Social Competence with an Unfamiliar Peer in Children and Adolescents with High Functioning Autism: Measurement and Individual Differences

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Abstract

Children and adolescents with high functioning autism (HFA) display heterogeneity in social competence, which may be particularly evident during interactions with unfamiliar peers. The goal of this study was to examine predictors of social competence variability during an unfamiliar peer interaction. Thirty-nine participants with HFA and 39 age-, gender- and IQ-matched comparison participants were observed during dyadic laboratory interactions and detailed behavioral coding revealed three social competence dimensions: *social initiative*, *social reciprocity*, and *social self-monitoring*. Participants with HFA displayed higher social initiative but lower reciprocity than comparison participants. For participants with HFA, theory of mind was positively associated with observed initiative. For COM participants, social anxiety was negatively associated with reciprocity. However, for HFA participants, there was a quadratic relation between parent-reported social anxiety and observed reciprocity, demonstrating that low and high levels of anxiety were associated with low reciprocity. Results demonstrated the utility of our behavioral coding scheme as a valid assessment of social competence for children and adolescents with and without HFA. The curvilinear association between social anxiety and reciprocity highlights the importance of examining nonlinear relations in individuals with HFA, and emphasizes that discrete profiles of social anxiety in individuals with HFA may necessitate different treatment options.

Keywords

high functioning autism; social competence; peer interaction; initiative; reciprocity; self-monitoring

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Conflict of Interest

The authors declare that they have no conflict of interest.

1. Introduction

Despite having average or above average IQ, individuals with high functioning autism (HFA) display a striking discrepancy between cognitive and social abilities that significantly impairs their quality of life (Howlin, 2005; Kenworthy, Case, Harms, Martin, & Wallace, 2010; Shipman, Sheldrick, & Perrin, 2011). Social competence is particularly critical throughout late childhood and emerging adolescence, as typically and atypically developing individuals learn to independently navigate a less structured social environment than that of earlier childhood (Parker, Rubin, Erath, Wojslawowicz, & Buskirk, 2006; Rao, Beidel, & Murray, 2008). During this transition, individuals must learn to flexibly implement social skills in unfamiliar contexts, such as new classrooms, the workplace, and romantic relationships (Warnes, Sheridan, Geske, & Warnes, 2005). For children with HFA transitioning to adolescence, navigating novel social environments is particularly challenging given the core social deficits associated with the diagnosis in addition to common co-occurring elevations in social anxiety (Bellini, 2006), which may be intensified during novel experiences and may further impact the quantity and quality of social interactions.

The goals of this study were to develop a coding system to quantify individual differences in social behavior during a laboratory peer interaction paradigm and to examine social cognitive and affective predictors of individual differences. Specifically, we examined diagnostic group differences between HFA and COM participants in dimensions of observed social competence and differential associations between those observed behaviors and independent assessments of theory of mind and social anxiety.

1.2. Social Skills and Social Competence

Social skills are discrete behaviors that individuals use to initiate and maintain positive social interactions, such as eye contact, sharing ideas, and conversational turn-taking (Kwon, Kim, & Sheridan, 2012; Phillips, 1978). Children with HFA are reported by their parents and observed at home and at school to have difficulty with several social skills, including establishing and maintaining eye contact, initiating and sustaining conversation, and displaying appropriate positive affect (Jones & Schwartz, 2009; Luteijn, Luteijn, Jackson, Volkmar, & Minderaa, 2000; Matson & Wilkins, 2007; Stichter et al., 2010). Social competence refers to the ability to spontaneously apply discrete social skills in novel interactions in a flexible and adaptive manner (Lillvist, Sandberg, Björck-Äkesson, & Granlund, 2009). Social competence is a prerequisite for children to achieve interpersonal success as they transition into adolescence (Elliott & Gresham, 1987) and is a core component of adaptive functioning throughout the lifetime.

Children and adolescents with HFA have specific social skills and competence challenges (Stichter et al., 2010; Stichter, O'Connor, Herzog, Lierheimer, & McGhee, 2012) that we aimed to capture with our observational paradigm. The tasks in our paradigm were designed to elicit three specific domains of social competence supported by previous literature (Gresham & Elliott, 1990): *social initiative*, the tendency to make social approaches to a peer, such as offering or seeking information (Rydell, Hagekull, & Bohlin, 1997); *social reciprocity*, the give-and-take quality of a social interaction (Jung, 1990); and *social self-*

monitoring, the ability to attend to, and modify, one's own behavior during a social interaction (Harchik, Sherman, & Sheldon, 1992). Self- and parent-reported social competence dimensions of social initiative, reciprocity, and self-monitoring have been found to be lower in children and adolescents with autism than in typically developing individuals (Maestro et al., 2005; Russell & Jarrold, 1998), and specifically in those with high functioning autism (Attwood, 2000).

One factor that may be related to social competence deficits in children and adolescents with autism, and individual differences in the severity of these deficits, is difficulties with theory of mind. Theory of mind, or the ability to assign mental states to others, allows people to explain and predict others' behavior (Bretherton & Beeghly, 1982; Miller, 2006). Theory of mind is positively associated with reports of children's social skills in both typical and atypical development (Lerner, Hutchins, & Prelock, 2011; Watson, Nixon, Wilson, & Capage, 1999), suggesting that theory of mind and social competence deficits may be intricately related.

A second factor that may be associated with deficits in social competence in autism, and particularly for older and higher functioning children with autism, is social anxiety. Social anxiety is performance-related distress that involves a fear of negative evaluation in social situations and anticipated feelings of humiliation (Mancini, Ameringen, Bennett, Patterson, & Watson, 2005). For children with HFA, awareness of social and behavioral differences inherent to the diagnosis may serve to increase anxiety in social situations (Henderson et al., in press). Parent- and self-reports indicate that children and adolescents with HFA demonstrate elevated, and often clinically-significant, levels of social anxiety (Kim, Szatmari, Bryson, Streiner, & Wilson, 2000; Kuusikko et al., 2008). Further, social anxiety has been found to be negatively related to social skills in typically and atypically developing children (Chang, Quan, & Wood, 2012; Erath, Flanagan, & Bierman, 2007).

Although negative correlations between anxiety and social competence have been identified (e.g., Erath et al., 2007; Chang et al., 2012), there is also evidence for nonlinear associations. Bellini (2004) reported a curvilinear association, resembling an inverted U, between social anxiety and social skills (both self-reported) in high functioning adolescents with autism. Both low and high levels of social anxiety were associated with low social skills, while a moderate amount of social anxiety was associated with better social skills. This evidence of quadratic relations between anxiety and social competence guided our approach in this study.

1.3. Measuring Social Competence

Given that social competence involves one's unprompted implementation of context-appropriate social skills, behavioral observations may be particularly informative. In-vivo observations provide a rich index of spontaneous behaviors in social situations that may not be fully captured by parent- or teacher-reports (Roberts, Tsai, & Coan, 2007). Informant report provides important information, but is potentially subject to bias (Wilson, Pianta, & Stuhlman, 2007), particularly for parents of children and adolescents with autism who may not fully understand their children's perspectives on day-to-day experiences (Sheldrick, Neger, Shipman, & Perrin, 2012). Furthermore, as children transition to adolescence and

spend more time with peers, parents may have fewer opportunities to observe in-vivo behaviors, especially with unfamiliar peers. Thus, direct observation provides unique information helpful for quantifying the behavior of children and adolescents with autism.

Most behavioral observations for children and adolescents with autism have assessed individuals interacting with familiar people, such as family members, classmates, or friends (e.g., Friendship Observation Scale; Bauminger, Rogers, Aviezer, & Solomon, 2005). However, observation of interactions with unfamiliar peers provides a measure of the spontaneous social skills that children and adolescents employ in novel situations, similar to those that may be encountered on a daily basis. The novel context is particularly salient for individuals with HFA, who have often received extensive social skills interventions, but may still struggle with flexibly implementing skills outside the contexts of established friendships or family interactions (Williams White, Keonig, & Scahill, 2007). Observations with familiar individuals may result in an overestimate of true skills because family members may overcompensate when interacting with individuals with autism by making more social initiatives than those interacting with typically developing children (Meirsschaut, Roeyers, & Warreyn, 2011).

