; Maddox & White, 2015; Swain et al., 2015; White & Roberson-Nay, 2009). Worth noting, however, is that four of the seven studies on this topic defined and assessed social motivation as the tendency to initiate versus withdraw from or avoid social interactions with peers. However, a child may have the desire or interest to interact with peers but may withdraw, not due to lack of social motivation, but due to fear of negative social evaluation (Meuret et al., 2016) or ASD-related social difficulties (Halim, Richdale, & Uljarevic, 2018). Of the remaining studies that assessed social motivation, all three used the social motivation subscale of the SRS-2 (Constantino & Gruber, 2012); however, studies have failed to find evidence that the SRS-2 subscales assess distinct underlying factors of social functioning (Constantino et al., 2003). As such, the interpretation of these results is not straightforward. Studies that assess both the behavioural (i.e., social initiation) and cognitive (i.e., social interest) manifestations of social motivation using valid instruments are needed to clarify the likely nuanced relationship of social motivation with social anxiety in ASD.
Research also suggests that children with ASD and social anxiety have poorer social skills, such as assertiveness, that are instrumental in initiating social interactions and establishing friendships (Bellini, 2004; Bellini, 2006; Chang et al., 2012; Maddox & White, 2015). Given their limited interest in social interaction, children with reduced social motivation likely have fewer social opportunities to develop and practice these skills, resulting in poorer social skills and potentially fewer or poorer quality friendships. Indeed, research suggests that anxious typically developing children with poorer self-reported social skills are more likely to have poorer self-reported friendship quality (Crawford & Manassis, 2011). Additionally, social anxiety symptoms in children with ASD have also been linked to a more negative pattern of social information processing (e.g., hostile attribution bias) and less reciprocity in social interactions and relationships, which could elicit negative responses from peers and further contribute to poor social skills via social rejection and isolation (Meyer et al., 2006; Usher et al., 2015). However, the quality of peer relationships among youth with ASD and social anxiety disorder has not yet been directly examined; thus, whether social fears are associated with greater risk of negative social outcomes than non-social fears among youth with ASD is unclear.

**Social Functioning & the Presentation of Anxiety in ASD**

In addition to understanding how different facets of social functioning relate to one another and to anxiety severity, it is important to clarify potential differences in social functioning across different presentations of anxiety in ASD in order to better understand and treat these disorders and their negative psychosocial sequelae. Recent clinical evidence suggests that social communication differences and other core symptoms of ASD may influence the presentation of anxiety disorders, such that some individuals on the spectrum may present with *distinct* anxiety symptoms that differ qualitatively from more *traditional* presentations of anxiety.
captured by current diagnostic classification systems (i.e., DSM-5) (Kerns & Kendall, 2012; Ozsivadjian, Knott, & Magiati, 2012; White, Bray & Ollendick, 2012; White et al., 2015). Alongside traditional co-occurring anxiety disorders, such as generalized, separation and social anxiety disorder, approximately 48% of children and youth with ASD and clinical anxiety present with distinct fears that do not fit neatly into the traditional anxiety disorder categories (e.g., unusual phobias, fears of change and novelty, fears related to circumscribed interests) (Mayes et al., 2013; Halim et al., 2018; Kerns et al., 2014, 2020; Kerns, Renno, Kendall, Wood, & Storch, 2017; Trembath, Germano, Johanson, & Dissanayake, 2012). In particular, some individuals with ASD present with fear and avoidance of social situations in the absence of awareness or anxiety about negative social evaluation (i.e., worries about embarrassing oneself or being rejected by others), a key criterion for the diagnosis of social anxiety disorder per the DSM-5 (American Psychiatric Association, 2013). Qualitative evidence and clinical theory has suggested that, for some children and youth with ASD, the uncertainty and unpredictability of social situations is more distressing than worries about the risk of social judgment or humiliation (Bearss et al., 2016; Kerns & Kendall, 2012; Kerns et al., 2014, 2015; Ozsivadjian et al., 2012).

Differences in the focus of social worries between traditional and distinct presentations of social anxiety (i.e., fear of negative evaluation vs. fear of social unpredictability) may be influenced by the key social deficits of ASD. In particular, youth with distinct anxiety have been found to present with more severe parent-reported social communication difficulties (Kerns et al., 2014), which may explain the perceived unpredictability and distress associated with social situations reported by these individuals (Bearss et al., 2016; Ozsivadjian et al., 2012); however, this association has not been examined specifically in distinct social anxiety (herein referred to as “other social fears”). ToM may also play a role; children with ASD and traditional social anxiety
tend to present with excessive fear and anxiety of social rejection or humiliation, suggesting heightened awareness of and attention to the mental states of others (Gillot et al., 2001; Kerns et al., 2014; Oszivadjian et al., 2012; Washburn, Wilson, Roes, Rnic, & Harkness, 2016), whereas children with other social fears tend to present with confusion and anxiety surrounding social roles and expectations, suggesting more limited social awareness and greater difficulty understanding others’ mental states (i.e., poor ToM) (Kerns et al., 2014, 2017, 2020). Though current clinical theory and qualitative evidence suggest that other social fears are distinguished from traditional social anxiety by a lack of awareness or fear of social judgment (Halim et al., 2016; Kerns et al., 2014, 2017), indicating potential differences in social motivation and ToM, the social ability of children with ASD and other social fears compared to traditional social anxiety has yet to be directly tested. Understanding the unique social challenges experienced by these youth is critical for both extending the current research literature on social functioning and anxiety in ASD and developing tailored psychosocial treatments for social anxiety that address the most pressing challenges for these youth.

The Current Study

The current study seeks to address several gaps in the literature on social functioning in children with ASD and anxiety disorders. First, most studies have focused on single broad outcome measures (e.g., the SRS-2), and few have examined specific social skills and experiences. Though the current literature has helped to identify the facets of social functioning that may be related to anxiety in children with ASD, limiting analyses to one or two forms of social functioning precludes the ability to examine how several forms of social functioning, all of which are affected in this population, might interact with one another and be differentially affected by anxiety symptoms (e.g., if impaired social motivation is associated with having fewer
friends; if severity of anxiety symptoms is associated with social communication problems, but not ToM). Second, few have utilized more objective measures (e.g., semi-structured interviews, observational assessments) of anxiety symptoms and social functioning. A multimethod approach is needed to clarify the associations among different facets of social functioning and anxiety, beyond the influence of respondent style. Third, though ToM has emerged as a potential mediator between social functioning and anxiety severity in youth with ASD, the role of ToM in the overall social profile of children with ASD and clinical anxiety is still unclear. Examining whether ToM, or other form(s) of social functioning, might explain difficulties in a number of other social realms could inform current models of the link between social functioning and anxiety in ASD, as well as inform potential intervention strategies to promote widespread improvement in social functioning and anxiety symptoms in youth with ASD. Fourth, though clinical theory (Kerns & Kendall, 2012; Kerns et al., 2015) and prior research (Bearss et al., 2016; Halim et al., 2016; Kerns et al., 2014, 2017; Ozsvadjian et al., 2012) have suggested that different presentations of social and non-social anxiety in ASD may be associated with differences in social functioning, no study to date has directly compared the social ability and experiences of children with ASD and comorbid social (traditional vs. distinct) and non-social fears. Given that approximately 4.5-35% of children with ASD and anxiety disorders experience significant social anxiety (Simonoff et al., 2008; van Steensel et al., 2011) and approximately 8-9% present with other social fears (Kerns et al., 2014, 2020), this is a critical gap in the literature that warrants investigation.

To address these gaps in the extant literature, the current study aimed to (1) examine the associations among clinical and parent-report measures of social functioning, and how these measures of social functioning are related to anxiety symptom severity and comorbidity, (2)
identify the most important form(s) of social functioning associated with difficulties in other social domains, and (3) examine how social functioning relates to social anxiety (traditional vs. distinct) compared to non-social anxiety in a large sample of treatment-seeking children with comorbid anxiety and ASD. The current study employed a multi-method, multi-informant battery of standard and specific measures of social ability and experiences, allowing a more comprehensive investigation of social functioning in this sample than has been done in prior work. To examine the associations among these different facets of social functioning, a novel network analytic approach was used. Network analysis is a state-of-the-art statistical technique that allows for the analysis of mutual interactions among single elements of a broad construct (e.g., social functioning) and how these elements are uniquely associated with one another, while controlling for the effects of all other elements in the model (Borsboom & Cramer, 2013; Cramer, Waldorp, van der Maas, & Borsboom, 2010; Epskamp, Borsboom, & Fried, 2018). Network analysis was chosen for the current study for its ability to clarify the unique associations among different facets of social functioning and anxiety in children with ASD, as well as to identify the form(s) of social functioning that play the most influential role in the social ability and peer relationships of children with ASD and anxiety disorders. Finally, to investigate potential differences in social functioning across traditional and distinct presentations of anxiety, the current study used a novel semi-structured clinical interview that differentiates anxiety and ASD-related difficulties, including challenges related to social ability and peer relationships, and assesses both the traditional and distinct presentations of anxiety that arise in ASD (the Anxiety Diagnostic Interview Schedule-Autism Addendum [ADIS/ASA]; Kerns et al., 2014, 2017). Through the use of multi-method assessment tools that carefully characterize social functioning and anxiety symptoms, the current study was able to clarify how specific facets of
social functioning relate to one another and to different presentations of anxiety in children ASD, thus extending the current state of knowledge on the social challenges faced by this population and identifying key areas for future research and intervention.

**Hypotheses**

**Aim 1.** Given prior work involving youth with ASD (Neuhaus, Webb, & Bernier, 2019), it is hypothesized that social motivation will demonstrate a strong association with friendship quality, above and beyond the effects of other variables in the network, such that children who express desire and interest in social interactions will be more likely to also have mutual, reciprocal friendships. Additionally, friendship quality is expected to be uniquely associated with experiences of bullying, such that children who have more difficulty forming reciprocal friendships may also have a greater history of bullying and peer rejection. It is also hypothesized that anxiety severity and comorbidity (i.e., the number of co-occurring anxiety disorders) will be uniquely associated with poorer social ability and more negative social experiences across both specific and standard measures of social functioning. Finally, it is hypothesized that standard measures of ASD-related social deficits (i.e., ADOS-2, SRS-2) will be uniquely associated with specific measures of social ability (ToM, social motivation), and that a standard measure of quality of peer relationships (i.e., *Child Behavior Checklist: Social Problems subscale* [CBCL: SP]) will be uniquely associated with specific measures of social experiences (friendship quality, bullying experiences).

**Aim 2.** Theory of Mind will be the most central variable in the network, with strong associations with social motivation, parent-reported and clinician-rated social communication skills, as well as friendship quality and bullying experiences.
**Aim 3.** It is hypothesized that children with ASD and other social fears will demonstrate significantly greater impairment in ToM and social motivation compared to children with traditional social anxiety. Further, it is hypothesized that children with traditional social anxiety will be more likely than children with other social fears and non-social fears to have poorer quality friendships and a history of peer victimization and rejection, which may contributed to the development of their fear of negative evaluation (as in typically developing youth; La Greca & Harrison, 2005; Pabian & Vandebosch, 2016; van Oort et al., 2011; Van Zalk, Van Zalk, Kerr, & Stattin, 2011). Though children with OSF are likely to have fewer positive social experiences compared to children with NSA, these children may be less interested in engaging socially with their peers, thus exposing them to fewer social opportunities and perhaps acting as a buffer against bullying. Finally, it is hypothesized that children with non-social anxiety may be less socially motivated and have poorer ToM than children with traditional social anxiety, but more socially motivated and have more developed ToM than children with other social fears.
Chapter Two: Method

Participants

Data for the current study were drawn from the *Treatment for Anxiety in Autism Spectrum Disorders* (TAASD; Wood et al., 2019; Kerns et al., 2016) trial, a 3-site (University of Los Angeles: California, University of South Florida, and Temple University) randomized clinical trial comparing modular (*Behavioral Interventions for Anxiety in Children with Autism* [BIACA]; Wood et al., 2009) to standard CBT (*Coping Cat*; Kendall & Hedtke, 2006) for anxiety in children with ASD. Participants were recruited through flyers, online advertisements, and presentations at local community organizations that serve children with ASD.

