Children with Autism and Their Friends: A Multidimensional Study of Friendship in High-Functioning Autism Spectrum Disorder

**Nirit Bauminger · Marjorie Solomon · Anat Aviezer ·
Kelly Heung · Lilach Gazit · John Brown ·
Sally J. Rogers**

Abstract This study of Israeli and American preadolescent children examined characteristics of friendship in 44 children with high-functioning autism spectrum disorder (HFASD) compared to 38 typically developing children (TYP), as they interacted with a close friend Participants were 8–12 years of age (HFASD: Israel, $n=24$; USA, $n=20$; TYP: Israel, $n=23$; USA, $n=15$), and were matched on SES, receptive language vocabulary, child age, and gender (each study group included one girl). Multidimensional assessments included: individual behaviors of target children and observed child–friend interactions during construction and drawing scenarios; target child's and friend's self-perceived mutual friendship qualities; and mother-reported characteristics (friendship's duration/frequency; friend's age/gender/disability status). Overall, children with HFASD displayed a number of differences on individual and dyadic friendship measures. Both age and verbal abilities affected friendship behaviors. Children with HFASD and their friends perceived friendship qualities similarly, suggesting that preadolescents with HFASD have capacities for interpersonal awareness. Between-group similarities also emerged on several complex social behaviors, suggesting that friendship follows a developmental trajectory in autism and may enhance social interaction skills in autism.

N. Bauminger (✉) · A. Aviezer · L. Gazit
School of Education, Bar Ilan University,
Ramat Gan 52900, Israel
e-mail: bauminn@mail.biu.ac.il

M. Solomon · K. Heung · J. Brown · S. J. Rogers
Mind Institute, University of California,
Davis, USA

Peer friendships are basic and essential affective relationships that human beings form throughout the life span (Parker and Gottman 1989). Friendship involves a close, intimate, affective, and relatively long-term tie (6 months or more) between children, based on reciprocal, stable interactions and companionship capacity (e.g., Dunn 1993; Howes 1996; Parker and Gottman 1989). Friendship has important influences on children's social development. Through friendship, children develop and practice fundamental prosocial behaviors including mutual caring, companionship, and empathy. In middle childhood, children build trust and experience intimacy by sharing feelings and experiences with an age-mate (Asher et al. 1996; Parker and Gottman 1989). Friendships provide the child with a sense of belonging and self-worth (Bagwell et al. 1998). Moreover, having a friend serves as an important source of emotional support and protection from loneliness and social rejection, and friendship is an important mediator of social adjustment, with lack of friends related to later adjustment problems (e.g., Burgess et al. 2006; Parker and Gottman 1989; Parker et al. 1995).

The conceptual framework most commonly used to study friendship is the social relationships approach (Hinde 1979). According to this approach, through interactions over long periods, children construct a model of their relationship that goes beyond the influence of each member's characteristics (Dunn 1993). The development of friendship reflects the "wholeness and order" principle taken from general systems theory, in which wholes are considered to be more than the sum of their parts (Sameroff

1983). Thus, through continuous dyadic interactions, friendships develop social–emotional functions and resources that serve to fulfill the individual friends' basic social needs (Buhrmester 1996; Sullivan 1953).

Three dimensions of friendship—companionship, intimacy–trust, and closeness–affection—have been considered crucial criteria for distinguishing friends from non-friends in preadolescence and adolescence (e.g., Buhrmester 1996; Howes 1996; Parker and Gottman 1989). Friendship serves the important function of fulfilling the need for enjoyable companionship, which is present throughout the entire life course (Buhrmester 1996). Companionship is defined as children's ability to cooperate while spending time together either in shared play ("playing together") or in shared activities ("hanging out", "doing things together"), and as having fun (Howes 1996). Intimacy, which involves openness in sharing thoughts, feelings, and experiences, is necessary for loyalty and trust—the belief that in times of need, friends can be relied upon to provide support and help. Intimacy is also related to the sense of stability in friendship and to the belief that the friendship is strong enough to overcome negative events like quarrels (e.g., Bukowski et al. 1994). Closeness underscores the essence of friendship as an affective bond reflecting the strength of the child's attachment to the friend. It includes mutual liking and caring and a sense of "specialness" to one another (Bukowski et al. 1994).

The aforementioned friendship functions and characteristics are manifested by certain classes of behavioral markers. Markers of companionship involve children's cooperative skills during shared work or play as well as their social conversation skills and positive affect (e.g., shared fun) (Asher et al. 1996). Markers of intimacy include sharing capabilities and prosocial resources such as providing help (e.g., Bukowski et al. 1994). Verbal and nonverbal expressions of affect and caring are markers of closeness (Howes 1996).