1.4. Specific Aims and Hypotheses

We used a novel observational measure of social competence to assess dyadic interactions between children and adolescents with HFA and unfamiliar gender-, age-, and IQ-matched peers without autism. The behavioral paradigm employed in this study indexes social competence uniquely in several ways. First, participants are observed during an interaction with an unfamiliar peer rather than with a familiar peer or an adult. Second, our measure includes structured and unstructured tasks, which mimic multiple facets of everyday interactions in which children and adolescents must spontaneously apply their existing social skills. Third, our behavioral observation was designed to elicit specific, objective, measurable elements of social competence, such as eye contact, behavioral appropriateness, and frequency of social initiations.

Our first aim was to examine interrelations among individual observed behaviors and identify discrete factors. Next, we aimed to assess group differences in observed social competence between individuals with HFA and gender-, age-, and IQ-matched comparison individuals without autism. It was hypothesized that, consistent with past literature (Maestro et al., 2005; Attwood, 2000; Russell & Jarrold, 1998), participants with HFA would display lower levels of social initiative, reciprocity, and social self-monitoring than COM participants. The second aim of this study was to examine the associations between observed social competence and independent assessments of theory of mind and parent-reported social anxiety. It was hypothesized that, consistent with past literature (Watson et al., 1999; Lerner et al., 2011), for all individuals, theory of mind would be positively associated with social initiative, reciprocity, and social self-monitoring. We also predicted a negative association between social anxiety and competence across both groups, but given past findings revealing social anxiety to be non-linearly related to social competence for children with HFA, quadratic effects were also examined.

2. Method

2.1. Participants

All study procedures were approved by the Institutional Review Board at the University of Miami. Participants were 80 children and adolescents (40 HFA, 40 COM) who were drawn from a larger sample of 210 individuals participating in a study of social emotional functioning in children and adolescents with HFA. One male participant from each diagnostic group was excluded from all analyses due to a failure of the recording equipment during the dyadic interaction. Thus, there were 39 HFA and 39 COM participants (68 males, 10 females; M_{age} = 12.82 years, SD = 2.38 years) in the final sample. Our sample was characteristic of the original, larger sample in terms of demographic and diagnostic variables.

For the larger study, participants with HFA were recruited through the Center for Autism and Related Disabilities at the University of Miami. A comparison (COM) sample of children without an autism diagnosis was recruited through the Miami-Dade County Public Schools system. Letters to families included an explanation of the study and contact information for families interested in participating. Parents and participants who enrolled in the study completed written informed consent and assent procedures.

All participants in the larger study completed an abbreviated IQ test in the laboratory and were required to have a verbal IQ equal to or greater than 70 to be retained in the final sample. Community diagnoses of autism were confirmed in the laboratory. Participants with HFA were required to meet criteria on two out of three of the following diagnostic measures: Social Communication Questionnaire (SCQ; Rutter, Bailey, Lord, Cianchetti, & Fancello, 2007), Autism Spectrum Screening Questionnaire (ASSQ; Ehlers, Gillberg, & Wing, 1999), and Autism Diagnostic Observation Schedule (ADOS; Lord, Rutter, DiLavore, & Risi, 2002). The ADOS was administered by four students with a minimum of master's level training who had attended an ADOS training. After administration, final scores were reviewed by a research-reliable individual. COM participants were excluded if they met criteria on two out of three diagnostic measures. The majority of participants with HFA (77%) met criteria for autism on all three diagnostic measures, while 23% met on two out of three. Following completion of the larger study, participants were invited to return to the laboratory for peer interaction visits.

The sample was primarily Hispanic (52.6%) and non-Hispanic Caucasian (39.7%), with few African-American (2.6%), Asian (1.3%), Mixed (1.3%), and nonreporting (2.6%). Parents reported having an advanced or professional degree (32.1% of mothers and 32.1% fathers), a two-year college education (28.2% of mothers and 23.1% of fathers), four-year college education (15.4% of mothers and 12.8% of fathers), less than two years of college (20.5% of mothers and 14.1% of fathers, and high school education (3.8% of mothers and 12.8% of fathers). Most families reported an annual household income over $100,000 (35.9%), with the rest reporting $75,000-99,000 (19.2%), $50,000-74,999 (11.5%), $25,000-49,000 (15.4%), $10,000-24,999 (9.0%), and less than $10,000 (1.3%).

2.2. Procedure

Parents of participants interested in the peer interaction study were provided with additional information over the phone. If they decided to participate, they were scheduled for two visits to the Social Development Laboratory in the Department of Psychology at the University of Miami. In the first visit, parents completed a series of questionnaires regarding their child. After the first visit, participants from the HFA and COM samples were paired based on age, verbal IQ, and gender, and each HFA-COM dyad was scheduled to return to the laboratory to take part in the peer interaction session. All peer interaction sessions were videotaped for later behavioral coding. Families were remunerated $40 for participation in each visit.

2.3. Measures

The Wechsler Intelligence Scale for Children-Fourth Edition (WISC-IV; Wechsler, 2003) is a standard measure of intelligence designed for children ages 6-16. A brief version of the Wechsler Intelligence Scale for Children-Fourth Edition, comprised of the Vocabulary and Similarities subtests, was administered to all participants to obtain an index of verbal comprehension (VCI). These scales have the highest loadings on the VCI factor, strong test-retest reliabilities, and good split-half and test-retest internal consistencies among the WISC-IV scales (Williams, Weiss, & Rolfhus, 2003).

The **Autism Spectrum Screening Questionnaire** (ASSQ; Ehlers et al., 1999) is a 27-item instrument intended to screen for symptoms of HFA. Raters are asked to indicate whether a child "stands out as different from other children of his/her age" on each item by choosing "no," "somewhat," or "yes." Scores range from 0-54, with higher scores indicating more autism symptoms. For this study, a cutoff score of 13 was used.

The **Autism Diagnostic Observation Schedule** (ADOS; Lord et al., 2002) is an observational assessment that consists of a series of semi-structured activities intended to elicit social, communication, and repetitive behaviors associated with autism spectrum disorders. The four modules of the ADOS are designed for use with individuals at particular developmental and language ability levels. For this study, all participants received either a Module 3 or 4, which are intended for verbally fluent children and younger adolescents, and older adolescents, respectively. Items on the ADOS are typically scored from 0 (no evidence of abnormality) to 3 (markedly abnormal behavior), thus higher domain scores indicate more abnormal behaviors. A cutoff score of 7 on the Communication + Social Interaction Total was used to verify diagnostic status. For this study, internal consistency was good for this subscale for both modules, Module 3 α = .84, Module 4 α = .95.

The **Social Communication Questionnaire** (SCQ; Berument et al., 1999) is a parent report instrument for the screening or verification of autism spectrum disorder symptoms in children. It was developed from the 40 critical items of the Autism Diagnostic Interview (Lord, Rutter, & Le Couteur, 1994), compiled into a parent report questionnaire (Berument et al., 1999). Parents choose "yes" or "no" in response to 40 questions regarding children's current behavior as well as behavior between the ages of 4 and 5 years. The SCQ has three subscales, Reciprocal Social Interaction Domain (RSID), Communication Domain (CD), and Restricted and Repetitive Behavior Domain (RRBD). For this study, the three subscales

displayed good internal consistencies for both groups, HFA group: RSID α = .71, CD α = .67, RRBD: α = .80; COM group: RSID α = .95, CD α = .75, RRBD: α = .96. For this study, the Lifetime SCQ total score was used as a measure of individual differences in autism symptom severity, and a cutoff of 12 was used.