Families (*N* = 214) participated in intake interviews involving clinical interviews and parent-report questionnaires to confirm their eligibility. Eligibility criteria for the trial included: (a) community diagnosis of ASD, (b) age 7 – 13 years, (c) verbally proficient in the English language, (d) maladaptive and interfering anxiety confirmed via clinical evaluation (Pediatric Anxiety Rating Scale [PARS] total score of ≥14 points; diagnosis of an anxiety disorder per the Anxiety Diagnostic Interview Schedule-Autism Addendum [ADIS/ASA]; Ginsburg, Keeton, Drazdowski, & Riddle, 2011; Kerns et al., 2014, 2017; RUPP Anxiety Study Group, 2002), and (e) an IQ score of ≥70 points on select subscales of the Wechsler Intelligence Scale for Children-Fourth Edition (*WISC-IV*) (Vocabulary, Matrix Reasoning) (Wechsler, 2003). Ninety six percent of the sample (*n* = 192) received a confirmed diagnosis of ASD via clinical evaluation by the research team (Childhood Autism Rating Scale Second Edition–High Functioning Version [CARS-2HF]; Autism Diagnostic Observation Schedule–2 [ADOS-2]; Lord et al., 2012; Schopler, Van Bourgondien, Wellman, & Love, 2010). Children were excluded if they had a diagnosis of bipolar or schizophrenia spectrum disorder, suicidal ideation or suicidal
behaviours in the past 6 months, had been nonresponsive to CBT for anxiety in the past 2 years, and if they were receiving concurrent treatment (i.e., psychosocial therapy, social skills training groups with homework, applied behavioural analysis; not including occupational therapy, school counselling, or speech therapy) and unwilling to cease this treatment or unwilling or unable to keep the child’s medication regimen consistent during the trial. In the current study, participants were also excluded if they did not meet clinical criteria for a primary diagnosis of anxiety on the ADIS/ASA \( (n = 13) \) or did not complete the ADIS/ASA \( (n = 1) \). Participants with an IQ below 70 on the WISC-IV \( (n = 6) \), who were excluded from the trial, were included in the current study to capture a more representative sample of clinically anxious children with ASD with a greater range of cognitive functioning. After applying the above inclusion and exclusion criteria, the final sample of the current study included 200 children with ASD and co-occurring anxiety disorders and their caregivers. See Figure 1 for a CONSORT diagram of participant flow through the current study.

**Measures**

*Anxiety Disorders Interview Schedule for DSM-IV–Parent Version (ADIS-IV-P) with the Autism Spectrum Addendum (ASA)*

The ADIS-IV-P is a semi-structured interview designed to assess DSM-IV anxiety disorders in children (American Psychiatric Association, 1994; Silverman & Albano, 1996). A version for DSM-V had not yet been released; however, the diagnostic criteria for anxiety disorders remained largely consistent between the DSM-IV and the DSM-5 (American Psychiatric Association, 1994, 2013; Crome et al., 2015; Merikangas et al., 2010; Kessler, Petukhova, Sampson, Zaslavsky, & Wittchen, 2012). The ADIS-IV is a widely-used and psychometrically sound assessment of pediatric anxiety disorders (Silverman, Saavedra, & Pina,
with demonstrated inter-rater reliability (.91) and convergent validity (.51) in youth with ASD (Ung et al., 2014). The ADIS assesses diagnostic criteria for generalized anxiety disorder (GAD), separation anxiety, specific phobia, social anxiety disorder (SAD), and obsessive-compulsive disorder (OCD), as well as major depressive disorder (MDD), oppositional defiant disorder (ODD), and attention-deficit hyperactivity disorder (ADHD). For each module, clinicians assigned a Clinical Severity Rating (CSR) to indicate the degree of distress and impairment experienced by the child and family due to these symptoms ranging from 0 (not impairing) to 8 (debilitating). A CSR of 4 indicates clinically significant interference and that the clinical threshold for diagnosis has been met. A CSR of 3 indicates subclinical interference.

The current study also included the Autism Spectrum Addendum, a set of additional questions intended to identify distinct anxiety symptoms that do not fit traditional diagnostic categories and to inform differential diagnosis of traditional versus distinct anxiety symptoms in children with ASD (Kerns et al., 2014). ASA items include targeted inquiries into child sensory sensitivity, perseverative cognitive style, and social functioning, including four items assessing Theory of Mind (i.e., child’s awareness of other’s thoughts and emotions), Social Motivation (i.e., interest in social interactions and relationships, regardless of actual social behaviour or inclusion by peers), Friendships (i.e., quantity, quality, and reciprocity of friendships), and Bullying (i.e., history and severity of peer rejection and exclusion) (see Appendix A for sample prompts of the ADIS/ASA Social Functioning items). These inquiries are used to inform the diagnosis of anxiety disorders, particularly GAD, specific phobia and SAD (e.g., determining whether social avoidance stems from fear of negative evaluation, low social motivation and/or sensitivity to playground noise). These items are assigned a Likert rating by the clinician from 0
(no difficulties) to 3 (severe difficulties or a marked deficit in that area of social functioning).
For example, a score of 0 on the ToM item indicates awareness and sensitivity to the thoughts, feelings, and opinions of others, while a score of 3 indicates very poor to no awareness. On the Social Motivation item, a score of 0 indicates a clear desire to engage socially, even if attempts have been unsuccessful, while a score of 3 indicates a lack of social interest (e.g., never initiates social interaction except to fulfill a want or need). A score of 0 on the Friendships item indicates the presence of at least one mutual, fully reciprocal friendship, while a score of 3 indicates no peer relationships involving sharing of interests and no preference for any particular peer.
Finally, on the Bullying item, a score of 0 indicates no bullying or peer rejection, while a score of 3 indicates severe rejection or bullying that results in school refusal and/or removal from school or activities due to concerns for the child’s welfare.

In addition, the ASA includes modules to assess distinct presentations of anxiety seen in ASD that differ from more traditional presentations of anxiety captured by current diagnostic classification systems (i.e., DSM-5), including fears of change, negative reactions to change, other social fears, unusual phobias, and fears related to their special interest (Kerns et al., 2014). The Social Phobia/Other Social Fears module includes probes designed to distinguish whether fear and avoidance of social situations is related to fears about social judgment, as in social anxiety disorder (SAD), or distress related to difficulty understanding social situations, as in other social fear (OSF) (see Appendix B for sample prompts of the ADIS/ASA Social Phobia/Other Social Fears module). These modules also receive a CSR of 0 to 8, with a CSR of 4 or higher indicating that the symptoms are causing clinically significant impairment for the child and family. The current study used the ADIS/ASA Social Functioning items and anxiety CSR ratings as a measure of (a) traditional anxiety presentations, including SAD, (b) clinically
significant distinct anxiety presentations, including the presence of Other Social Fears (OSF), as well as (c) specific social abilities (ToM, social motivation) and experiences (friendships, bullying) that may be associated with anxiety symptoms.

The ADIS/ASA has demonstrated excellent inter-rater reliability of severity ratings and diagnostic agreement overall (ICC = 0.85-0.98; κ = 0.67-1.00), including diagnosis of SAD (ICC = 0.95; κ = 0.84) and OSF (ICC = 0.88; κ = 0.78), as well as excellent 2-week test-retest reliability (.88-1.00) (Kerns et al., 2014). Inter-rater reliability of CSRs on the Social Functioning items is also high (ICC = 0.82-0.89) (Kerns et al., 2017). Analyses of convergent and discriminant validity support the notion that the ADIS/ASA CSRs for traditional anxiety (includes SAD) and distinct anxiety (includes OSF) assess different presentations of anxiety in ASD (Kerns et al., 2017). The overall traditional anxiety CSR correlated positively with both the PARS 5-item Total Score (r = 0.40) and CBCL Anxiety subscale (r = 0.30), whereas the overall distinct anxiety CSR did not correlate with either measure (PARS 5-Item Total: r = 0.11; CBCL Anxiety: r = 0.11), supporting the notion that distinct anxiety is tapping into a different cluster of symptoms than traditional anxiety. Neither traditional nor distinct anxiety symptoms correlated with either the Attention or Aggression subscales of the CBCL, suggesting that the ADIS/ASA demonstrates good discriminant validity.

*Autism Diagnostic Observation Schedule, Second Edition (ADOS-2)*

The ADOS-2 (Lord et al., 2012) is a semi-structured observational assessment of social, communicative, and restricted or repetitive behaviours associated with ASD. Module 3 of the ADOS-2, which is administered to children with ASD with verbal fluency (i.e., able to use language to describe events outside the immediate context; grammatically correct use of terms such as “but” or “like” to connect multiple concepts within a sentence), was used to assess the
presence of ASD at screening. The ADOS-2, Module 3 has appropriate sensitivity (.91) and specificity (.84; Gotham, Risi, Pickles, & Lord, 2007). The ADOS-2 calculates a composite Social Affect score that encapsulates children’s social communication ability (i.e., ability to communicate desires and emotions, to engage in reciprocal conversation), social interest (i.e., quality and quantity of social overtures to the evaluator, rapport), and social awareness (i.e., understanding of one’s own and others’ roles in social relationships). The ADOS-2 Social Affect (ADOS:SA) score was used in the current study as a measure of reciprocal social communication ability, referred to herein as social affect.

Social Responsiveness Scale: Parent Version—Second Edition (SRS-2)

The SRS-2 (Constantino & Gruber, 2012) is a parent-report measure of ASD-related social deficits. It measures ASD symptoms on a continuum that includes typical social functioning, allowing for a nuanced assessment of ASD symptoms as dimensional traits that are present in the general population. Parents rate their child’s behaviour on a scale of 1: *Not true* to 4: *Almost always true*. The SRS-2 Total score reflects social-communication impairments associated with ASD including social motivation, social cognition (ToM), social awareness, and social communication as well as repetitive and restricted behaviors and interests. The SRS-2 has demonstrated sound psychometric properties, including good internal (.72–.93), inter-rater (.8), and test-retest reliability (.83; Frazier et al., 2014). The SRS-2 has also demonstrated good convergent validity (.7) with the *ASD Diagnostic Interview-Revised* (Constantino et al., 2003) and discriminant validity with measures of anxiety (e.g., MASC-P, ADIS/ASA) (Kerns et al., 2014; Renno & Wood, 2013), suggesting that it is an effective measure of social functioning deficits that are associated with ASD specifically. The SRS-2 was used in the current study as a broad measure of ASD-related social impairment, referred to herein as social competence.

The Child Behavior Checklist (CBCL) (Achenbach, 1999) is a parent-report measure of child emotional and behavior problems. The CBCL includes subscales that assess a range of DSM-oriented behavioural and emotional difficulties, including anxiety and depression symptoms, aggressive behaviour, and attention problems, among others. The current study analyzed parent-rated scores on the CBCL: Social Problems subscale, which asks parents about how their child interacts with peers (e.g., “Doesn’t get along with other kids”) and how other children might perceive or behave towards their child (e.g., “Gets teased a lot”, “Not liked by other kids”). Parents rated their child’s behaviour on a scale of 0: Not true to 2: Very true or often true. The syndrome scales of the CBCL have good psychometric properties and have demonstrated good scale reliability ($r_c = 0.69$-$0.94$), including the Social Problems subscale ($r_c = 0.84$), in samples of children with and without ASD (Dedrick, Friedman, Wetherington, & Knoff, 1997; Ivanova et al., 2007; Pandolfi, Magyar, & Dill, 2012). The current study used the CBCL: Social Problems subscale (CBCL:SP) as a broad measure of difficulties in peer relationships, referred to herein as social problems.

**Pediatric Anxiety Rating Scale (PARS)**

The Pediatric Anxiety Rating Scale (PARS) (RUPP Anxiety Study Group, 2002) is a clinician-rated scale that assesses anxiety symptoms and severity in children ages 7–17 years based on a clinical interview with both the child and parent(s). The PARS has demonstrated good construct validity and satisfactory inter-rater and test-retest reliability in samples of youth with ASD (Kerns et al., 2015; Storch et al., 2012). The clinician-rated 7-Item PARS Total score
was used to characterize the overall severity and interference of anxiety symptoms in the current sample.

**Procedure**

This study was approved by the Institutional Review Board and conducted at research clinics at each research site. Caregivers completed informed consent, and children completed informed assent before completing the study. All participants completed a phone screen and were then invited to complete an in-person intake interview, which included clinical evaluations of anxiety (ADIS/ASA, PARS), autism (ADOS-2, CARS), cognitive functioning (WISC-IV), and other socioemotional difficulties (CBCL), as well as basic demographic questionnaires collecting information on child age, sex, ethnicity, and living arrangements. ADIS/ASA interviews were audio-recorded with the consent of participating families. Participants received $25 for participating in the intake interview.

Clinical evaluations were administered by doctoral-level behavioural health clinicians and doctoral-level psychology students who were trained to research-reliable standards (e.g., percent agreement on the ADOS-2 > .80; Wood et al., 2019). Inter-rater agreement demonstrated excellent reliability in ASD diagnosis and anxiety symptom severity (100% agreement for meeting ASD criteria on the ADOS-2 and CARS; \( r = .88 \) inter-rater reliability on the PARS). All student clinicians were trained and supervised on the ADIS/ASA by C. Kerns, the developer of the tool and a licensed clinical psychologist. Prior to conducting the ADIS/ASA, all evaluators participated in a day-long training and initial consensus check led by the principal investigator (see Kerns et al., 2016). Evaluators also participated in weekly supervision with the principal investigator to discuss questions regarding administration and scoring throughout the trial to
prevent drifts in rater reliability. In a validity study published on a subset of the current sample, evaluators demonstrated excellent inter-rater reliability (ICC = 0.82-0.98).