Friends display a higher level of mutual social engagement and responsiveness towards one another than do acquaintances. Friends exhibit a higher level of active involvement when jointly performing a task (Field et al. 1992); greater affective interchange, evidenced by matched laughter, smiling at one another, exclamations, and touching (Field et al. 1992; Newcomb and Brady 1982); a higher frequency of verbal communications such as issuing commands (Brachfield-Child and Schiavo 1990); reciprocal verbal exchanges (Newcomb and Brady 1982); and, finally, a higher likelihood of assisting one another, e.g., jointly manipulating the same materials to accomplish a task (Newcomb and Brady 1982).

Friendship's dyadic and reciprocal nature both fosters and requires social cognition, particularly awareness and responsiveness to another's emotions, desires, intentions,

and thoughts—theory of mind capabilities. Recent research on social information processing emphasizes that the quality of children's friendship influences the processing of social situations. A close peer friendship motivates a child to embark on more complex social information processing and to consider the friend's point of view (Lemerise and Arsenio 2000).

Hinde (1979), while defining relationship dimensions, underscored children's capabilities to interconnect or to "mesh" with one another. Friends need to monitor the shifting interests of their friends and, at times, to get involved in their friends' interests and activities even if those interests were not originally their own (Asher et al. 1996). In addition, the egalitarian style of exchange in friendships requires a balance between dominant and subordinate roles (Brody et al. 1982). Thus, certain friendship dimensions (e.g., cohesiveness, harmony) can be better explored when looking at the dyads rather than individual children.

In sum, friendship is typified by stable, frequent, and interconnected affective interactions that are manifested by certain classes of behavioral markers (e.g., sharing, play and conversational skills) that facilitate the functions of companionship, intimacy, and closeness. A satisfying friendship is an interpersonal achievement that both develops and builds upon a foundation of capacity for affective relationships and social cognition.

Friendship in Autism Spectrum Disorder

Autism spectrum disorder (ASD) is a neurobiological disorder that significantly impairs reciprocal social relations, verbal and nonverbal communication, and behavior (DSM-IV-TR; American Psychiatric Association 2000). Children's ability to form affective bonds comprises a major theoretical dilemma in understanding this disorder (Hobson 2005). Two main theoretical views—the affective view and the theory of mind view—offer a framework for considering research on these children's interpersonal capabilities. Following Kanner (1943), the affective view of autism perceives children with ASD as lacking the basic ability to experience relationship-based emotions (Hobson 2005). This view predicts difficulties in developing affective closeness and intimacy, based on a core deficit in intersubjective sharing (Hobson 2005; Kanner 1943; Rogers and Pennington 1991). According to Hobson et al. (2006), this intersubjective sharing deficit hampers children's understanding of reciprocal relationships based on feelings, leading to a more impersonal–superficial rather than interpersonal perception of friendship. This view thus predicts difficulties not only in the formation of friendship, but also in the perception of interpersonal relationships as

such (see also in Bauminger and Kasari 2000; Carrington and Graham 2001; Carrington et al. 2003).

A different theoretical explanation to the social–emotional deficit in ASD is the theory of mind view. This view emphasizes the difficulty among children with autism in understanding that other people have different thoughts, desires, and feelings. It also predicts crucial difficulties in reciprocity and empathic prosocial behaviors (e.g., comforting, caring, complimenting, listening), which are key defining characteristics of friendship (Tager-Flusberg 2001). These two views, affective and social cognitive, have led to a general consensus that friendship constitutes a major area of difficulty for children with ASD (e.g., Green et al. 2000; Orsmond et al. 2004). However, there has been little empirical study of friendship relations in autism.

There are reports of friendship relations for some children with high-functioning autism spectrum disorder (HFASD), though differing in quality and quantity from that experienced by typically developing children (e.g., Bauminger and Kasari 2000; Bauminger and Shulman 2003; Green et al. 2000; Koning and Magill-Evans 2001). Most of what is known about friendship in children with HFASD is based on diagnostic criteria and clinical evaluations (Attwood 1998) or on the use of self-reports and mother reports (e.g., Green et al. 2000; Koning and Magill-Evans 2001; Orsmond et al. 2004; Bauminger and Kasari 2000), but no observational studies on friendship in ASD have been conducted so far.

It is important to consider the role of cognitive-linguistic resources in the understanding of these children's interpersonal capabilities. Children with ASD who have less impaired intellectual ability may engage in more advanced levels of social relationships than children with greater impairment, by using their stronger linguistic abilities (e.g., Hermelin and O'Connor 1985). For example, receptive language capabilities have been found to be related to security of attachment in children with HFASD (Capps et al. 1994), and verbal IQ was related to the understanding of social-complex emotions (e.g., empathy, embarrassment), only for children with HFASD and not for their typical age-mates (see review in Kasari et al. 2001). Also, friendships were reported mainly for children with HFASD versus children with greater intellectual impairment. Thus, it seems that at least some children with HFASD develop ways to recognize and express their interpersonal-affective experiences. Hermelin and O'Connor (1985) suggested a cognitive compensatory mechanism that they called the "logico-affective" hypothesis. According to this hypothesis, children with ASD learn cognitive strategies to recognize and express emotions and relations that "come naturally" to non-autistic individuals. In sum, existing findings suggest that at least some children with HFASD may experience friendship as a positive and beneficial form of social relatedness, perhaps

with some alterations. However, the characteristics, qualitative attributes, and behavioral manifestations of friendships have not yet been directly examined. These are the primary goals of the current study.