The **Social Anxiety Scale for Children-Revised** (SASC-R; La Greca & Stone, 1993) was used to assess parent-reported social anxiety. The SASC-R contains 22 statements rated on a 5-point scale from 1 (not at all) to 5 (all the time). This measure is composed of three scales: Fear of Negative Evaluation from Peers (FNE; 8 items), e.g. "My child worries about being teased;" Social Avoidance and Distress-Specific (SAD-N; 6 items), e.g. "My child worries about doing something new in front of other kids;" and Social Avoidance and Distress-General (SAD-G; 4 items), e.g. "My child is quiet when he/she is with a group of kids." The SASC-R has been shown to display good discriminant and concordant validity, and good test-retest reliability (La Greca & Stone, 1993), and the measure has been used in previous studies of children with autism (Kuusiko et al., 2008). For this study, internal consistencies for the three subscales were good for both diagnostic groups, HFA group: FNE α = .96, SAD-N α = .88, SAD-G α = .84; COM group FNE α = .93, SAD-N α = .84, SAD-G α = .71. Of interest for the present study was the SASC-R total score.

Theory of Mind—All participants completed the following measures of theory of mind:

The *Strange Stories Task* (Happé, 1994) consists of 12 short vignettes and assesses the ability to attribute mental states to others in the context of stories involving a pretend event, a joke, a lie, a white lie, a figure of speech, and bluffing. Following each story, participants were asked a simple question to confirm their understanding of the story events and an open-ended question in which they were asked to explain why the story events happened in that way. Variables of interest were the total number of correct responses to the simple and open-ended questions (possible range 0-24) and the number of mental (as opposed to physical) explanations provided (possible range 0-12). One participant in the HFA group scored more than three standard deviations below the sample mean on the Strange Stories measure and was therefore removed from analyses related to theory of mind.

The *Reading the Mind in the Eyes Test* (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001) was used to index the capacity to process and recognize facial affect as expressed in photographs of the eyes of adults. The test is comprised of 28 photographs of the eye region of the face. Children were asked to choose which of four words best describes what the person in each of the 28 photos is thinking or feeling. Responses to each photograph were scored as correct or incorrect, yielding a score with a possible range of 0 to 28.

Observed social competence during interaction with an unfamiliar peer—To obtain an in vivo assessment of social competence, dyads (one HFA and one COM participant) were observed during a series of unstructured (Get to Know You Task) and structured (Teaching Task, Teamwork Task) tasks. For all tasks, individuals were seated across from each other at a table in an observation room equipped with video cameras. Approximately 25% of the dyadic interactions were double-coded by two graduate research assistants for reliability purposes. Reliability for individual task coding was considered

acceptable if intraclass correlation coefficients (ICCs) were greater than or equal to.70, indicating good interrater reliability (Hallgren, 2012). See Table 1 for an abbreviated description of codes, and Appendix A for full descriptions of codes and examples.

Get to Know You Task: Each dyad was given five minutes at the beginning of the session to become acquainted. The researcher left them alone in the room to do so and simply said, "Why don't you get to know each other? I'll be back in about five minutes." Videos were coded for each child's **total time talking** and frequency of shares and seeks, as well as other responses without elaboration (i.e., an abrupt response to a seek). A **share** was defined as an individual's spontaneously telling anything about themselves to the peer or sharing information about thoughts, feelings, or opinions. A **seek** typically occurred in the form of a question looking to find out something about the peer. **Responses without elaboration** included 'yes,' 'no,' 'that's cool,' or other responses to peers' seeks that did not share or ask for information and did not facilitate a reciprocal conversation. In addition to frequency counts, global codes were assigned based on the entire task length for eye contact, conversational efficacy, and the quality of rapport during the interaction using 5-point scales. Codes for **eye contact** ranged from 1 (uncoordinated with other communication: either frequent staring or never looking at peer) to 5 (well-coordinated with other communication: looking away when not interacting and looking at peer when interacting). Codes for **conversational efficacy** ranged from 1 (rarely implementing conversational skills) to 5 (conversational skills throughout that maintain the conversation). Specific behaviors that factored into the conversational efficacy code were: turn-taking, taking half the responsibility for maintaining the conversation, answering and asking questions appropriately,, responding and sharing appropriate information (i.e., not revealing overly friendly/familiar information). Codes for **rapport** during the interaction ranged from 1 (behaviors make it difficult for peer to continue interaction) to 5 (behaviors that facilitate an ongoing interaction). Rapport encompassed facial affect, conversational skills, and eye contact, while echolalia counted against rapport. ICCs for the Get to Know You Task ranged from .70 to .96.

Teaching Task: Each individual in the dyad was instructed to teach his/her peer how to make an object. The choices offered were an origami cat, a toy construction set, or a drawing. Participants with HFA always went first to ensure that they were spontaneously and independently deciding how to complete the task and not obtaining ideas from their peers. Each choice came with one set of materials for each participant and a set of step-by-step instructions that only the "teacher" was allowed to see (each choice had approximately the same number of steps). Each participant was instructed, "There are directions the teacher has to follow. The teacher's job is to make sure the other person follows along with them so you both complete the project. The teacher can get the student to follow along by doing just about anything they want, but there are two rules: the teacher cannot touch the materials of the student and the student cannot look at the instructions." Participants were asked if they had any questions before the task began. Each participant had up to ten minutes to finish the task, which was considered complete when both participants had a finished product, regardless of whether it was correct or incorrect.

Videos were coded for frequencies of waiting, showing actions, and verbal directives. **Waiting** included any time the child paused before moving to the next step or looked at their peer or the peer's materials. **Showing actions** included holding up an item or pointing — any physical indication to the peer of what to do. A **verbal directive** was defined as any spoken instructions to the peer, including reading the steps aloud. A global rating of **teaching efficacy** was also coded from this task, on a scale ranging from 1 (poor teaching; no attempts at helping peer; simply completing task as if peer was not there) to 5 (frequent checks and attempts to make sure peer is following along). ICCs for the Teaching Task ranged from .77 to .98.

Teamwork Task: Each dyad was given up to fifteen minutes to compose a list of the ten best movies. The dyad was told, "The last thing you're going to do is make a list together of the top ten movies ever made. Here's one piece of paper and one pencil. So at the end you should have one list with ten movies on it that you both agree on." The task was considered complete once the dyad had a completed list of ten movies.

Videos were coded for each participant's frequency of **suggestions made** and **rapport** during the interaction. Suggestions made included ideas of movies to include on the list and ideas on how to complete the task itself. Similar to rapport during the Get to Know You Task, rapport was a global code rated on a scale from 1 (behaviors inhibiting continuation of the interaction) to 5 (behaviors promoting continuation of the interaction). Individual behaviors that were considered for rapport included facial affect, making suggestions, and accepting the peer's suggestions. ICCs for the Teamwork Task ranged from .75 to .78.

3. Results

3.1. Preliminary Analyses and Data Reduction

All analyses were completed using the Statistical Package for Service Solution (SPSS) Version 21. Descriptive statistics, including means and standard deviations for primary study variables, are presented separately for HFA and COM participants in Table 2.

Preliminary analyses were conducted to examine differences between groups on age and verbal IQ to determine whether either of these variables should be included as between-group covariates. There were no significant group differences between HFA and COM participants on age or verbal IQ (see Table 3).

Bivariate correlations, presented in Tables 4 and 5, were conducted separately by diagnostic group to examine whether demographic or diagnostic variables correlated with primary variables. Age and verbal IQ were included as covariates for all within-group individual difference analyses, as they significantly correlated with primary variables within each group. Symptom severity was also included as a covariate in within-group analyses to obtain the most conservative estimates.

Peer Social Competence Composite Variables—Examination of individual variable skewness and kurtosis revealed that for both groups, the following variables were kurtotic: Get to Know You Task responses without elaboration, Get to Know You Task seeking, Get

to Know You Task eye contact, Teaching Task waiting, Teaching Task directives, Teaching Task efficacy, and Teaching Task showing. The following variables were skewed: Teaching Task waiting and Teaching Task directives (HFA group only), and Get to Know You Task eye contact and Teaching Task showing (COM group only). A square root transformation reduced skewness and kurtosis to an acceptable value for all variables except Get to Know You Task eye contact for the COM group. All results remained the same using the transformed composite, so we have reported the original non-transformed results here.