Data Analytic Plan

**Aim 1: Network estimation.** Network analysis was conducted to examine the structure and strength of associations among the four ADIS/ASA Social Functioning items (ToM, Social Motivation, Friends, Bullying) and standard clinical and parent-report measures of social functioning (ADOS:SA, SRS-2, CBCL:SP) in children with ASD and anxiety disorders. Anxiety severity (i.e., highest CSR score received across all anxiety diagnoses on the ADIS/ASA) and anxiety comorbidity (i.e., number of anxiety diagnoses on the ADIS/ASA with a CSR of 4 or higher) were also added to the network to examine the connection between severity and variety of anxiety and different aspects of social functioning in children with ASD.

Most widely used network estimation models, such as the Graphical Gaussian Model, are limited in that the model assumes that all variables are of the same data type (i.e., continuous). While adjustments can be made to run these models using ordinal data (e.g., calculating a polychoric rather than Pearson correlation matrix; Epskamp et al., 2018), they are unable to estimate networks based on variables of differing data types, as is the case in the current study. By contrast, Mixed Graphical Models (MGM) permit each variable to belong to a potentially different data class (i.e., binary, ordinal, continuous) (Haslbeck & Waldorp, 2020; Yang, Baker, Ravikumar, Allen, & Liu, 2014). Thus, networks were estimated by calculating a $k$-degree MGM via nodewise regression using the package `mgm` in R (Haslbeck & Waldorp, 2020), which
estimates the unique, independent connections between every pair of variables, while controlling for the variance of all other variables in the model.

This model was then used to plot the network using the package *bootnet* in R, in which nodes represent the variables of interest and edges represent the unique independent connections between the nodes when controlling for the effects of all other nodes (Epskamp et al., 2018). When estimating the network, regularization was applied to the MGM via the graphical LASSO (Least Absolute Shrinkage and Selection Operator) algorithm and the related tuning parameter was chosen with the Extended Bayesian Information Criterion (EBIC) (Foygel & Drton, 2011). By doing so, all trivially small or unstable edges are reduced to zero and all remaining edges are conditionally dependent (i.e., not spuriously due to any other variable in the network) and most likely to represent genuine connections (Costantini et al., 2015; Epskamp et al., 2018; Epskamp, Kruis, & Marsman, 2017). This serves to increase specificity of the network and only display the strongest edges. To calculate the tuning parameter and apply regularization, 100 different network models are estimated with ranging degrees of sparsity. The hyperparameter gamma ($\gamma$) value, usually set between 0 and 0.5 (Epskamp & Fried, 2016), is then used to select the model with the lowest EBIC value (Epskamp et al., 2017). If $\gamma$ is set to 0.5, the EBIC will select a more specific model that contains fewer edges, increasing confidence that the edges are authentic (i.e., more conservative). If $\gamma$ is set to 0, the EBIC will select a more sensitive model that contains a greater number of edges (i.e., more liberal). As has been done in prior studies of psychological networks (Beard et al., 2016; Bernstein, Heeren, & McNally, 2017; Heeren & McNally, 2018), $\gamma$ was set to 0.5 to increase the specificity of the network.

Predictability, a measure of the proportion of variance for a specific node that can be explained by variance in nodes to which it is connected (i.e., $R^2$) (Haslbeck & Waldorp, 2018),
was also estimated for each node using the `mgm` package in R (Haslbeck & Waldorp, 2020).

Finally, to increase interpretability of the network, network communities (i.e., strongly connected clusters of nodes) were estimated using the Spinglass algorithm in the R package `igraph` (Csardi & Nepusz, 2006). The Spinglass algorithm tests for communities whereby the number and strength of edges within a cluster exceeds the number and strength of edges between clusters (Reichardt & Bornholdt, 2006). Nodes within a network community were assigned the same colour in the plotted networks.

**Missing data.** When estimating the primary network of social functioning and anxiety variables, 30 participants were identified with missing data on one or more of the variables of interest. Pairwise deletion was applied to include all participants in the network, including those with missing data on one or more measures, thereby maximizing statistical power. Prior work has shown that pairwise deletion does not affect the stability of network estimations, and may be preferable to imputation, particularly in the case of networks involving psychosocial variables (Borsboom et al., 2017). However, in the case of predictability estimates, complete data is required to acquire an accurate estimate (Haslbeck & Fried, 2017). Thus, when estimating predictability, listwise deletion was used (i.e., participants with any missing data were removed from the analyses). After listwise deletion, the resulting predictability estimates were based on 170 participants (15% omitted).

**Assumptions of network analysis.** Statistical assumptions specific to network analysis have yet to be established, but given that network analyses are derived from partial correlation matrices, the assumptions of linearity and normality that apply to partial correlation can also be applied to network analyses (Epskamp et al., 2018). However, the current study estimates the network via MGM, a model estimation procedure designed for mixed models containing binary,
ordinal and continuous data, that is robust to non-linearity and non-normality (Haslbeck & Waldorp, 2020; Yang et al., 2014). To confirm that variables entered into the network represent distinct constructs, tests of multicollinearity were conducted. Given the ordinal structure of the ADIS/ASA Social Functioning items, Spearman correlations were calculated to test for multicollinearity among the four items, as well as between the ADIS/ASA Social Functioning items and the other standard measures of social functioning (SRS-2, ADOS:SA, CBCL:SP) (Chen & Popovich, 2002). Given the ordinal structure of the ADIS/ASA CSRs of anxiety severity, Spearman correlations were also calculated between CSRs of anxiety severity and the other key variables of interest. A Pearson correlation matrix was also calculated to test for multicollinearity between the continuous social functioning measures (SRS-2, ADOS:SA, CBCL:SP) and anxiety comorbidity. If any of the variables in the network were extremely highly correlated (e.g., $r = 0.8–0.9$), the highly correlated items were combined into a single composite variable (Grice & Iwasaki, 2007). Additionally, to test for outliers or extreme values that may unduly influence the connections between nodes in the network, box plots were examined for all continuous variables (Rousseeuw & Hubert, 2011). Extreme outliers are defined as values $> 3$ times the interquartile range away from the median. Per Aguinis and colleagues’ (2013) recommendations, if any extreme outliers were detected, the network model would be estimated with the outliers excluded to determine if they had an undue influence on the model fit (i.e., structure and strength of edge-weights in the network). If so, the outliers would not be included in the final network analysis.

Edge accuracy. Recent work has brought to light the need for network estimation research to also investigate the accuracy of edge strength and network structure (Epskamp et al., 2018). To examine the variability of edge-weights (i.e., the connections between the nodes) in
the primary network, 95% confidence intervals (CIs) were calculated for each edge weight via bootstrapping procedures. Non-parametric bootstrapping, in which observations in the data are resampled with replacement to create new plausible datasets, is advised in cases of ordinal data (Epskamp et al., 2018). Thus, non-parametric bootstrapping was applied 1,000 times to the current sample to evaluate the accuracy of edge-weights reported in the primary network. Plots that depict the distribution of the edge-weights are presented to provide a visualization of the variation of edge-weights in the network.

**Aim 2: Network centrality indices.** Network centrality indices were calculated using the R package *qgraph* to identify the most central aspects of social functioning in the primary network (Epskamp, Cramer, Waldorp, Schmittmann, & Borsboom, 2012). The centrality of each node was estimated using four different centrality indices: Degree centrality, node strength, closeness, and betweenness. *Degree* centrality is the sum of direct edges connected to each node (Freeman, 1979; Wasserman & Faust, 1994). In psychological networks, the node with the highest degree centrality is the symptom or psychosocial characteristic that is directly, independently associated with many other symptoms or characteristics in the network. Node *strength* is calculated via the sum of the weights of the edges that a node is directly connected to, indicating the degree to which a node is directly connected with other nodes in the network (Barrat, Barthelemy, Pastor-Satorras, & Vespignani, 2004). Node *closeness* is a measure of the degree to which a node is indirectly connected to all other nodes in the network, indicating how quickly and efficiently information from this node can reach other nodes (Freeman, 1979; Wasserman & Faust, 1994). In psychological networks, changes in a symptom or characteristic with high closeness centrality are more likely to affect other symptoms or characteristics, and changes in other symptoms or characteristics are more likely to affect symptoms or
characteristics with high closeness centrality (Bringmann et al., 2019). Closeness is calculated by summing and averaging the shortest path length (i.e., smallest number of edges) between the node of interest and all other nodes in the network, accounting for the strength of those connections whereby stronger edges indicate “faster” connections and shorter path length (Opsahl, Agneessens, & Skvoretz, 2010). Finally, node betweenness is the degree to which a node connects other nodes in the network, calculated via the number of times that it lies on the shortest path length (stronger edges indicating shorter path length) between any pair of other nodes (Freeman, 1977). A node with high betweenness centrality plays an important intermediary role in the network; in a psychological network, a symptom or characteristic with high betweenness centrality influences the flow of the network by acting as a bridge between two other symptoms or characteristics (Bringmann et al., 2013; Bringmann et al., 2019; Opsahl et al., 2010). Higher values reflect greater centrality in the network. Centrality plots that depict these values as z-scores are presented to allow comparison of centrality indices across all nodes in the network.

As network analysis has grown in popularity in the field of psychological science, greater attention has been paid to the robustness of current methods and their applicability to psychological constructs (Epskamp et al., 2018). In particular, some data scientists have proposed that centrality indices—originally designed for social network research—are ill-suited to psychological networks and may not provide meaningful information about the relationships between nodes in a network, potentially leading to invalid or inaccurate interpretations (Bringmann et al., 2019; Epskamp et al., 2018). Additionally, closeness and betweenness centrality are not suitable for networks that are not fully connected (i.e., networks that include nodes without direct edges to any other nodes) or that contain negative edges (Bringmann et al.,
both of which are common in psychological networks. However, given the aims of the current study, it is believed that these estimates may provide valuable insight into the indirect effect of these different forms of social functioning on one another. Nonetheless, it is recommended that betweenness and closeness centrality are regarded as exploratory and interpreted with caution.

**Stability of centrality indices.** Stability of the three centrality indices (strength, betweenness, closeness) was calculated to determine whether the order of centrality indices remains the same after re-estimating the network. A subset bootstrapping procedure (Costenbader & Valente, 2003) was applied by repeatedly correlating centrality indices of the original sample with centrality indices calculated from a subsample of participants with a gradually increasing proportion of missing cases via person-dropping bootstraps as implemented in R package *bootnet* (Epskamp et al., 2018). Centrality indices are considered less stable if correlation values decline substantially as participants are removed. The case-dropping procedure was used to generate a correlation stability (CS) coefficient, which indicates the maximum proportion of participants that can be dropped from the original sample while maintaining 95% probability that the correlation between centrality indices from the original and reduced sample (i.e., the sample only including cases that remain after case-dropping) are at least .70. A minimum CS-coefficient of 0.25 is recommended to interpret centrality indices, while a CS-coefficient of 0.50 or higher indicates robust estimations of centrality (Epskamp et al., 2018).

**Exploratory social anxiety network.** A secondary network was estimated to examine the connection between presence and type of social fears on different aspects of social functioning. To do so, a subsample including only participants with clinically significant social fears (i.e., a CSR of 3 or higher on the Social Phobia module of the ADIS/ASA) was created (n = 123) to
explore whether the network of social functioning and anxiety appeared to differ among children with social fears compared to the full sample of children with ASD and anxiety. Additionally, a binary variable indicating whether participants were assigned to the SAD group or OSF group (SAD = 1, OSF = 0) was included in the network to examine whether type of social fear demonstrated unique independent connections to any measures of social functioning in the network.

**Exploratory comorbid psychopathology networks.** An additional set of exploratory networks was estimated to examine the influence of comorbid psychopathology on different aspects of social functioning in children with ASD and anxiety. Three additional networks were estimated, each including a binary variable indicating diagnostic status (0 = no diagnosis, CSR < 4; 1 = diagnosis, CSR ≥ 4) of one of three categories of co-occurring psychopathology assessed by the ADIS/ASA: ADHD (including ADHD-Inattentive [ADHD-I], ADHD-Hyperactive-Impulsive [ADHD-H/I], ADHD-Combined [ADHD-C]), depression (including MDD, dysthymia), and ODD. Three separate networks were estimated to examine how each comorbidity relates to the social variables in the network, independent of the effects of the other comorbidities. Only one participant in the current sample received a diagnosis of PTSD. As such, a separate network including a variable indicating diagnostic status of PTSD was not included in analyses.

**Aim 3: Binary logistic regressions.** To address Aim 3 of the current study, participants were categorized into three groups according to diagnosis: (1) Social Anxiety Disorder (SAD), (2) Other Social Fears (OSF), and (3) Non-Social Anxiety (NSA). Participants with clinical or subclinical social fears (i.e., a CSR of 3 or greater) were categorized into the SAD or OSF groups according to caregiver responses to two interview questions in the ADIS/ASA regarding fear of
negative evaluation (see Appendix B). If caregivers endorsed fear of negative evaluation, participants were assigned to SAD; if caregivers did not endorse fear of negative evaluation, participants were assigned to OSF. Participants were included in the SAD or OSF group if they received a CSR of 3 or higher on the Social Phobia module to capture children with social anxiety symptoms that do not meet the clinical threshold but are nonetheless experiencing some distress and/or impairment. Participants with a CSR of 2 or lower on the Social Phobia module of the ADIS/ASA, but a CSR score of 4 or higher on any other anxiety disorder, were included in the NSA group.

Four binary logistic regressions were conducted to examine whether different presentations of social anxiety (SAD, OSF) are associated with greater social impairment per the ADIS/ASA Social Functioning items than other, non-social anxiety (NSA). The ADIS/ASA Social Functioning items were dummy-coded such that 0 indicated no or minimal difficulties (i.e., a score of 0 or 1) and 1 indicated moderate or severe difficulties (i.e., a score of 2 or 3). Anxiety severity (highest CSR across all anxiety diagnoses on the ADIS/ASA), anxiety comorbidity (number of co-occurring anxiety diagnoses per the ADIS/ASA), presence of comorbid psychopathology (ADHD, depression, ODD), and research site were entered as covariates in Step 1 in all regression analyses. The three anxiety groups were then entered in the Step 2, with SAD as the reference group. Odds ratios were calculated to determine the effect size of statistically significant predictor variables. Additionally, 95% confidence intervals were calculated for all odds ratios. Regression analyses were conducted using SPSS 23.

Assumptions of binary logistic regression. The first assumption of binary logistic regression is the absence of multicollinearity among variables. Similar to the tests of assumptions for the network analysis, a Spearman intercorrelation matrix of the ADIS/ASA Social
Functioning items and CSRs of anxiety severity was examined to test for multicollinearity. Any items that were highly correlated ($r = 0.8–0.9$) were combined into a single composite variable (Grice & Iwasaki, 2007). The second assumption of binary logistic regression is the absence of extreme outliers among the continuous predictor variables. To test this assumption, a box plot was calculated for anxiety comorbidity to identify extreme outliers (i.e., values $> 3$ times the interquartile range away from the median). If any extreme outliers were identified, they were removed from each regression to determine if they had an undue influence on model fit (i.e., Nagelkerke’s $R^2$) (Aguinis, Gottfredsen, & Joo, 2013). Any extreme outliers that were found to influence model fit were excluded from that analysis. The third assumption of binary logistic regression is the assumption of independence of observations. To address the assumption of independence, it is necessary to ensure that observations in each group are independent (i.e., groups consist of different individuals recruited via random sampling). While the sample recruited for the TAASD trial was a convenience sample and thus not randomly selected, participants could only be assigned to either the SAD, OSF or NSA group, and could only receive a score of 0 (no or minimal impairment) or 1 (some or severe impairment) on the ADIS/ASA Social Functioning items. Thus, the assumption of independence of observations should be met.

**Power Analysis**

A power analysis was conducted for the TAASD trial, which found that a sample of approximately 180 participants was needed to conduct general linear mixed models and detect a between-group (BIACA vs. *Coping Cat*) difference at a medium-sized effect ($d = 0.47$) over two time points (mid-treatment and post-treatment) with at least 80% power at $\alpha = .05$ (Kerns et al.,
A sample of $N = 214$ was recruited to account for possible attrition throughout the course of the trial.

Given the novelty of psychological network analysis as a statistical technique, power analysis techniques have not yet been developed for network analysis procedures (Epksamp et al., 2018). Simulation studies suggest that larger sample sizes yield more accurate estimations of network structure and more stable centrality indices (Epskamp et al., 2018); however, prior studies involving a similar or greater number of nodes and similar sample size to the current study have demonstrated moderate to good accuracy and stability estimates (Armour, Fried, Deserno, Tsai, & Pietrzak, 2017; Levinson et al., 2017). As such, it is believed that the current sample size is sufficient to estimate a network of ten nodes with satisfactory reliability and accuracy.
Chapter Three: Results

Descriptive Statistics of Demographic and Clinical Variables

The average age of participating children was 9.95 years (SD = 1.78) and the sample was predominantly male ($n = 156, 78.4\%$) and White ($n = 152, 77.2\%$). Participants presented with a range of severity of autism and anxiety symptoms per the ADOS-2 Total severity score (range: 1–10) and the 7-Item PARS Total (range: 8–33), and mildly impaired to superior intellectual functioning per the full-scale IQ (FSIQ) of the WISC-IV (range: 54–146). Five participants (2.5\%) received an FSIQ below 70 and four participants (2.1\%) received an FSIQ above 130. GAD was the most prevalent anxiety diagnosis ($n = 141, 71\%$), followed by SAD ($n = 97, 48.5\%$) and specific phobia ($n = 88, 44.0\%$). ADHD was the most prevalent form of comorbid psychopathology ($n = 128, 64.0\%$), followed by ODD ($n = 34, 17.0\%$). Seventy-seven of 200 children (38.5\%) were using psychiatric medication, primarily stimulants ($n = 45, 22.5\%$), selective serotonin reuptake inhibitors ($n = 33, 16.5\%$), and $\alpha$-agonists ($n = 26, 13.0\%$). Visual inspection of box plots revealed that, of these participants, none were identified as extreme outliers (i.e., values > 3 times the interquartile range away from the median) on any of the variables of interest. See Table 1 and 2 for descriptive statistics of the demographic and clinical characteristics of the full sample and of the three groups of interest (SAD, OSF, NSA). See Table 3 and 4 for descriptive statistics of the key variables of interest.

Tests of Statistical Assumptions

To test for multicollinearity among the primary variables of interest, zero-order Spearman correlation matrices (for ordinal measures) and Pearson correlation matrices (for continuous measures) were calculated (see Table 5). Overall, no concerns regarding multicollinearity were
observed. Additionally, box plots were examined for all continuous variables to identify outliers, defined as values > 3 times the interquartile range away from the median. No extreme outliers were detected.

**Aim 1: Network Estimation**

The network was estimated via the graphical LASSO algorithm with EBIC model selection and plotted using the *R* package *bootnet*, whereby variables of interest are represented as nodes (circles in the graph) and the unique connections between them are represented as edges (lines in the graph). Blue edges indicate positive connections between nodes, while red edges indicate negative connections. Thickness of the edges indicate the strength of the connection whereby thicker edges indicate stronger connections. Predictability estimates are represented by the light grey circle surrounding each node. Node placement was determined by the Fruchterman-Reingold (1991) algorithm which places the most strongly connected nodes centrally and weakly connected nodes peripherally.

The obtained network is presented in Figure 2. Three distinct communities of strongly connected nodes were detected by the spin glass algorithm that seem to reflect strong associations among measures of social ability, social integration, and anxiety, with few associations between these communities. The first community, which includes the friendship difficulties, social motivation, social affect (i.e., ADOS:SA), and ToM nodes, seems to capture the difficulties with social communication and social reciprocity that are classically associated with ASD. In particular, the ToM, friendship quality, and social motivation nodes are among the most strongly connected nodes in the network (i.e., demonstrating a thicker edge in the network). The social affect node is also connected to the ToM, social motivation and friendship difficulties nodes, though less strongly. The second community, which includes the social problems (i.e.,
CBCL:SP), social competence (i.e., SRS-2), and bullying nodes, appears to reflect the social exclusion and rejection that may be experienced by children with more severe ASD symptoms. The social problems node is strongly connected to the social competence and bullying nodes, though social competence and bullying are only weakly connected. Notably, ToM appears to act as a bridge within the network, connecting these two otherwise distinct social ability and social integration communities via a moderate edge with social competence, as well as a weak edge with bullying. Also of note is that the anxiety severity and comorbidity nodes, which form the third community, are strongly connected to one another, but do not appear to be connected to most other nodes in the network, with the exception of a moderate connection to the bullying node. Other weak edges, indicating statistically significant but smaller associations relative to the other associations in the network, were also observed, including an edge between friendship difficulties and social competence.

The predictability index demonstrated that, on average, approximately 23.5% of each node’s variance could be explained by the nodes to which it is connected ($M_{\text{Predictability}} = .235 \pm .079$). Within the social ability community, 28.2% of the variance of both the ToM and social motivation nodes was explained by the nodes that they are directly connected to. By contrast, variance in the friendship difficulties and social affect nodes were moderately explained by the nodes that they were connected to (friendship difficulties predictability = .207, social affect predictability = .156). Within the social problems cluster, approximately 30% of the variance within the social problems (i.e., CBCL:SP), social competence (i.e., SRS-2), and bullying nodes was explained by the nodes they were connected to (social problems predictability = .336, social competence predictability = .306, bullying experiences predictability = .279). Variance in the anxiety nodes was less well explained by other nodes in the network (anxiety severity
predictability = .130, anxiety comorbidity predictability = .133). It is worth stressing that, on average, the majority of variance (i.e., 76.5%) in the network was unexplained.

**Network robustness.** Non-parametric boot-strapping was conducted to evaluate the accuracy of edge-weight estimates, or the structure and strength of edges between nodes in the network. To do so, 1,000 bootstraps were run to calculate 95% CIs on each edge-weight (i.e., each unique connection between nodes in the network). A graph of non-parametric bootstrapped confidence intervals of estimated edges is presented in Figure 3. The CIs of most edge-weights in the network are relatively narrow, suggesting that the strength of edges in the network can be interpreted with a greater degree of certainty. Though there is considerable overlap among the 95% CIs of the edge-weights in the network, six of the strongest edges were significantly greater than zero, suggesting that the network is moderately accurately estimated. This is consistent with reported accuracy of psychological networks with similar sample sizes (Armour et al., 2017; Levinson et al., 2017).

**Aim 2: Network Centrality Indices**

Degree centrality and the standardized z-score centrality indices (strength, betweenness, closeness) for each node are presented in Figure 4. When accounting for all four centrality indices, ToM was the most central node in the network, and the anxiety nodes were the least central nodes in the network. ToM had the highest degree centrality, demonstrating unique connections to five other nodes in the nine-node network. ToM also demonstrated the highest strength centrality and among the highest betweenness and closeness centrality metrics, suggesting that the ability to understand the thoughts and feelings of others plays an important role in the social skills and social experiences of the current sample of children with ASD and anxiety disorders. This can be seen visually in the plotted network, in which ToM shares strong
edges with four other nodes and appears to serve as the primary link between the social ability
and social integration communities, which are otherwise largely distinct from one another.

**Stability of centrality estimates.** A subset bootstrap procedure was conducted to
evaluate the stability of the centrality indices. CS-coefficients of 0.285, 0.205, and 0 were found
for strength, closeness, and betweenness centrality indices, respectively. A minimum CS-
coefficient of .25 is recommended for interpreting centrality indices (Epskamp et al., 2017). Per
these guidelines, these results indicate that strength centrality is the most stable centrality index,
whereas closeness and betweenness centrality may not be stable and should be interpreted
cautiously. This is in line with research suggesting that closeness and betweenness are unstable
estimates, particularly in psychological networks (Bringmann et al., 2019).

**Exploratory Network Analyses**

**Social anxiety.** An exploratory network involving the subsample of children with social
anxiety (SAD or OSF; n = 123) was estimated to examine the influence of type of social anxiety
on the network structure (see Figure 5). A binary variable reflecting type of social anxiety (1 =
SAD; 0 = OSF) was added to the network along with the original nine social functioning and
anxiety variables. A negative edge emerged between the social anxiety node and the social affect
and ToM nodes, indicating that a diagnosis of OSF is associated with greater impairment in ToM
and reciprocal social communication. The overall structure of the network remained the same,
though a weak edge emerged between ToM and social problems. Interestingly, the edge between
ToM and bullying that was positive in the primary network grew negative in this network,
suggesting that, among children with ASD and social anxiety, the ability to understand the
thoughts and feelings of others may be associated with increased risk of being bullied rather than
reduced risk of bullying, as seems to be the case in the full sample.
**Comorbid psychopathology: ADHD.** Exploratory networks were estimated to examine the influence of each comorbid psychopathology (ADHD, depression, ODD) on the network structure. A binary variable indicating diagnosis of ADHD (a CSR of 4 or higher on ADHD-I, ADHD-H/I or ADHD-C on the ADIS/ASA) was added to the network along with the original nine social functioning and anxiety variables (see Figure 6). Weak edges are apparent between ADHD and bullying, social competence, and ToM, suggesting that a diagnosis of ADHD is associated with more severe ASD-related social impairment, greater difficulties with ToM, and greater likelihood and severity of bullying experiences. No changes were observed among the pre-existing edges between the social functioning and anxiety variables.

**Comorbid psychopathology: Depression.** A binary variable indicating a diagnosis of depression (a CSR of 4 or higher on MDD or dysthymia on the ADIS/ASA) was added to the network (see Figure 7). The depression node demonstrated a moderately strong edge with social competence, and a weaker edge with social problems, suggesting that more severe ASD-related social impairment and greater difficulties getting along with peers are associated with clinically significant depressive symptoms. Depression diagnosis also shared a moderately strong edge with anxiety severity. Otherwise, the structure and strength of pre-existing edges among the social functioning and anxiety variables remained largely unchanged from the primary network.