Inter-relations among individual observed behavioral codes were examined using Principal Component Analysis (PCA; Abdi & Williams, 2010). Standard factor-analytic procedures were followed, first entering the variables into a PCA using a Varimax rotation, then specifying eigenvalues 1 (Kaiser's criteria), and using the scree plot and percent variance accounted for to determine the number of factors. The results justified a three-factor solution, which accounted for 61.42% of the variance (see Table 6). Total time talking and sharing during the Get to Know You Task and number of suggestions made during the Teamwork Task, loaded onto the first factor, labeled *social initiative.* Seeking, eye contact, conversational efficacy, and rapport during interaction during the Get to Know You Task, and asking for suggestions and rapport during the Teamwork Task, loaded into the second factor, labeled *social reciprocity*. Finally, pauses/looks toward the peer, showing actions, verbal directives, and global teaching efficacy during the Teaching Task, loaded onto the third factor, labeled *social self-monitoring*. Composite scores were created by standardizing and averaging the variables for each of the three components identified through PCA.

Theory of Mind Composite Variable—The two measures of theory of mind, Strange Stories and Reading the Mind in the Eyes Test, were highly positively correlated across the full sample, $r(68) = .39$, $p = .001$. Therefore, a composite score for theory of mind was created by standardizing and averaging the two theory of mind variables.

3.2. Diagnostic Group Differences

Social competence dimensions—A multivariate analysis of variance (MANOVA) was conducted with diagnostic group as the between subjects factor to examine mean differences between HFA and COM participants in social initiative, reciprocity, and social self-monitoring. The MANOVA revealed significant group differences in social competence, Wilks's $\Lambda = .60$, $F(3, 72) = 16.30$, $p < .001$, partial $\eta^2 = .41$. Post hoc univariate comparisons were conducted to identify the specific dimensions on which the diagnostic groups differed. Participants with HFA ($M = .28$, $SD = .81$) demonstrated higher social initiative than COM participants ($M = -.29$, $SD = .75$), $F(1, 74) = 10.28$, $p = .002$, partial $\eta^2 = .12$. HFA participants' observed social reciprocity ($M = -.36$, $SD = .63$) was lower than that of COM participants ($M = .34$, $SD = .63$), $F(1, 74) = 23.59$, $p < .001$, partial $\eta^2 = .24$. However, there were no significant differences between HFA and COM participants in social self-monitoring, $F(1, 74) = .41$, *ns*. See Figure 1.

Initiations—Given the unexpected finding that participants with HFA were rated higher than COM participants on social initiative, post hoc analyses were conducted to further explore the nature of this difference. Because the social initiative composite included total

time talking and frequency of shares during the Get to Know You Task as well as suggestions made during the teamwork task, we examined diagnostic group differences at the level of individual variables. In addition, because total time talking during the Get to Know You Task included sharing, seeking, and other responses without elaboration, we examined group differences in the proportions of each of these types of talking out of total number of initiations made.

A repeated measures ANOVA revealed that there was a main effect of talking type, Wilks's $\Lambda = .17$, $F(2, 73) = 174.80$, $p < .001$, partial $\eta^2 = .83$. Follow up pairwise comparisons indicated that overall, participants shared more than they asked questions, and asked questions more than they responded without elaborating. This was qualified by a significant interaction between diagnostic group and proportion of talking type, Wilks's $\Lambda = .86$, $F(2, 73) = 6.03$, $p < .01$, partial $\eta^2 = .14$ (see Figure 2). Follow up t-tests revealed that participants with HFA shared significantly more information about themselves than did COM participants, $t(74) = 3.49$, $p < .001$, Cohen's $d = .79$. Participants with HFA also sought information from their interaction partners significantly less than did COM participants, $t(74) = −2.62$, $p = .01$, Cohen's $d = .62$. There was no significant difference between HFA and COM participants on proportion of responses without elaboration, $t(74) = −1.38$, $p = .17$. In addition, a separate t-test revealed that there was no difference between the number of suggestions that participants with HFA made during the Teamwork Task and the number made by COM participants, $t(72) = .72$, $p = .48$.

3.3. Theory of Mind and Social Anxiety in Relation to Observed Competence

Theory of mind—Associations between the theory of mind composite and social initiative, social reciprocity, and self-monitoring were examined using separate regression analyses for each outcome variable as well as for HFA and COM groups, for a total of six models. All models controlled for age, symptom severity, and verbal IQ. For participants with HFA, the model including covariates and theory of mind as predictors of social initiative trended toward significance, $F(4, 30) = 2.62$, $p = .055$, $R^2 = .26$. Theory of mind was positively associated with social initiative for participants with HFA, $\beta = .58$, $t(31) = 2.70$, $p = . 01$. For COM participants, theory of mind was not significantly associated with any social competence dimensions.

Social anxiety—Polynomial regression analyses were conducted separately for participants with HFA and comparison participants to examine whether the relations between parent-reported social anxiety and social competence dimensions were better modeled by a linear or nonlinear function. For typically developing participants, the model consisting of covariates and social anxiety was significant, $F(4, 30) = 3.22$, $p = .03$, $R^2 = .30$. There was a negative linear association between parent-reported social anxiety and observed social reciprocity, $\beta = −.39$, $t(30) = −2.54$, $p = . 02$. The quadratic and cubic regression models did not significantly improve the model, $F_{change} = 1.21$, $p = .28$ and $F_{change} = .07$, $p = .79$, respectively. See Figure 3. Social anxiety did not significantly predict either social self-monitoring or social initiative in the COM sample.

For participants with HFA, the linear regression examining parent-reported social anxiety as a predictor of reciprocity was not significant, $F(4, 30) = 1.38$, $p = .27$. The quadratic regression examining the addition of parent anxiety squared was significant, $F(5, 29) = 3.30$, $p = .02$, $R^2 = .36$. Adding the squared term resulted in a significantly better model than the linear model, $\beta = -2.90$, $t = -2.66$, $p = .01$, $F_{change} = 9.46$, $p = .01$, indicating that the association between reciprocity and social anxiety was best represented as an inverted-U. See Figure 4. A cubic regression analysis was conducted to determine whether the quadratic regression provided the best-fitting equation. Adding the cubic term did not result in a significantly better model than the quadratic, $F_{change} = .12$, $p = .73$, so the quadratic model was retained as the best fit. The regression analyses examining social anxiety as a predictor of social self-monitoring and social initiative did not result in any significant models for Participants with HFA.

4. Discussion

The goal of this study was to use an observational paradigm to simulate the social demands of everyday interactions of children and adolescents with and without high functioning autism and to create reliable indices of social competence. We compared the behaviors of children with HFA to same-aged children without autism and examined relations of theory of mind and social anxiety with individual differences in observed social competence.

4.1. Observational Coding

We used a novel observational paradigm and developed a coding scheme to assess several dimensions of social competence during unfamiliar peer interactions of children and adolescents with and without autism. We identified three observed domains consistent with current conceptualizations of social competence: social initiative, reciprocity, and self-monitoring. These components of social competence may become increasingly challenging for parents to report on during children's transition to adolescence and may therefore be best measured through observation with an unfamiliar peer. Standard measures of social competence often index skills using parent-reported checklists and rarely integrate subdimensions into composite variables, as we did in this study. Our unfamiliar peer interaction paradigm provides an ecologically valid measure by mimicking the complexities of interactions that children and adolescents might encounter in their everyday lives.

4.2. Diagnostic Group Comparisons

Social initiative, reciprocity, and social self-monitoring emerged as separate dimensions of social competence across diagnostic groups. As expected, participants with HFA displayed lower social reciprocity, including seeking, eye contact, conversational skills, and rapport, than COM participants during an unfamiliar peer interaction task, consistent with past findings (Constantino et al., 2003), and reflective of some of the core social and communicative challenges inherent to autism (American Psychological Association; 2013).