**Comorbid psychopathology: ODD.** A binary variable indicating a diagnosis of ODD (a CSR of 4 or higher on ODD on the ADIS/ASA) was added to the network (see Figure 8). A weak edge appeared between ODD and ToM, and a moderately strong edge appeared between ODD and social problems, suggesting that a diagnosis of ODD was associated with greater difficulties getting along with peers and less awareness of the thoughts and emotions of others. As in the two prior comorbid psychopathology networks, the overall network structure and
strength of pre-existing edges among the social functioning and anxiety variables did not change when accounting for the variance added by ODD diagnosis.

**Aim 3: Binary Logistic Regressions**

Four binary logistic regressions were conducted to examine the association of anxiety type (SAD, OSF, NSA) with specific social skills and experiences (ToM, social motivation, friendship difficulties, bullying experiences) per the ADIS/ASA Social Functioning items, controlling for anxiety severity and comorbidity, comorbid psychopathology, and research site. The SAD group was the reference group across all four analyses. Beta weights, odds ratios, and 95% CIs of odds ratios are presented. See Table 6 for a summary of regression results.

**Theory of Mind.** In Step 1 of the model, none of the covariates (anxiety severity and comorbidity, comorbid psychopathology, research site) were significantly associated with ToM impairment. In Step 2, impairment in ToM was significantly greater in the OSF than in the SAD group ($\beta = 1.00, p = .041, \text{OR} = 2.71 [1.04, 7.05]$), indicating that children with OSF in the current sample are more likely to experience significant difficulties in ToM than children with SAD. However, impairment in ToM was not significantly different between the NSA and SAD groups ($\beta = -0.22, p = .514, \text{OR} = 0.81 [0.42, 1.54]$). Overall, the final model accounted for 8.9% of the variance in ToM.

**Social motivation.** Like the ToM model, none of the covariates were significantly associated with difficulties with social motivation. In Step 2, difficulties with social motivation were not significantly greater in either the OSF group ($\beta = 0.44, p = .460, \text{OR} = 1.55 [0.48, 4.99]$) or the NSA group ($\beta = -0.10, p = .834, \text{OR} = 0.91 [0.36, 2.30]$) compared to the SAD group. Overall, the final model accounted for 2.3% of the variance in social motivation.
**Friends.** In Step 1 of the model, none of the covariates were significantly associated with friendship difficulties. In Step 2, friendship difficulties were not significantly greater in either the OSF group ($\beta = -0.04, p = .933, OR = 0.96 [0.35, 2.63]$) or the NSA group ($\beta = -0.44, p = .256, OR = 0.65 [0.30, 1.38]$) compared to the SAD group. Overall, the model accounted for 4.1% of the variance in friendship difficulties.

**Bullying.** In Step 1 of the model, anxiety comorbidity ($\beta = 0.37, p = .002, OR = 1.44 [1.14, 1.82]$), ADHD diagnosis ($\beta = 0.82, p = .032, OR = 2.27 [1.07, 4.80]$), and research site ($\beta = -0.62, p = .003, OR = 0.54 [0.36, 0.82]$) were significantly associated with presence and severity of bullying experiences. Anxiety severity, comorbid ODD, and comorbid depression were not significantly associated with bullying. In Step 2, the severity of bullying experiences was not significantly greater in the OSF group ($\beta = -0.36, p = .503, OR = 0.70 [0.24, 2.01]$) or the NSA group ($\beta = -0.08, p = .820, OR = 0.92 [0.45, 1.89]$) compared to the SAD group. Taken together, these findings suggest that greater number of comorbid anxiety disorders, as well as a comorbid diagnosis of ADHD, may be related to increased risk and severity of bullying experiences among the current sample of children with ASD and anxiety disorders. Overall, the model accounted for 23.7% of the variance in bullying experiences.
Chapter Four: Discussion

The current study sought to extend prior work by using network analysis to examine how different facets of social functioning relate to one another and to anxiety severity and comorbidity in a large treatment-seeking sample of children with ASD and anxiety disorders. Additionally, this study sought to clarify the role of social functioning in the presentation of anxiety symptoms in children with ASD; specifically, whether different presentations of social (SAD, OSF) or non-social anxiety are associated with different types of social problems. In doing so, this study sought to illustrate key areas of social difficulty experienced by children with ASD and anxiety disorders, extending prior empirical and clinical work and potentially indicating optimal targets for intervention among anxiety disorders generally, and traditional and distinct presentations of social anxiety specifically, in this population.

As expected, ToM, social motivation, friendship quality, and social affect (ADOS:SA) were among the most strongly connected nodes in the network, forming a fully interconnected community that seems to reflect the key social deficits characteristic of ASD (i.e., difficulties in social communication and understanding that affect social behaviour and relationships; American Psychiatric Association, 2013). These findings suggest that the ability to engage in reciprocal social communication, and the social awareness, interest and engagement needed to develop positive relationships with peers, may be a highly inter-connected set of social skills for children with ASD and anxiety disorders. In contrast to prior studies, which have predominantly relied on broad parent-report measures of social functioning (e.g., Duvekot et al., 2018; Mazurek & Kanne, 2010; McVey et al., 2018), the current study examined specific elements of social functioning via clinically informed measures of social skills and experiences. The social ability community indicated in this network includes specific measures of social functioning from two
unique sources (i.e., clinical observation, clinical interview with parent), supporting the robustness of the current findings and providing a more nuanced understanding of how the social communication difficulties observed in youth with ASD and anxiety disorders might affect other social skills and behaviours, particularly the social interest and skills necessary to establish and maintain friendships.

Friendship quality and social motivation were among the most strongly connected nodes in this community, suggesting that a child’s level of interest in social interactions and relationships is highly linked to their ability to develop and maintain reciprocal friendships, and vice versa. Though prior work has demonstrated that children with ASD and anxiety with more limited social interest may also demonstrate poorer social skills, which was believed to indirectly impact friendship quality (Bellini, 2004; Bellini, 2006), the current study demonstrates a direct link between these constructs. Additionally, the social affect node shared moderately strong edges with ToM and social motivation, but only shared a weak edge with friendship quality, suggesting that the link between poor social communication skills and poorer quality peer relationships reported in prior work (see Schroeder et al., 2014) may be better explained by other facets of social functioning, like social motivation or ToM. That is, the ability to engage in reciprocal social communication may only influence the quality of peer relationships in children with ASD and anxiety disorders who are socially motivated and attuned to the mental states of others. Surprisingly, friendship difficulties were not associated with bullying experiences in the current sample, contradicting evidence from a number of studies involving youth with and without ASD (Humphrey & Hebron, 2014; Spriggs, Iannotti, Nansel, & Haynie, 2007; Wainscot, Naylor, Sutcliffe, Tantam, & Williams, 2008). Nonetheless, these findings may be a hopeful indication that experiences of bullying and social exclusion may not result in global social
isolation, and that children with ASD and anxiety can develop positive relationships with some peers even when others victimize and reject them.

Distinct from this social ability community, a second community comprised of the social problems (CBCL:SP), social competence (i.e., SRS-2), and bullying experiences nodes was observed. If the social ability community reflects the social deficits associated with ASD, this social integration community may reflect the peer rejection and victimization that can sometimes result from the social impairment associated with ASD (Schroeder et al., 2014; Chou et al., 2019). Notably, ASD-related social impairment per the SRS-2 was strongly associated with difficulties getting along with peers and weakly associated with bullying experiences, suggesting that greater ASD-related social impairment may put children with ASD and anxiety disorders at greater risk of negative peer experiences. The SRS-2 is a broad measure of social functioning and autistic traits that captures ASD-related difficulties with social interaction and understanding (e.g., social motivation, social cognition), as well as restricted and repetitive behaviours and interests. The latter cluster of symptoms have been identified as risk factors for peer rejection and victimization among youth with ASD (Schroeder et al., 2014), which may explain the link between the scores on SRS-2 and difficulties getting along with peers observed in the current network. Like the social ability community, this community also contains nodes from different measurement formats (i.e., parent-report questionnaire, clinical interview), further supporting the robustness of these associations.

The anxiety nodes, which made up the third community, were peripherally located in the network and largely unrelated to social communication skills and the quality of peer relationships. However, consistent with recent findings (Chou et al., 2020; Hu et al., 2016, 2019; Zeedyk, Rodriguez, Tipton, Baker, & Blacher, 2014), greater severity and variety of child
anxiety symptoms was associated with greater risk of negative peer experiences, including bullying, teasing, and social exclusion. This raises the question of whether peer victimization and exclusion precipitates the development of anxiety disorders in children with ASD (as in typical development; Pabian & Vandebosch, 2016; van Oort et al., 2011), or if the presence of severe and varied anxiety symptoms earlier in life put children at greater risk of being bullied or rejected by peers as they age and social demands grow more complex (Picci & Scherf, 2015).

Consistent with our second hypothesis, ToM emerged as a central variable in the network, demonstrating strong to moderate edges with nearly every other social functioning node (with the exception of social problems). The centrality of ToM can also be seen visually in the plotted network, in which it appears to act as a bridge between the otherwise distinct social ability and social integration communities. Based on these findings, it seems that the ability to understand others’ thoughts and feelings may play a critical role in both seeking out and experiencing positive peer relationships, as demonstrated by the strong edges between ToM and the friendship quality and social motivation nodes, as well as avoiding or reducing risk of negative social experiences, as demonstrated by the moderate edge between ToM and the bullying experiences node. Prior work has shown that ToM is related to better social well-being (e.g., greater peer acceptance, more friendships) and less social adversity (e.g., bullying) among children and adolescents with and without ASD (Brunsdon & Happé, 2014; Happé, 2015; Mazza et al., 2016; Liu et al., 2018; Lonigro, Baiocco, Pallini, & Laghi, 2018; Peterson, Slaughter, Moore, & Wellman, 2016; Shakoor et al., 2012; see Derksen, Hunsche, Giroux, Connelly, & Bernstein, 2018 for a review). The current study supports and extends these findings among children with ASD and anxiety disorders, who are at heightened risk of poor social outcomes (Chang et al., 2012; Spain et al., 2018), by suggesting that ToM ability is associated with a range
of social abilities and experiences, and thus may be a central factor in the social well-being of this at-risk population. Notably, ToM is strongly associated with nodes from every measurement format in the current study (parent-report questionnaire, clinical interview with parent, observational assessment), highlighting the importance of this social-cognitive skill across a range of environments (e.g., per parent-report: at home or school; per observational assessment: in an interaction with a stranger). The centrality of ToM in the current network, as well as the strength of its connections to other nodes in the network, suggests that improvements in ToM may lead to more global improvements in social outcomes and overall quality of life for children with ASD and anxiety disorders. Some treatment trials have incorporated social skills training into CBT protocols for anxiety in ASD, with promising results (Drahota et al., 2011; Wood et al., 2015; Wood et al., 2019). Thus, the addition of ToM training to existing psychosocial treatment programs may represent the next step in the development of modified interventions for anxiety disorders that accommodate the unique needs of clients with ASD.

Hypotheses regarding the relationship of social functioning to different presentations of social anxiety were partially supported. Children with OSF were more likely to have impaired ToM compared to children with SAD, but not reduced social motivation, nor poorer friendships or more severe bullying experiences. In other words, children with ASD with social fears who did not demonstrate or express concerns about negative social evaluation had more difficulty understanding the thoughts and feelings of others, but were not more or less socially motivated, nor more or less likely to have poorer quality friendships or experience peer victimization or rejection, than children with ASD with traditional social anxiety or other non-social anxiety. Notably, rates of impairment in social motivation, friendship quality and bullying experiences were similar across presentations of social anxiety (SAD, OSF) and non-social anxiety.
Significant impairment in social motivation was present in a minority of participants, whereas poor friendship quality and moderate to severe bullying were present in approximately half and three-quarters of participants, respectively. These findings suggest that the presentation of social anxiety in children with ASD, particularly the presence or absence of fear of negative evaluation, is influenced by social understanding, whereas social motivation or social outcomes like bullying and friendship attainment may be similarly impacted across anxiety presentations. The current study provides empirical evidence that children with OSF present with different social challenges than children with SAD, bolstering evidence that OSF represents a qualitatively distinct presentation of social worries from SAD. As reported in qualitative studies of social worry in adults with ASD, it is possible that these children fear and avoid social situations as a result of the confusion and uncertainty that undoubtedly results from struggling to understand others’ intentions and emotions and feeling unsure of the rules of social interactions and relationships. As stated by a participant in Halim et al.’s (2016) qualitative study: “Reading between the lines is impossible… people will say things and mean something else entirely...and I miss something important”. The current study suggests that fears arising from this sense of social uncertainty may occur in children as well as adults with ASD, suggesting that the inclusion of social skills and ToM training into interventions for children with ASD and co-occurring anxiety is warranted.

Results also do not support our hypotheses that social ability or quality of peer relationships differ in children with ASD with or without social anxiety. Prior evidence has indicated that youth with ASD with more severe social anxiety also demonstrate poorer social skills (e.g., cooperation, assertiveness, reciprocity) and social information processing (e.g., hostile attribution bias) (Bellini, 2004; Bellini, 2006; Chang et al., 2012; Maddox & White,
2015; Meyer et al., 2006; Usher et al., 2015), which may affect the quality of peer relationships. However, only one of these studies also assessed other, non-social anxiety disorders (Chang et al., 2012). Our results extend this work by suggesting that children with ASD and anxiety disorders may demonstrate similar rates of impairment in ToM and social motivation, and may experience severe bullying and poor friendship quality at similar rates, regardless of whether their fears or social or non-social in nature.

Another finding of note in the current study is the lack of association between anxiety severity and comorbidity and social ability or the quality of peer relationships, both when considering zero-order correlations among the variables as well as the unique associations among nodes in the network. In the only other study to date to examine the association between anxiety severity assessed via clinical interview and social ability (i.e., assertiveness) (Kerns et al., 2015), a similar pattern of findings was reported. Notably, both the current study and Kerns et al. (2015) involved samples with clinical anxiety, which may not capture as wide a range of anxiety severity, and thus may not be as sensitive to the effect of anxiety on social functioning, as samples with non-clinical anxiety (e.g., Eussen et al., 2013; McVey et al., 2018). Additionally, the ADIS/ASA CSRs are a categorical measure of anxiety severity, which may not be as sensitive as continuous measures (e.g., the PARS). Clinical ratings of anxiety severity may also relate to social functioning measures differently than standard parent-report questionnaires of anxiety symptoms. Whereas parents may respond to questionnaires based on their child’s global impairment, which may overlap with difficulties related to social problems or ASD symptoms (Moskowitz et al., 2017), clinical interviews allow the clinician to guide the parent to report on anxiety-related impairment that is independent of these overlapping challenges. This is particularly true of the ADIS/ASA, which was designed specifically to differentiate between
autism and anxiety symptoms (Kerns et al., 2014, 2017). Interestingly, removing the anxiety nodes from the network did not change the overall structure of the associations among variables, suggesting that though the severity of social problems may be greater in youth with ASD and clinical anxiety compared to youth with ASD alone (Chang et al., 2012; Spain et al., 2018), the interactions among these social domains may be similar. However, given that the current sample did not include children with ASD without anxiety disorders, interpretations of this finding are limited; further investigation is needed to compare the network structure of different facets of social functioning and anxiety among children with ASD with and without clinical anxiety.

Other forms of comorbid psychopathology—ADHD, depression, ODD—were also found to be associated with several facets of social functioning in the network, though it is interesting to note that accounting for other psychiatric comorbidities did not alter the overall structure and strength of associations between the social functioning nodes. Depression was moderately associated with social problems, perhaps capturing the social isolation, loneliness and associated negative mental health outcomes (i.e., anxiety, depression, suicidality) that have been linked to lack of peer acceptance in prior work involving youth with ASD (van Schalkwyk et al., 2018; Wright & Wachs, 2019). Depression and ADHD were also linked to the anxiety severity node, suggesting that more severe anxiety symptoms are associated with greater risk of co-occurring mental health concerns, a well-documented finding in the literature (Mannion, Brahm, & Leader, 2014; Ung et al., 2013). Consistent with prior research, a diagnosis of co-occurring ADHD was associated with greater bullying severity (McVey et al., 2018; Montes & Halterman, 2007) and ADHD and ODD were both associated with poorer ToM (Mandy, Skuse, Steer, St Pourcain, & Oliver, 2013; Uekermann et al., 2010). Additionally, both ADHD and depression were moderately associated with ASD-related social impairment per the SRS-2, which aligns with
research suggesting that the SRS-2 may also capture symptoms of other commonly co-occurring psychopathology in youth with ASD, particularly ADHD and depression (Moul, Cauchi, Hawes, Brennan, & Dadds, 2015; South et al., 2017). Considering this, it is possible that the association between the SRS-2 and the social problems and bullying experiences nodes observed in the network may not purely reflect the influence of ASD-related social challenges, but also the social impairment associated with other comorbid psychopathology. Socially “inappropriate” behaviours such as those captured by the SRS-2, including fixating on special interests during conversations, overeager approach-related behaviours, and lack of understanding or violation of social norms, are also common in ADHD, and may increase the risk of peer victimization (Nijmeijer et al., 2008). ADHD is estimated to co-occur in approximately 30-70% of children with ASD (Antshel, Zhang-James, Wagner, Ledesma, & Faraone, 2016; Leitner, 2014; Simonoff et al., 2008) (and 64% of the current sample), highlighting the importance of considering all facets of a child’s clinical presentation to understand the social challenges they may face.

**Strengths & Limitations**

The current study had several strengths and limitations. Though analyses suggest that the network was accurately estimated, two of the three estimated centrality indices—closeness and betweenness—did not meet Epskamp et al.’s (2018) recommended stability threshold, casting some doubt over the interpretability of these estimates. However, the presence and strength of edges in the network can be interpreted with more certainty: The graphical LASSO procedure with EBIC model selection, adjusted to select the most sparse and specific estimated network, ensures that only the strongest uniquely dependent associations are included in the network. Additionally, the CS-coefficient for strength centrality was within the acceptable range, indicating that the strength of the edges in the network are likely accurate and can be interpreted
with more confidence. Even when only considering degree and strength centrality, ToM is still the most central node in the network; thus, our interpretations of the centrality indices are supported, despite the potential instability of the betweenness and closeness indices.

Additionally, strong associations were observed between nodes from multiple information sources, a finding that is rare in most psychological networks. In mixed methods networks, community estimation will often reveal clusters of closely related nodes from the same measurement format or informant, such as items on a parent-report symptom checklist, while nodes from a different measurement format or informant are more distant and peripheral (e.g., Montazeri et al., 2019). This is a standard finding in psychological research, in which data from multiple information sources often demonstrate weaker associations than data from the same information source, despite measuring the same construct (De Los Reyes & Kazdin, 2005). By contrast, in the current network, two of three communities of strongly connected nodes contain nodes from different measurement formats, offering a testament to the strength of the associations among these constructs and perhaps the reliability of the findings reported here.

However, it is worth noting that, although the clinical severity ratings of the ADIS/ASA were made by trained clinicians, the ratings were based on parent report; thus, most measures in the study ultimately relied on parent report, even though some were interpreted through a clinical lens. Parent report may not be fully representative of children’s social skills and peer relationships, given parents’ limited access to their child’s social world (e.g., school). For example, parent-reported rates of peer victimization are often significantly lower than self- and peer-reported rates among children with and without ASD (Matsunaga, 2009; Rowley et al., 2012; van Schalkwyk et al., 2018). Additionally, though parents may be better able to report on daily evidence of ToM (e.g., response to the emotions of others) than can be tested in an...
experimental setting, these reports are nonetheless subjective and may not provide as specific a measure of ToM ability as experimental ToM tasks completed by the child.

Another limitation of the current study was the relatively high intellectual functioning of children in the current sample (average FSIQ on the WISC-IV = 100.89). Though children with an FSIQ below 70 were included in the current sample, they represented a very small proportion of participants (2.6%). Higher IQ may protect against some of the negative social outcomes experienced by youth with ASD and anxiety (e.g., social communication difficulties, friendship difficulties) (Black, Wallace, Sokoloff, & Kenworthy, 2009). As such, the severity of social problems may be greater among the general population of youth with ASD, and the associations among social problems, as well as the influence of social problems on the presence and presentation of anxiety symptoms, may differ from current findings. The current sample was also not representative of the variation in ethnicity (Centers for Disease Control & Prevention, 2019) and, to a less concerning degree, gender (Loomes et al., 2017) of children on the spectrum. This is a widespread issue in the literature on ASD (Pickard et al., 2019) and may result in findings that are generalizable only to a small portion of individuals on the spectrum.

Finally, the OSF group was relatively small ($n = 26$); thus, the current study may have been underpowered to detect differences in the degree of social impairment across the three anxiety groups.

**Future Directions**

The current study gives rise to a number of important questions for future research. One question that could not be answered by the current study is the directionality of the associations among different facets of social ability and peer relationships in children with ASD and anxiety.
disorders. For example, it is unclear whether more developed ToM skills result in greater social motivation and better social communication skills, or if children who are more socially motivated and have more positive social experiences then develop better ToM skills by learning from their peers (as typically-developing children learn from their siblings; McAlister & Peterson, 2007; McAlister & Peterson, 2013; Prime, Plamondon, Pauker, Perlman, & Jenkins, 2016). Further, while the current network and prior evidence support the hypothesis that poor ToM ability may increase risk of peer victimization, which then leads to increased anxiety severity, the cross-sectional nature of the current analyses limit any interpretations of causality. Longitudinal analyses investigating the development of social skills, peer relationships, and anxiety symptoms across childhood and adolescence are needed to better understand the developmental trajectories of these psychosocial phenomena in children with ASD. Doing so may provide insight into early risk factors of social difficulties and anxiety symptoms and inform early intervention strategies for this at-risk population. Finally, further work is needed involving larger samples of children with ASD and OSF to replicate and extend the current findings, in order to understand the unique social challenges faced by these children and to further clarify potential areas of intervention for future clinical research and practice.

Summary & Clinical Implications

The current study offers a nuanced view into how difficulties across different aspects of social functioning may relate to one another, and influence the presentation of social and non-social fears, among children with ASD and co-occurring anxiety disorders. The use of cutting-edge network analytic techniques provided novel insight into the profile of social functioning among children with ASD and anxiety. In particular, strong associations were observed between facets of social functioning related to the core social deficits of ASD (social motivation, ToM,
social affect, friendship quality), and between measures of social integration (i.e., being bullied, not getting along with peers, broad ASD-related social impairment), indicating that problems in one domain of social ability or peer relationships may have a domino effect on other, related forms of social functioning. Little overlap was observed between these two communities, with the exception of ToM, which played a highly central role and was associated with nearly every measure of social ability and peer relationships in the network. These findings suggest that improvement in this social-cognitive skill may also lead to improvement across a range of social skills and the overall quality of peer relationships, indicating that ToM may represent an optimal target for clinical interventions for children with ASD and anxiety disorders.

This study also provided empirical evidence that ToM ability may differ across traditional and distinct presentations of social anxiety. Current findings suggest that children with other social fears who do not express fear of negative evaluation may have greater difficulty understanding the thoughts and feelings of others than children with ASD and traditional social anxiety, providing empirical support for the theoretical conceptualization of other social fears as a qualitatively distinct presentation of social worries. Thus, development of tailored interventions, adapted specifically to address this unique presentation of social anxiety, is warranted. Further, incorporating ToM skill training into these interventions may serve to reduce the social uncertainty and confusion associated with this distinct presentation, hopefully ameliorating the associated distress and improving social and mental health outcomes for these youth.
Table 1. Descriptive Statistics of Sample Demographic and Clinical Characteristics

<table>
<thead>
<tr>
<th>Demographic Characteristics</th>
<th>N</th>
<th>n (%) or M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
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<td>9.96 (1.78)</td>
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<tr>
<td>Sex</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>157</td>
<td>(78.5%)</td>
</tr>
<tr>
<td>Female</td>
<td>43</td>
<td>(21.5%)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>197</td>
<td></td>
</tr>
<tr>
<td>Black or African American</td>
<td>11</td>
<td>(5.6%)</td>
</tr>
<tr>
<td>Asian</td>
<td>15</td>
<td>(7.6%)</td>
</tr>
<tr>
<td>White</td>
<td>152</td>
<td>(77.2%)</td>
</tr>
<tr>
<td>Native Hawaiian or Other Pacific Islander</td>
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<td>(0.5%)</td>
</tr>
<tr>
<td>American Indian or Alaskan Native</td>
<td>3</td>
<td>(1.5%)</td>
</tr>
<tr>
<td>Other</td>
<td>15</td>
<td>(7.6%)</td>
</tr>
<tr>
<td>Living Arrangements</td>
<td>197</td>
<td></td>
</tr>
<tr>
<td>Both biological parents</td>
<td>138</td>
<td>(70.1%)</td>
</tr>
<tr>
<td>Both biological parents (joint custody)</td>
<td>7</td>
<td>(3.6%)</td>
</tr>
<tr>
<td>Biological parent and stepparent/partner</td>
<td>14</td>
<td>(7.0%)</td>
</tr>
<tr>
<td>Single biological parent</td>
<td>24</td>
<td>(12.2%)</td>
</tr>
<tr>
<td>Adoptive parent(s)</td>
<td>7</td>
<td>(3.6%)</td>
</tr>
<tr>
<td>Grandparent(s)</td>
<td>1</td>
<td>(0.5%)</td>
</tr>
<tr>
<td>Other relative(s)/friend(s)</td>
<td>1</td>
<td>(0.5%)</td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
<td>(2.5%)</td>
</tr>
<tr>
<td>Site</td>
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</tr>
<tr>
<td>University of California Los Angeles</td>
<td>75</td>
<td>(37.5%)</td>
</tr>
<tr>
<td>University of South Florida</td>
<td>70</td>
<td>(35%)</td>
</tr>
<tr>
<td>Temple University</td>
<td>55</td>
<td>(27.5%)</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Clinical Characteristics</th>
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</thead>
<tbody>
<tr>
<td>Full-Scale IQ (WISC-IV)</td>
<td>194</td>
<td>100.89 (16.02)</td>
</tr>
<tr>
<td>ADOS-2 Total Severity Score</td>
<td>190</td>
<td>7.18 (2.24)</td>
</tr>
<tr>
<td>PARS 7-Item Anxiety Severity Score</td>
<td>196</td>
<td>23.84 (3.60)</td>
</tr>
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<td>Comorbid Psychopathology</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>Attention Deficit Hyperactivity Disorder</td>
<td>128</td>
<td>(64.0%)</td>
</tr>
<tr>
<td>Oppositional Defiant Disorder</td>
<td>24</td>
<td>(17.0%)</td>
</tr>
<tr>
<td>Major Depressive Disorder or Dysthymia</td>
<td>16</td>
<td>(8.0%)</td>
</tr>
<tr>
<td>Post-Traumatic Stress Disorder</td>
<td>1</td>
<td>(0.5%)</td>
</tr>
</tbody>
</table>
Table 1. Descriptive Statistics of Sample Demographic and Clinical Characteristics