Interestingly, participants with HFA displayed higher social initiative than did COM participants. Our follow-up analyses revealed that this difference was characterized by HFA participants' greater overall talking and sharing, but not by more suggestions offered during

a cooperative task. This finding suggests that there are differences between participants with and without HFA in propensities to share information about themselves as well as to seek information from social partners. This finding is particularly interesting when considered alongside the finding of low social reciprocity. Children with HFA may display higher social initiative but lower reciprocity because they may be unaware of social norms regarding the appropriateness of oversharing information about oneself, especially with unfamiliar peers. Ponnet, Buysse, Roeyers, and De Corte (2005) examined self-reports of the content of thoughts and feelings of typically and atypically developing participants during an unfamiliar peer interaction. They found that typically developing adults reported twice as many thoughts and feelings about their interaction partner than did adults with a pervasive developmental disorder. Atypically developing individuals may be less likely to think about, and consequently less likely to ask question of, social partners during a social interaction than typically developing individuals. Interestingly, in our study, individuals with and without HFA did not differ on responses without further elaboration, such as "Oh," or "Cool," indicating that both those with and without autism were paying attention to their social partners and responding in a way that allowed the interaction to continue.

Given the evidence for increased frequency of sharing, future studies should look more closely at the quality of the information being shared to examine the types of topics that children with HFA bring up during a novel interaction. Although individuals with HFA may share a lot of self-relevant information during an interaction, they may not flexibly modulate their conversation topics in response to their social partner's cues (Nadig, Lee, Singh, Bosshart, & Ozonoff, 2010). This quality of conversations of children with HFA may reduce opportunities to practice asking questions of social partners and taking others' perspectives in the context of a social interaction.

Contrary to hypotheses, there were no observed differences between groups on social self-monitoring, which consisted of pausing, showing, verbal directives, and overall efficacy of instruction during the Teaching Task. The relatively low demands of the task may have allowed both typically and atypically developing participants to exhibit good self-monitoring. Of the three laboratory observation tasks, the Teaching Task was the most structured with specific instructions for both "teacher" and "student." Alternatively, the lack of a significant difference between HFA and COM participants may be an artifact of the study design. Since participants with HFA always went first, COM participants consistently had the opportunity to observe their peer complete the task before completing it themselves, and may have adopted the teaching style of their interaction partner. Future studies should investigate social self-monitoring using different methods in individuals with HFA, counterbalancing the order of roles.

4.3. Individual Differences

We examined associations between our behavioral coding of three components of social competence and theory of mind, and found a positive association between theory of mind and observed social initiative for participants with HFA only, after controlling for age, symptom severity, and verbal IQ. Theory of mind and social initiative may be related for participants with HFA because an ability to read and understand the subtle social cues of a

social partner may be necessary to motivate a child to engage socially with a peer through sharing and making suggestions that keep an interaction going. Theory of mind skills and social initiative may not have been related for COM participants in our study because of the much narrower distribution of theory of mind scores for COM participants than for those with HFA.

As hypothesized, we found an inverse relation between parent-reported social anxiety and observed reciprocity for COM participants, but for participants with HFA, the relation between social anxiety and reciprocity was represented as an inverted U shape. This is consistent with previous research that has found a curvilinear relation between self-reported social skills and self-reported anxiety (Bellini, 2004). In line with Bellini's interpretation, we observed that both low and high levels of social anxiety were related to lower levels of social skills than was a moderate level of social anxiety. Future research would benefit from investigating these associations longitudinally to parse apart the order of effects.

4.5. Limitations and Future Directions

One limitation of this study was our relatively wide age range, which included children from age 8 to 16. Although age did not relate to social competence within the HFA group, it did relate in the COM group, indicating that older children and adolescents displayed more competent behaviors. Dimensions of social competence may present differently as typically developing children age and may be best measured in different ways across childhood and into adolescence. Future studies would benefit from investigating narrower age bands in order to examine how specific aspects of social competence presentation look at different ages.

Secondly, our study included both children and adolescents with HFA as well as a comparison group of those without autism. Other comparison groups, such as individuals diagnosed with anxiety, or individuals with developmental disabilities other than autism, would be beneficial for future research studies. Additional comparison groups would provide information about whether specific types of social skills are challenging to children and adolescents with HFA, and would also offer insight into strengths that individuals with HFA possess in the domain of social competence. Dyads consisting of two children without autism (COM-COM in addition to HFA-COM dyads) would also indicate whether behavior changes due to characteristics of a social partner.

Third, in our study, we did not formally document social skills intervention that participants had. Thus, children's performance in the dyadic interaction may have been impacted by extensive therapeutic interventions that were not taken into account. Future studies should gather data on the type and amount of social skills training that children and adolescents have undergone in order to better understand the social skills that children possess in the absence of training as well as once social skills have been specifically taught.

5. Conclusions

Taken together, the findings of this research study suggest that our observational unfamiliar peer interaction paradigm provides a valid index of social competence for both typically and

atypically developing children and adolescents. Previous research has shown that, although they do not have intellectual disability, individuals with HFA experience social deficits that appear early, reducing adaptive functioning levels and quality of life (Shipman et al., 2011). Therefore, it is crucial to identify factors that support social competence for individuals with HFA. Our research found theory of mind to be associated with social competence for children and adolescents with HFA, and social anxiety to be associated with social competence, although in different ways, for both those with and without HFA.

The curvilinear association between social anxiety and social competence present among participants with HFA suggests examining non-linear relations between social competence and other individual difference measures often studied in autism. Given the patterns of comorbid diagnoses like anxiety in individuals with autism, examination of nonlinear associations between variables may reveal different distributions and relations among variables for children and adolescents with HFA versus those without. Further studies are needed to examine dynamic interactions of social competence and both theory of mind and social anxiety over time. A longitudinal examination of these relations would allow for a better assessment of the direction of effects. For children and adolescents with HFA, theory of mind may support social competence, or alternatively, social competence may provide opportunities to practice skills that bolster theory of mind. The association between social anxiety and social competence seems likely to be driven by anxiety, but only a longitudinal study has the potential to provide strong support for this hypothesis.

Implications of this research include using individual difference measures as predictors of social functioning abilities in order to identify children and adolescents who may benefit from particular types of interventions. Theory of mind and social anxiety may also be targeted for interventions that may in turn benefit social competence, particularly for individuals with HFA.

Acknowledgements

Appendix

Get to Know You Task

1. **Total time talking**, including one-word responses, is recorded for the entire segment.

2. Each utterance by a participant receives one of the following codes:

   - • A "**share**" occurs when a participants reveals thoughts, feelings, or opinions about themselves to the peer.

     ○ *Examples*:

       ■ "My favorite animal is a hedgehog."

■ "I'm in sixth grade science, and they haven't even gotten to the lab part."

■ "I used to be in the football team at my last school."

- A "**seek**" usually occurs in the form of a question looking to find out thoughts, feelings, or opinions from the peer.

  ○ *Examples*:

  ■ "Have you seen Mortal Combat?"

  ■ "What do you like to do, like at home?"

  ■ "You know about cold fronts?"

- A **response without elaboration** is defined as a "yes", "no" or other utterance in response to a seek that does not share or ask for information. This type of response usually ends a back and forth exchange. Laughing or other verbalizations that are not actual words are not coded here. Do not code gestures.

  ○ Examples (Peer 2 comments are response without elaboration:

  ■ *Peer 1*: "What made you decide to work on this project?" *Peer 2:* "I don't know."

  ■ *Peer 1*: "I was born in Colorado. *Peer 2*: "Oh."

  ■ *Peer 1*: "I love South Park." *Peer 2*: "Wow."

3. A global rating of **eye contact** is determined from the participant's gaze. High ratings of eye contact should be assigned when participant's eye contact is well-coordinated with other communication (i.e., looking at peers when interacting and looking away when not interacting). Eye contact is rated low when participants are staring at peers or consistently avoiding eye contact.

1 = Mostly uncoordinated eye contact (frequent staring or never looking at peer)

2 = Mostly staring or looking away, but a few instances of coordinated eye contact

3 = Coordinated about half the time

4 = One or two times when eye contact lingers too long or is not coordinated with communication with peer

5 = Well coordinated with other communication (looking away when not interaction/looking at peer when interacting)

4. A global rating of **conversational efficacy** takes into account participants' talking when it is their turn, taking half the responsibility for maintaining and continuing the conversation, answering and asking questions, initiating topics appropriate when meeting someone for the first time, and not revealing overly familiar/friendly

information about self or others given the context of meeting someone for the first time.