<table>
<thead>
<tr>
<th>Condition</th>
<th>N</th>
<th>n (%) or M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Traditional Anxiety</strong></td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>Social Anxiety Disorder</td>
<td></td>
<td>97 (48.5%)</td>
</tr>
<tr>
<td>Separation Anxiety Disorder</td>
<td></td>
<td>44 (22.0%)</td>
</tr>
<tr>
<td>Specific Phobia</td>
<td></td>
<td>88 (44.0%)</td>
</tr>
<tr>
<td>Generalized Anxiety Disorder</td>
<td></td>
<td>141 (70.5%)</td>
</tr>
<tr>
<td>Obsessive-Compulsive Disorder</td>
<td></td>
<td>26 (13.0%)</td>
</tr>
<tr>
<td><strong>Distinct Anxiety</strong></td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>Other Social Fear</td>
<td></td>
<td>26 (13.0%)</td>
</tr>
<tr>
<td>Unusual Phobia</td>
<td></td>
<td>16 (8.0%)</td>
</tr>
<tr>
<td>Atypical OCD</td>
<td></td>
<td>3 (1.5%)</td>
</tr>
<tr>
<td>Special Interest Fear</td>
<td></td>
<td>3 (1.5%)</td>
</tr>
<tr>
<td>Fear of Change</td>
<td></td>
<td>44 (22.0%)</td>
</tr>
<tr>
<td><strong>Medication (% taking)</strong></td>
<td>200</td>
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</tr>
<tr>
<td>Selective Serotonin Reuptake Inhibitors</td>
<td></td>
<td>33 (16.5%)</td>
</tr>
<tr>
<td>Antipsychotics</td>
<td></td>
<td>14 (7.0%)</td>
</tr>
<tr>
<td>Stimulants</td>
<td></td>
<td>45 (22.5%)</td>
</tr>
<tr>
<td>α-agonists</td>
<td></td>
<td>26 (13.0%)</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td>20 (10.0%)</td>
</tr>
</tbody>
</table>

Note. N: Number of responding participants, n(%): Number (percentage) of participants, M: Mean, SD: Standard deviation
Table 2. Descriptive Statistics of Sample Demographic and Clinical Characteristics by Group

<table>
<thead>
<tr>
<th>Group</th>
<th>SAD</th>
<th>OSF</th>
<th>NSA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demographic Characteristics</strong></td>
<td><strong>n (%) or M (SD)</strong></td>
<td><strong>n (%) or M (SD)</strong></td>
<td><strong>n (%) or M (SD)</strong></td>
</tr>
<tr>
<td>Age (years)</td>
<td>10.02 (1.72)</td>
<td>10.27 (1.56)</td>
<td>9.78 (1.91)</td>
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<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>72 (74.2%)</td>
<td>20 (76.9%)</td>
<td>65 (84.4%)</td>
</tr>
<tr>
<td>Female</td>
<td>25 (25.8%)</td>
<td>6 (23.1%)</td>
<td>12 (15.6%)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black or African American</td>
<td>7 (7.3%)</td>
<td>2 (7.7%)</td>
<td>2 (2.7%)</td>
</tr>
<tr>
<td>Asian</td>
<td>7 (7.3%)</td>
<td>6 (23.1%)</td>
<td>2 (2.7%)</td>
</tr>
<tr>
<td>White</td>
<td>71 (74.0%)</td>
<td>14 (53.8%)</td>
<td>67 (89.3%)</td>
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<tr>
<td>Native Hawaiian or Other Pacific Islander</td>
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<td>1 (3.8%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>American Indian or Alaskan Native</td>
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<td>1 (3.8%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Other</td>
<td>9 (9.4%)</td>
<td>2 (7.7%)</td>
<td>2 (7.7%)</td>
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<tr>
<td>Living Arrangements</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Both biological parents</td>
<td>71 (74.0%)</td>
<td>17 (65.4%)</td>
<td>50 (66.7%)</td>
</tr>
<tr>
<td>Both biological parents (joint custody)</td>
<td>4 (4.2%)</td>
<td>0 (0%)</td>
<td>3 (4.0%)</td>
</tr>
<tr>
<td>Biological parent and stepparent/partner</td>
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<td>2 (7.6%)</td>
<td>6 (8.0%)</td>
</tr>
<tr>
<td>Single biological parent</td>
<td>7 (7.3%)</td>
<td>6 (23.1%)</td>
<td>11 (14.3%)</td>
</tr>
<tr>
<td>Adoptive parent(s)</td>
<td>4 (4.2%)</td>
<td>0 (0%)</td>
<td>3 (4.0%)</td>
</tr>
<tr>
<td>Grandparent(s)</td>
<td>1 (1.0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Other relative(s)/friend(s)</td>
<td>1 (1.0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Other</td>
<td>2 (2.1%)</td>
<td>1 (3.8%)</td>
<td>2 (2.7%)</td>
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<tr>
<td>Site</td>
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<td></td>
<td></td>
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<tr>
<td>University of California Los Angeles</td>
<td>40 (41.2%)</td>
<td>14 (53.8%)</td>
<td>21 (27.3%)</td>
</tr>
<tr>
<td>University of South Florida</td>
<td>31 (32.0%)</td>
<td>7 (26.9%)</td>
<td>32 (41.6%)</td>
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<tr>
<td>Temple University</td>
<td>26 (26.8%)</td>
<td>5 (19.2%)</td>
<td>24 (31.2%)</td>
</tr>
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</table>
Table 2. Descriptive Statistics of Sample Demographic and Clinical Characteristics by Group

<table>
<thead>
<tr>
<th>Group</th>
<th>SAD</th>
<th>OSF</th>
<th>NSA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Clinical Characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full-Scale IQ (WISC-IV)</td>
<td>101.89 (16.12)</td>
<td>99.20 (19.39)</td>
<td>100.15 (14.72)</td>
</tr>
<tr>
<td>ADOS-2 Total Severity Score</td>
<td>7.14 (2.22)</td>
<td>8.15 (1.80)</td>
<td>6.87 (2.33)</td>
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<tr>
<td>PARS 7-Item Anxiety Severity Score</td>
<td>23.80 (3.40)</td>
<td>23.88 (4.72)</td>
<td>23.88 (3.45)</td>
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<td>Comorbid Psychopathology</td>
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<td>50 (64.9%)</td>
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<tr>
<td>Oppositional Defiant Disorder</td>
<td>15 (15.5%)</td>
<td>4 (15.4%)</td>
<td>15 (19.5%)</td>
</tr>
<tr>
<td>Major Depressive Disorder or Dysthymia</td>
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<td>3 (11.5%)</td>
<td>3 (3.9%)</td>
</tr>
<tr>
<td>Post-Traumatic Stress Disorder</td>
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<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Traditional Anxiety</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Separation Anxiety Disorder</td>
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<td>15 (19.5%)</td>
</tr>
<tr>
<td>Specific Phobia</td>
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<td>9 (34.6%)</td>
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<td>14 (53.8%)</td>
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<td>Obsessive-Compulsive Disorder</td>
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<td>4 (15.4%)</td>
<td>14 (18.2%)</td>
</tr>
<tr>
<td>Distinct Anxiety</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Unusual Phobia</td>
<td>9 (9.3%)</td>
<td>2 (7.7%)</td>
<td>5 (6.5%)</td>
</tr>
<tr>
<td>Atypical OCD</td>
<td>1 (1.0%)</td>
<td>0 (0%)</td>
<td>2 (2.6%)</td>
</tr>
<tr>
<td>Special Interest Fear</td>
<td>2 (2.1%)</td>
<td>0 (0%)</td>
<td>1 (1.3%)</td>
</tr>
<tr>
<td>Fear of Change</td>
<td>21 (21.6%)</td>
<td>4 (15.4%)</td>
<td>19 (24.7%)</td>
</tr>
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</table>
Table 2. Descriptive Statistics of Sample Demographic and Clinical Characteristics by Group

<table>
<thead>
<tr>
<th>Group</th>
<th>SAD</th>
<th>OSF</th>
<th>NSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medication (% taking)</td>
<td>35 (36.1%)</td>
<td>14 (53.8%)</td>
<td>28 (36.4%)</td>
</tr>
<tr>
<td>Selective Serotonin Reuptake Inhibitors</td>
<td>18 (18.6%)</td>
<td>8 (30.8%)</td>
<td>7 (9.1%)</td>
</tr>
<tr>
<td>Antipsychotics</td>
<td>6 (6.2%)</td>
<td>1 (3.8%)</td>
<td>7 (9.1%)</td>
</tr>
<tr>
<td>Stimulants</td>
<td>15 (15.5%)</td>
<td>7 (26.9%)</td>
<td>17 (22.1%)</td>
</tr>
<tr>
<td>α-agonists</td>
<td>13 (13.4%)</td>
<td>3 (11.5%)</td>
<td>6 (7.8%)</td>
</tr>
<tr>
<td>Other</td>
<td>8 (8.2%)</td>
<td>2 (7.7%)</td>
<td>8 (10.4%)</td>
</tr>
</tbody>
</table>

*Note. SAD: Social Anxiety Disorder, OSF: Other Social Fear, NSA: Non-Social Anxiety, N: Number of responding participants, n(%): Number (percentage) of participants, M: Mean, SD: Standard deviation*
Table 3. Descriptive Statistics of Key Variables of Interest

<table>
<thead>
<tr>
<th>Social Functioning Variables</th>
<th>N</th>
<th>n (%) or M (SD)</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADIS/ASA Social Functioning items:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Theory of Mind</td>
<td>192</td>
<td>1.37 (0.76)</td>
<td>0-3</td>
</tr>
<tr>
<td>Social Motivation</td>
<td>192</td>
<td>0.65 (0.77)</td>
<td>0-3</td>
</tr>
<tr>
<td>Friendships</td>
<td>189</td>
<td>0.90 (1.04)</td>
<td>0-3</td>
</tr>
<tr>
<td>Bullying</td>
<td>195</td>
<td>1.19 (0.88)</td>
<td>0-3</td>
</tr>
<tr>
<td>Social Responsiveness Scale-2\textsuperscript{nd} Edition (SRS-2)</td>
<td>190</td>
<td>159.61 (20.96)</td>
<td>52-208</td>
</tr>
<tr>
<td>Child Behavior Checklist: Social Problems (CBCL:SP)</td>
<td>193</td>
<td>6.64 (2.94)</td>
<td>0-13</td>
</tr>
<tr>
<td>ADOS-2: Social Affect</td>
<td>192</td>
<td>10.58 (4.24)</td>
<td>0-24</td>
</tr>
</tbody>
</table>

| Anxiety Variables            |     |                 |       |
| Anxiety Severity (highest CSR on ADIS/ASA) | 200 | 5.11 (0.82)     | 3-8   |
| Number of Co-Occurring Anxiety Disorders | 200 | 2.64 (1.46)     | 1-8   |

Note. CSR: Clinical severity rating. ADIS/ASA: Anxiety Disorders Interview Schedule-Autism Spectrum Addendum. N: Number of responding participants. n(%): Number (percentage) of participants. M: Mean. SD: Standard deviation.
Table 4. Clinical Severity Ratings on the ADIS/ASA Social Functioning Items

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>0 (%)</th>
<th>1 ( %)</th>
<th>2 ( %)</th>
<th>3 ( %)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Theory of Mind</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAD</td>
<td>92</td>
<td>12 (13.0%)</td>
<td>41 (44.6%)</td>
<td>32 (34.8%)</td>
<td>7 (7.6%)</td>
</tr>
<tr>
<td>OSF</td>
<td>25</td>
<td>0 (0.0%)</td>
<td>9 (36.0%)</td>
<td>14 (56.0%)</td>
<td>2 (8.0%)</td>
</tr>
<tr>
<td>NSA</td>
<td>75</td>
<td>11 (14.7%)</td>
<td>35 (46.7%)</td>
<td>28 (37.3%)</td>
<td>1 (1.3%)</td>
</tr>
<tr>
<td>Total</td>
<td>192</td>
<td>23 (12.0%)</td>
<td>85 (44.3%)</td>
<td>74 (38.5%)</td>
<td>10 (5.2%)</td>
</tr>
<tr>
<td><strong>Social Motivation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAD</td>
<td>92</td>
<td>46 (50.0%)</td>
<td>33 (35.9%)</td>
<td>12 (13.0%)</td>
<td>1 (1.1%)</td>
</tr>
<tr>
<td>OSF</td>
<td>26</td>
<td>11 (42.3%)</td>
<td>10 (38.5%)</td>
<td>3 (11.5%)</td>
<td>2 (7.7%)</td>
</tr>
<tr>
<td>NSA</td>
<td>74</td>
<td>41 (55.4%)</td>
<td>24 (32.4%)</td>
<td>8 (10.8%)</td>
<td>1 (1.4%)</td>
</tr>
<tr>
<td>Total</td>
<td>192</td>
<td>98 (51.0%)</td>
<td>67 (34.9%)</td>
<td>23 (12.0%)</td>
<td>4 (2.1%)</td>
</tr>
<tr>
<td><strong>Friendships</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAD</td>
<td>91</td>
<td>42 (46.2%)</td>
<td>23 (25.3%)</td>
<td>14 (15.4%)</td>
<td>12 (13.2%)</td>
</tr>
<tr>
<td>OSF</td>
<td>25</td>
<td>9 (36.0%)</td>
<td>9 (36.0%)</td>
<td>5 (20.0%)</td>
<td>2 (8.0%)</td>
</tr>
<tr>
<td>NSA</td>
<td>73</td>
<td>38 (52.1%)</td>
<td>21 (28.8%)</td>
<td>5 (6.8%)</td>
<td>9 (12.3%)</td>
</tr>
<tr>
<td>Total</td>
<td>189</td>
<td>89 (47.1%)</td>
<td>53 (28.0%)</td>
<td>24 (12.7%)</td>
<td>23 (12.2%)</td>
</tr>
<tr>
<td><strong>Bullying</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAD</td>
<td>93</td>
<td>16 (17.2%)</td>
<td>42 (45.2%)</td>
<td>26 (28.0%)</td>
<td>9 (9.7%)</td>
</tr>
<tr>
<td>OSF</td>
<td>26</td>
<td>6 (23.1%)</td>
<td>12 (46.2%)</td>
<td>7 (26.9%)</td>
<td>1 (3.8%)</td>
</tr>
<tr>
<td>NSA</td>
<td>76</td>
<td>23 (30.3%)</td>
<td>29 (38.2%)</td>
<td>19 (25.0%)</td>
<td>5 (6.6%)</td>
</tr>
<tr>
<td>Total</td>
<td>195</td>
<td>45 (23.1%)</td>
<td>83 (42.6%)</td>
<td>52 (26.7%)</td>
<td>15 (7.7%)</td>
</tr>
</tbody>
</table>

*Note.* ADIS/ASA: Anxiety Disorders Interview Schedule-Autism Spectrum Addendum. 0: No impairment. 1: Some impairment. 2: Moderate impairment. 3: Severe impairment. SAD: Social anxiety disorder. OSF: Other social fears. NSA: Non-social anxiety. N: Number of responding participants. n(%): Number (percentage) of participants endorsing the response option.
Table 5. Zero-Order Correlations between Key Variables of Interest

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<th>1</th>
<th>2</th>
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<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Theory of Mind</td>
<td>-</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Social Motivation</td>
<td>.36$^{a ***}$</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Friendship</td>
<td>.35$^{a ***}$</td>
<td>.45$^{a ***}$</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Bullying</td>
<td>.19$^{a **}$</td>
<td>- .09$^{a}$</td>
<td>.07$^{a}$</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. CBCL:SP</td>
<td>.18$^{a **}$</td>
<td>- .05$^{a}$</td>
<td>.06$^{a}$</td>
<td>.42$^{a ***}$</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. SRS-2</td>
<td>.23$^{a **}$</td>
<td>.11$^{a}$</td>
<td>.02$^{a}$</td>
<td>.19$^{a **}$</td>
<td>.43$^{b ***}$</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. ADOS:SA</td>
<td>.28$^{a ***}$</td>
<td>.29$^{a ***}$</td>
<td>.23$^{a **}$</td>
<td>-.11$^{a}$</td>
<td>-.03$^{b}$</td>
<td>.17$^{b **}$</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Anxiety Severity</td>
<td>.06$^{a}$</td>
<td>-.07$^{a}$</td>
<td>-.05$^{a}$</td>
<td>.22$^{a **}$</td>
<td>.15$^{a *}$</td>
<td>.11$^{a}$</td>
<td>-.11$^{a}$</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>9. Anxiety Comorbidity</td>
<td>.03$^{a}$</td>
<td>-.07$^{a}$</td>
<td>.00$^{a}$</td>
<td>.28$^{a ***}$</td>
<td>.14$^{b *}$</td>
<td>.15$^{b *}$</td>
<td>.00$^{b}$</td>
<td>.35$^{a ***}$</td>
<td>-</td>
</tr>
</tbody>
</table>


$^{a}$ Spearman correlation. $^{b}$ Pearson correlation.

*p < .05, **p < .01, ***p < .001.
Table 6. Odds Ratios and 95% Confidence Intervals for Variables Included in the Logistic Regressions

<table>
<thead>
<tr>
<th>Covariates</th>
<th>Theory of Mind</th>
<th>Social Motivation</th>
<th>Friendship</th>
<th>Bullying</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety Severity</td>
<td>1.13 (0.75-1.69)</td>
<td>0.89 (0.51-1.55)</td>
<td>0.76 (0.48-1.20)</td>
<td>1.29 (0.83-2.02)</td>
</tr>
<tr>
<td>Anxiety Comorbidity</td>
<td>1.10 (0.90-1.38)</td>
<td>1.10 (0.82-1.48)</td>
<td>1.12 (0.88-1.43)</td>
<td><strong>1.44 (1.14-1.82)</strong></td>
</tr>
<tr>
<td>Comorbid ADHD</td>
<td>1.23 (0.64-2.37)</td>
<td>0.69 (0.28-1.69)</td>
<td>1.12 (0.53-2.35)</td>
<td><strong>2.28 (1.08-4.84)</strong></td>
</tr>
<tr>
<td>Comorbid Depression</td>
<td>0.44 (0.11-1.73)</td>
<td>1.19 (0.22-6.46)</td>
<td>1.70 (0.44-6.57)</td>
<td>3.18 (0.79-12.74)</td>
</tr>
<tr>
<td>Comorbid ODD</td>
<td>1.93 (0.97-3.84)</td>
<td>1.54 (0.61-3.88)</td>
<td>1.34 (0.63-2.86)</td>
<td>0.89 (0.42-1.87)</td>
</tr>
<tr>
<td>Research Site</td>
<td>1.03 (0.71-1.50)</td>
<td>0.99 (0.59-1.66)</td>
<td>0.84 (0.55-1.30)</td>
<td><strong>0.53 (0.35-0.81)</strong></td>
</tr>
</tbody>
</table>

**Anxiety Type**

<table>
<thead>
<tr>
<th>Social Anxiety Disorder</th>
<th>Reference</th>
<th>Reference</th>
<th>Reference</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other Social Fear</td>
<td><strong>2.71 (1.04-7.05)</strong></td>
<td>1.55 (0.48-4.99)</td>
<td>0.96 (0.35-2.63)</td>
<td>0.70 (0.24-2.01)</td>
</tr>
<tr>
<td>Non-Social Anxiety</td>
<td>0.81 (0.42-1.54)</td>
<td>0.91 (0.36-2.30)</td>
<td>0.65 (0.30-1.38)</td>
<td>0.92 (0.45-1.89)</td>
</tr>
</tbody>
</table>

*Note:* SAD: ADHD: Attention-Deficit Hyperactivity Disorder. ODD: Oppositional Defiant Disorder.

Bolded text: $p < .05$. 
Figure 1. CONSORT Diagram of Participant Flow

214 Enrolled
78 Site 1
76 Site 2
60 Site 3

14 Excluded
13 Did not have severe anxiety
1 Did not complete ADIS/ASA

200 Included in final sample

200 Included in network analysis: Aims 1, 2

123 Included in social anxiety network: Exploratory

200 Included in regression analyses: Aim 3

170 Included in predictability analyses (30 excluded due to missing data)
Figure 2. Estimated Network of Social Functioning and Anxiety

Social Ability
- Soc Aft: Social Affect
- ToM: Theory of Mind
- Soc Mtv: Social Motivation
- Frnd Diff: Friendship Difficulties

Social Integration
- Social Comp: Social Competence
- Soc Prbls: Social Problems
- Bullying: Bullying

Anxiety
- Anx Comorb: Anxiety Comorbidity
- Anx Sev: Anxiety Severity

Note: Blue edges indicate positive associations, red edges indicate negative associations.
Figure 3. Boot-Strapped 95% Confidence Intervals of Estimated Edge-Weights

Note. Red line: Sample values. Gray area: Bootstrapped CIs. Each horizontal line represents one edge of the network, ordered from the edge with the highest edge-weight to the edge with the lowest edge-weight.
Figure 4. Centrality Estimates (Degree Centrality, Strength, Betweenness, Closeness)

Note. Estimated centrality indices (strength, betweenness, closeness) are shown as standardized z-scores.
Figure 5. Exploratory Estimated Network of Social Functioning and Anxiety Among Social Anxiety (SAD, OSF) Subsample

Note: Blue edges indicate positive associations, red edges indicate negative associations.
Figure 6. Exploratory Estimated Network of Social Functioning and Anxiety, Accounting for ADHD Diagnosis

- **Social Ability**
  - Soc Aft: Social Affect
  - ToM: Theory of Mind
  - Soc Mtvn: Social Motivation
  - Frnd Diff: Friendship Difficulties

- **Social Integration**
  - Social Comp: Social Competence
  - Soc Prbls: Social Problems
  - Bullying: Bullying
  - ADHD: ADHD

- **Anxiety**
  - Anx Comorb: Anxiety Comorbidity
  - Anx Sev: Anxiety Severity

*Note:* Blue edges indicate positive associations, red edges indicate negative associations.
Figure 7. Exploratory Estimated Network of Social Functioning and Anxiety, Accounting for Diagnosis of Depressive Disorders

Note: Blue edges indicate positive associations, red edges indicate negative associations.
Figure 8. Exploratory Estimated Network of Social Functioning and Anxiety, Accounting for ODD Diagnosis

Note: Blue edges indicate positive associations, red edges indicate negative associations.


Ahmedani, B. K., & Hock, R. M. (2012). Health care access and treatment for children with comorbid autism and psychiatric conditions. *Social psychiatry and psychiatric epidemiology, 47*(11), 1807-1814. doi:10.1007/s00127-012-0482-0


Brumariu, L. E., Obsuth, I., & Lyons-Ruth, K. (2012). Quality of attachment relationships and peer relationship dysfunction among late adolescents with and without anxiety


doi:10.1037/0033-2909.131.4.483

doi:10.1037/a0038498


doi:10.1007/s10803-010-1037-4

doi:10.1111/jcpp.12829

https://doi.org/10.1371/journal.pone.0179891


doi:10.1007/s10803-017-3056-x

doi:10.3102/0034654317740334


doi:10.1111/cpsp.12009

doi:10.1016/j.beth.2014.03.005

https://doi.org/10.1007/s10826-016-0372-2


Research in Autism Spectrum Disorders, 6(3), 1126–1134.

https://doi.org/10.1016/j.rasd.2012.03.004


### Theory of Mind

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<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does your child seem aware of the thoughts or feelings of others? How can you tell?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does your child seem aware of other people’s thoughts, judgments, or opinions? (Be sure to get examples)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Social Motivation

<table>
<thead>
<tr>
<th>Question</th>
<th>With other kids</th>
<th>Alone</th>
<th>Other</th>
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</thead>
<tbody>
<tr>
<td>Do you think your child would prefer to spend most of his/her time alone or with other kids?</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Does your child watch and appear interested in joining in with other kids, even if s/he doesn’t know quite how? Does s/he want to be included? (Get examples)</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

### Friendships

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Once your child has made friends, do you think s/he has trouble keeping them?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If yes: What makes friendships difficult for your child?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What does your child do to keep up his/her friendships?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does your child invite his/her friends to do things and do they invite him/her? Or is it more one-sided?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Bullying

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has your child been rejected by peers, picked on, teased, or bullied?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If yes: How often? What happened?</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

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Appendix B

ADIS/ASA Social Phobia/Other Social Fears Module: Sample Prompts

**Items Relating to Fear of Negative Evaluation:**

When your child is in certain social situations with other people in school, in restaurants, at parties, or when meeting new people, has s/he told you, or have you noticed, that s/he is afraid that people might think something s/he does is stupid or dumb or that they might laugh at her/him?

… that s/he might do something that will be embarrassing?

**Items Assessing Fear in Social Situations:**

Some children/teenagers get very nervous in situations involving other people. I am going to list some situations and ask you how you think your child feels in each situation. First, just tell me “Yes” or “No” if your child has fear of the situation.

Does your child try to avoid this situation?

When your child is in these types of situations, such as (list situations identified by parent), does s/he ever cry, get upset or angry, or freeze up as if s/he can’t talk?

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