> 1 = Rarely displays conversational skills that maintain the flow of the interaction
>
> 2 = A few moments displaying conversational skills that maintain the flow of the interaction but minimal seeking of information from peer
>
> 3 = Responds well but minimal real effort to maintain the interaction; has trouble maintaining flow of conversation
>
> 4 = A little trouble maintaining flow of conversation, but mostly displaying conversational skills that maintain the flow of the interaction
>
> 5 = Shows conversational skills throughout that maintain the flow of the interaction

5. A global rating of **rapport** during conversation/interaction is determined from participants' affect, conversation skills, echolalia, and eye contact.

> 1 = Behaviors during interaction make it difficult for the peer to continue the interaction; does not flexibly modulate behaviors in response to peer
>
> 2 = A few times when behaviors during interaction promote the continuation of the interaction, but mostly behaviors that make the interaction difficult to continue
>
> 3 = Behaviors promoting the continuation of the interaction present about half the time
>
> 4 = A few times when behaviors make the interaction difficult to continue, but mostly actions promoting the continuation of the interaction
>
> 5 = Behaviors during interaction promote the continuation of the interaction; flexibly responding to peer

Teaching Task

6   A frequency is recorded of the "teacher" **waiting** before moving to the next step (e.g., child looks at peer before or after looking at directions and before touching materials to complete next step) OR any time the child looks at the peer or the peer's materials. If looking and waiting occur simultaneously, only one is counted.

7   **Showing actions** include holding an item up for the peer to see, pointing, or any other physical indication to the peer of what to do. This must be directed at the peer and does not apply to just picking up the piece needed for the next step. A showing action may occur at the same time as a verbal directive and counts separately (e.g., a child may hold up a construction set piece *and* simultaneously say, "Now get this one."

8   Any **verbal directive** indicating what piece to use or what action to take. If the child appears to be reading the directions count that as a verbal directive. A

verbal directive can occur at the same time as a showing action and is counted separately.

- *Examples*:

    ○ "You might want to put a black line there."

    ○ "First you take this and slide this piece on here."

    ○ "Turn it over so the white side is up."

Teaching efficacy

1 = Poor teaching; no attempts at helping peer or completing task as if peer was not there; poor self-monitoring

2 = Very few checking/helping behaviors; mostly disregards peer, but some recognition of peer's presence in regard to needing to teach the peer

3 = Some checking/helping peer, but some disregard of peer's presence in regard to needing to teach the peer

4 = Mostly good teaching (e.g., lots of verbal directives or showing actions, but not well coordinated with other forms)

5 = Frequent checks and attempts to make sure peer is following along; excellent self-monitoring

Teamwork Task

10 The number of **suggestions made** for movies to include on the list, how to write the list, or other decisions related to task completion is counted.

- *Examples:*

    ○ "Maybe we can take turns writing."

    ○ "Think of something PG-13."

    ○ "What about *The Empire Strikes Back*?"

11 A global rating of **rapport** during the interaction is determined based on affective flexibility, constructively making suggestions, and accepting peer's suggestions.

1 = Behaviors during interaction make it difficult for the peer to continue the interaction; does not flexibly modulate behaviors in response to peer

2 = A few times when behaviors during interaction promote the continuation of the interaction, but mostly behaviors that make the interaction difficult to continue

3 = Behaviors promoting the continuation of the interaction present about half the time

4 = A few times when behaviors make the interaction difficult to continue, but mostly actions promoting the continuation of the interaction

5 = Behaviors during interaction promote the continuation of the interaction; flexibly responding to peer

Abbreviations

HFA   high functioning autism

COM   comparison

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Highlights

- Children with high functioning autism had higher initiative; lower reciprocity than controls.

- For participants with HFA, theory of mind was positively associated with observed initiative.

- Comparison participants' social anxiety was negatively associated with social reciprocity.

- There was a quadratic relation between social anxiety and reciprocity for HFA participants.
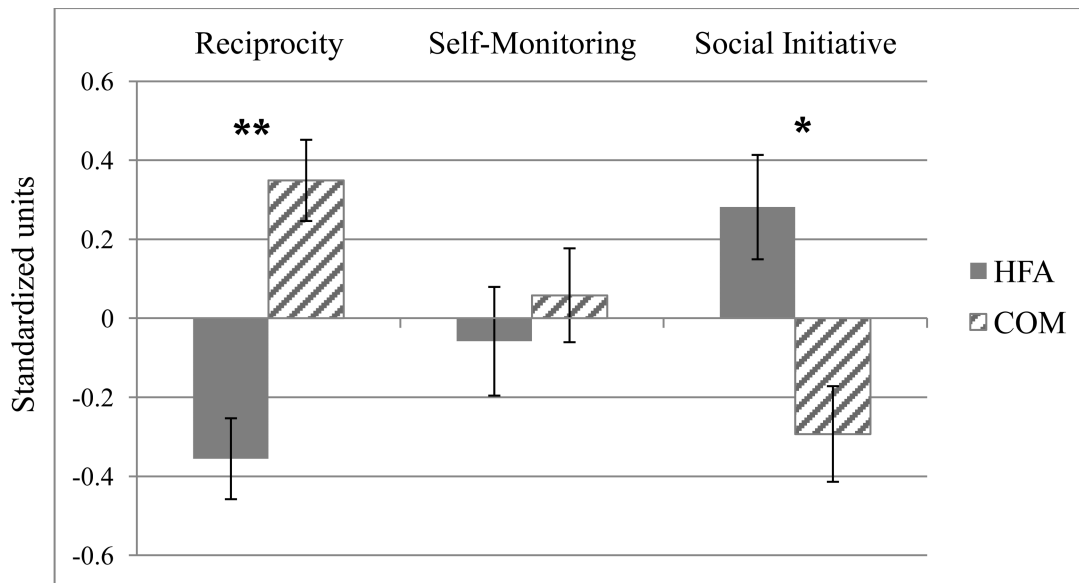
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Note. HFA = individuals with high functioning autism, COM = comparison individuals without autism diagnosis.

* *p* < .05. ** *p* < .01.

Figure 1.
Diagnostic group differences in social competence dimensions
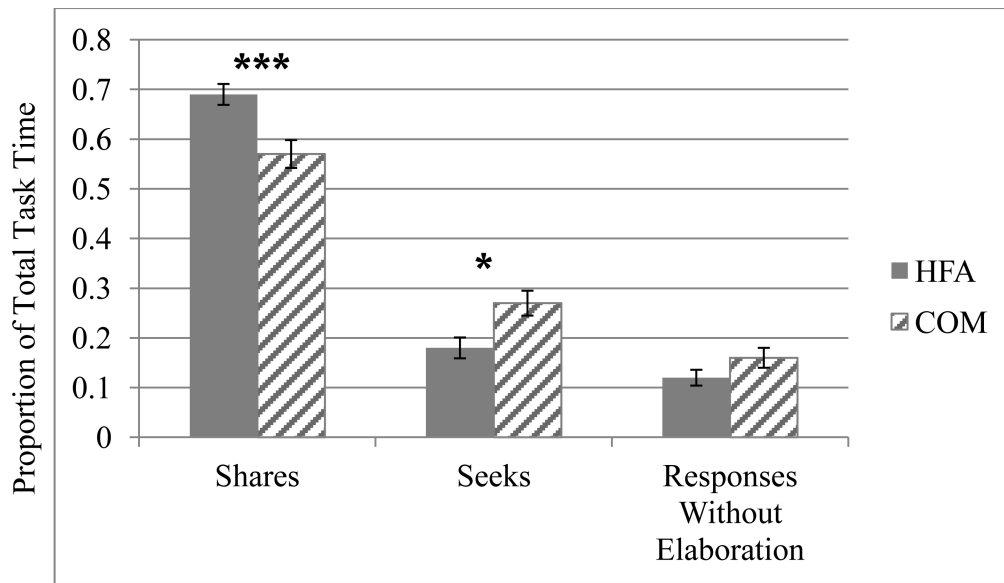
Note. HFA = individuals with high functioning autism, COM = comparison individuals without autism diagnosis.

* *p* < .05. *** *p* < .001.

Figure 2.
Interaction between initiation type and diagnostic group

Figure 3.
Linear association between parent-reported social anxiety and social competence in comparison group

Figure 4.
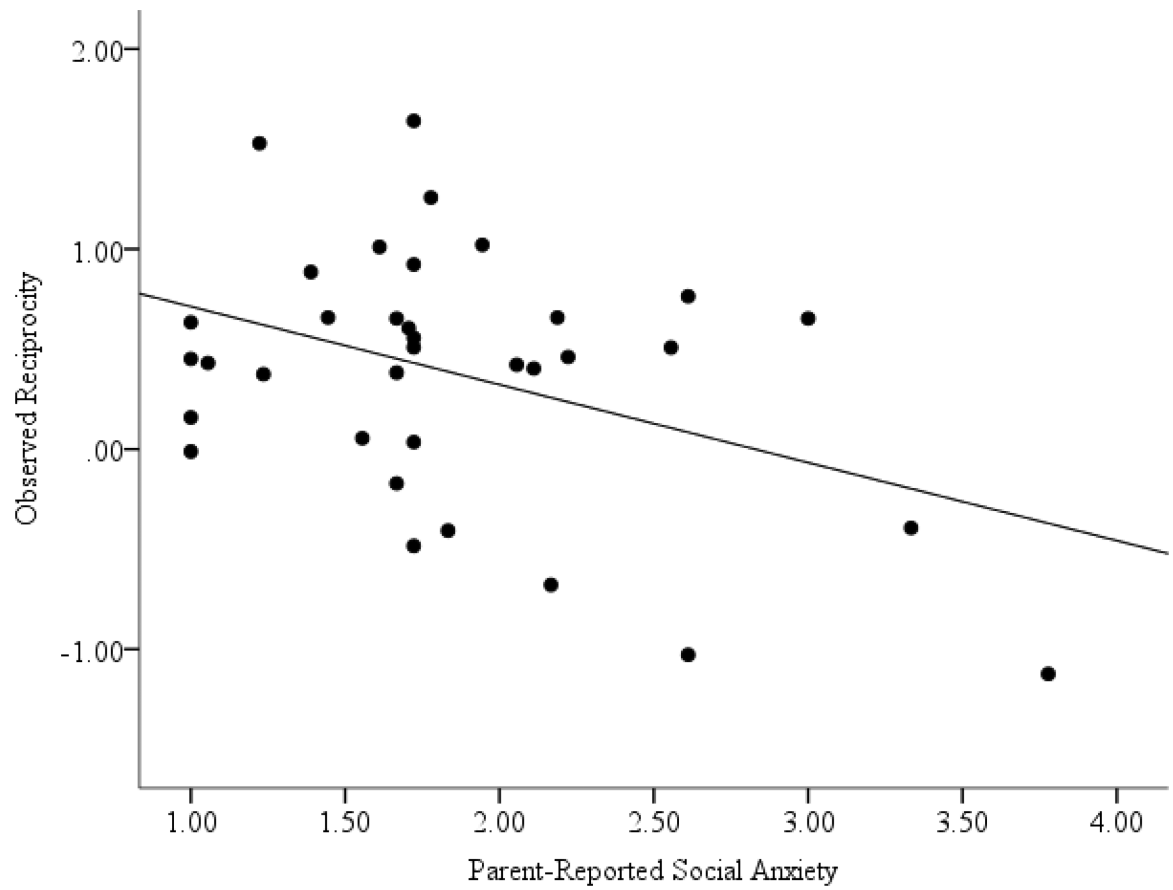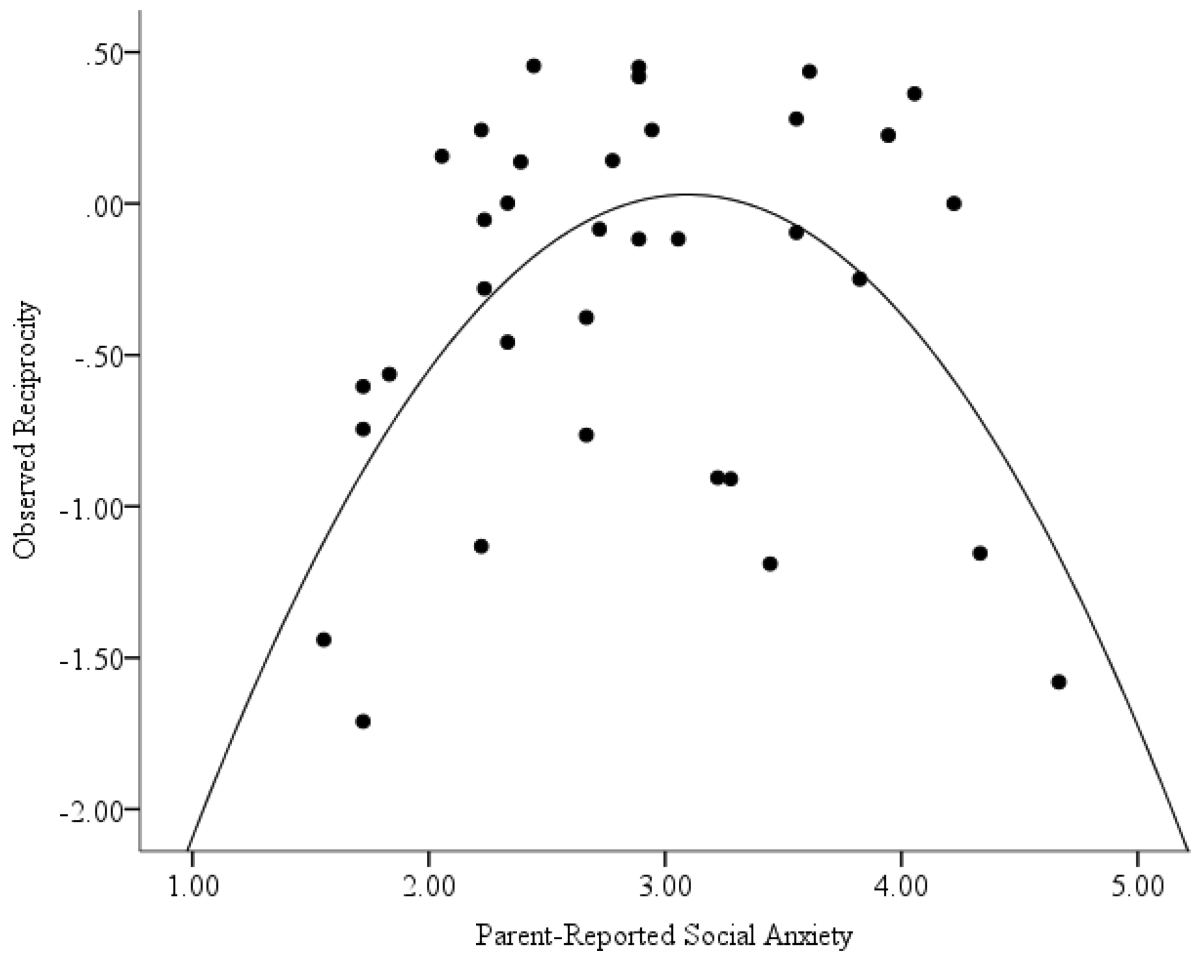Curvilinear association between parent-reported social anxiety and social competence in HFA group

Table 1

Abbreviated version of the Get to Know You Task, Teaching Task, and Teamwork Task Coding System (Each participant in a dyad receives codes for every item)

Get to Know You Task: 5 minutes

1. Record **total time talking**.

2. Code each utterance as one of the following:

    a. **Share**, e.g., *"I used to be in the football team at my last school."*

    b. **Seek**, e.g., *"Have you seen Mortal Combat?"*

    c. **Response without elaboration**: Peer 1: "I was born in Colorado. *Peer 2: "Oh."*

3. Rate **eye contact** on 5-point scale, based on flexibility and coordination with verbal communication (1=not coordinated with other communication, 5=well-coordinated with other communication).

4. Rate **conversational efficacy** on 5-point scale, based on social pragmatics, including taking turns, answering and asking questions, and not revealing overly friendly information (1=conversational skills rarely maintain flow of interaction, 5=conversational skills maintain flow of interaction).

5. Rate **rapport during conversation/interaction** on 5-point scale, based on behaviors that promote or inhibit the continuation of the interaction (1=behaviors make it difficult for peer to continue interaction, 5=behaviors promote continuation of interaction).

Teaching Task: up to 10 minutes

6. Count number of times teacher **waits** before moving to next step.

7. Count number of **showing actions** by the teacher, e.g., placing a toy construction piece in a particular position in the line of sight of the peer.

8. Count number of **verbal directives** by the teacher, e.g., *"First you take this and slide this piece on here."*

9. Rate **efficacy of teaching** on 5-point scale, based on checking/helping behaviors (1= no attempts to help peer, 5=frequent attempts to make sure peer is following along)

Teamwork Task: up to 15 minutes

10. Count number of **suggestions made**, e.g., *"What about The Empire Strikes Back?"*

11. Rate **rapport during the interaction** on 5-point scale, based on behaviors that promote or inhibit the continuation of the interaction (1=behaviors make it difficult for peer to continue interaction, 5=behaviors promote continuation of interaction).

Table 2

Means and standard deviations for all measures

Measure Name	HFA			COM			
	n	*M*	*SD*	*n*	*M*	*SD*	*F*-value
Autism Symptom Severity							
Social Communication Questionnaire	39	20.05	5.69	39	5.54	3.63	180.26***
Verbal IQ							
WISC-IV	39	103.31	15.42	39	107.74	11.61	2.06
Parent-reported Social Anxiety Scale							
Total Score Mean	37	2.88	.80	36	1.83	0.67	37.18***
Theory of Mind Composite	36	−.25	1.06	37	.20	.59	5.36*
Strange Stories	36	19.25	3.48	33	21.64	1.62	12.92***
Reading the Mind in the Eyes	36	19.47	3.92	37	20.03	2.73	.49
Observed Social Initiative Composite	38	.28	.81	38	−.29	.75	10.28**
Get to Know You Total Time Talking (seconds)	38	114.03	43.82	38	79.26	35.77	14.35***
Get to Know You Shares	38	29.87	9.96	38	21.61	9.00	14.39***
Teamwork Task Suggestions Made	37	10.57	4.48	37	9.73	5.55	.51
Observed Reciprocity Composite	38	−.36	.63	38	.35	.63	23.59***
Get to Know You Seeking	38	7.63	5.10	38	10.84	8.05	4.32*
Get to Know You Eye Contact	38	3.55	1.48	38	4.74	0.72	19.57***
Get to Know You Conversational Efficacy	38	3.71	1.23	38	4.13	1.14	2.39
Get to Know You Rapport	38	3.16	1.26	38	4.24	1.05	16.38***
Teamwork Task Suggestions Made	37	1.16	1.72	37	2.73	2.28	11.12**
Teamwork Task Rapport	37	3.78	0.95	37	4.59	0.60	19.38***
Observed Self-Monitoring Composite	38	−.06	.85	38	.06	.73	.41
Teaching Task Waiting	38	9.5	11.30	38	10.39	8.38	.16
Teaching Task Showing Actions	38	2.00	3.34	38	2.68	3.84	.69
Teaching Task Verbal Directives	38	7.34	7.35	38	6.63	5.68	.22
Teaching Task Teaching Efficacy	38	3.45	1.55	38	3.89	1.48	1.65

Note. HFA = high functioning autism, COM = comparison without autism, WISC-IV = Wechsler Intelligence Scales for Children-Fourth Edition, SASC-R = Social Anxiety Scale for Children-Revised, SAD-N = Social Avoidance and Distress-New, SAD-G = Social Avoidance and Distress-General, FNE = Fear of Negative Evaluations.

*
p < .05.

**
p < .01.

***
p < .001

Table 3

Descriptive statistics

| | Diagnostic Group | | | | Differences within dyads | Group differences |
| | HFA | | COM | | | |
	Mean (SD)	Range	Mean (SD)	Range	t value	F value
Gender	34 M, 5 F	-	34 M, 5 F	-	-	-
Age, years	13.85 (2.80)	9.58-18.25	14.14 (2.36)	9.58-17.75	−.77	.25
Verbal IQ	103.31 (15.42)	77-136	107.74 (11.61)	81-136	−1.94†	2.06
ADOS	11.79 (3.88)	3-21	2.66 (3.64)	0-15	9.89***	113.17***
SCQ	20.05 (5.69)	7-33	5.54 (3.63)	0-20	12.51***	180.26***
ASSQ	27.23 (7.05)	12-42	4.77 (4.45)	0-23	17.16***	283.02***

Note. HFA = high functioning autism, COM = comparison without autism, ADOS = Autism Diagnostic Observation Schedule, SCQ = Social Communication Questionnaire, ASSQ = Autism Spectrum Screening Questionnaire. Differences within dyads refer to paired-samples analyses used to determine whether differences existed between groups within dyads.

* $p < .05$.

† $p < .10$.

*** $p < .001$.

Table 4

Correlations between primary variables and covariates of age, symptom severity, and verbal IQ for group with high functioning autism

	1	2	3	4	5	6	7	8	9
1. Age	-								
2. Autism symptom severity	.01	-							
3. Verbal IQ	.06	−.20	-						
4. Parent-reported social anxiety	.06	.09	−.08	-					
5. Strange Stories	.49**	−.21	.45**	.16	-				
6. Reading the Mind in the Eyes	.42**	−.21	.36*	−.01	.54**	-			
7. Reciprocity composite	.17	.24	.26	.06	.15	.22	-		
8. Self-monitoring composite	.13	−.22	.26	.01	.27	.36*	.25	-	
9. Social Initiative composite	.27	−.07	−.04	.09	.42*	.33†	.21	.27	-

†
$p < .10$.

*
$p < .05$.

**
$p < .01$.

Table 5

Correlations between primary variables and covariates of age, symptom severity, and verbal IQ for comparison group

	1	2	3	4	5	6	7	8	9
1. Age	-								
2. Autism symptom severity	−.06	-							
3. Verbal IQ	−.01	.19	-						
4. Parent-reported social anxiety	−.09	.12	.03	-					
5. Strange Stories	.14	−.13	.46**	.14	-				
6. Reading the Mind in the Eyes	.42*	−.25	.01	.20	.03	-			
7. Reciprocity composite	.38*	.00	−.03	−.40*	−.07	.12	-		
8. Self-monitoring composite	.28†	.14	.35*	−.15	−.10	.19	.42**	-	
9. Social Initiative composite	.08	.08	.22	−.22	.17	−.03	.48**	.32*	-

† $p < .10$.

* $p < .05$.

** $p < .01$.

Table 6

Eigenvalues and loadings for peer social competence composite variables PCA

	Reciprocity	Social Self-Monitoring	Social Initiative
	4.00	2.34	1.65
Coded Variables			
Get to Know You Seeking	.30	-.11	-.23
Get to Know You Eye Contact	.87	.10	-.13
Get to Know You Conversational Efficacy	.80	.11	.31
Get to Know You Rapport	.92	.18	.05
Teamwork Task Rapport	.82	.12	-.03
Teaching Task Pauses/Looks	.08	.50	.06
Teaching Task Showing Actions	.16	.83	.14
Teaching Task Verbal Directives	.07	.88	.19
Teaching Task Global Efficacy	.21	.77	-.10
Response Without Elaboration	.12	.08	-.01
Get to Know You Total Time Talking	-.01	.14	.92
Get to Know You Sharing	.08	.07	.93
Teamwork Task Suggestions Made	-.10	.04	.43

Note. Shaded loading values indicate variables that were included in each factor.