Purpose of the Study

The present study aimed to explore two diagnostic groups' (HFASD/typical) differences and similarities in: (a) friendship characteristics (e.g., friendship duration, frequency of meetings, and target child's friend's gender, age, and familial and disability status); (b) friendship manifestations as reflected by behaviors, verbalizations, and affects during an interaction with a close friend; (c) dyadic components of friendship; and (d) perceived friendship qualities, first between HFASD and typical development (TYP) groups, and then within groups to examine differences between the target child's and close friend's perceptions of the quality of their friendship. We also aimed to explore the links between receptive language ability, age, and friendship patterns in each study group.

Based on the intersubjective sharing and theory of mind difficulties for the group with HFASD, we expected to find group differences on all friendship dimensions, with typically developing children outperforming children with HFASD. Likewise, we expected perceived friendship qualities to differ significantly between children with HFASD and their close friends. Lastly, we expected receptive language ability to relate more strongly to friendship in children with HFASD than in TYP, based on the logico-affective hypothesis.

Method

Participants

A total of 164 children participated in the study: 82 recruited research participants including 2 groups with HFASD ($n=24$, Israel; $n=20$, USA) and 2 TYP groups ($n=23$, Israel; $n=15$, USA), and 82 children who were the close friends of the participants.

HFASD Groups

Diagnostic criteria for the group of children with HFASD in Israel included prior clinical diagnosis based on the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; American Psychiatric Association 1994) of either Autistic Disorder ($n=9$; 37.5%, 1 girl) or Asperger syndrome ($n=15$; 62.5%) by a licensed psychologist unassociated with the current study. Inclusion of both children with HFASD and with Asperger's syndrome was

based on the shared social characteristic for both populations during middle childhood (see, for example, Frith 2004; Macintosh and Dissanayake 2004). In addition to the previous diagnosis, the Autism Diagnostic Interview-Revised (ADI-R; Lord et al. 1994) was administered to the children's parents. All 24 participants scored above the autism cutoff on the ADI-R.

Diagnostic criteria for the children with HFASD in the USA were based on the ADI-R (Lord et al. 1994) and on the Autism Diagnostic Observation Schedule-Generic (ADOS-G; Lord et al. 1999). All 20 participants scored above the autism cutoff on the ADI-R. Seven (35%) children were diagnosed with autistic disorder, and 13 (65%, 1 girl) with Asperger (demonstrating normative speech development, fitting the clinical diagnosis of Asperger). On the ADOS-G, 11 children scored over the cutoff for Autistic Disorder, and the remaining 9 scored in the ASD range.

Other inclusion criteria included: (1) Receptive vocabulary level score of 80 or above (as assessed by the Peabody Picture Vocabulary Test—PPVT; Dunn and Dunn 1997); (2) Normative reading comprehension level based on the Wide Range Achievement Test 3 (WRAT 3 Reading; Wilkinson 1993) for the USA sample and on the *Ma'akav* (Shany et al. 2003) for the Israeli sample; and (3) an identified close friendship of at least 6 months duration with friendship activities that included meetings outside school time based on maternal report and verified by the friend.

Typical Groups

The two groups of children with HFASD (Israel and USA) were matched to two groups of children with typical development on maternal education, verbal performance based on the PPVT (Dunn and Dunn 1997), child age, and gender (see Table 1).

The Friend Participants

The close friends of the Israeli children with HFASD were 19 boys, 5 girls, mean child age=111.08 months (SD= 13.81; range=86–145). The close friends of the Israeli participants in the TYP group were 21 boys, 2 girls, mean child age=120.90 months (SD=18.64; range=89–144). The close friends of the American children with HFASD were 15 boys, 5 girls, mean child age=119.70 months (SD= 18.92; range=84–144). The close friends of the American participants in the TYP group were 13 boys, 2 girls, mean child age=118.00 months (SD=16.9; range=90–144). Additional demographic information for the friends is provided in the "Results" section.

Measures

We implemented a multidimensional assessment battery that included: observation of children's interactions with their close friend during two experimental scenarios (construction and drawing); self-reports to assess the target child's and the friend's perceptions of their mutual friendship's qualities; and an interview with the target child's mother to obtain general information about her child's friendship.

Friendship Observation

Two Friendship Experimental Scenarios: Construction Game and Drawing

Children (HFASD and TYP) were invited to come to the laboratory with an identified close friend. Each dyad was observed and videotaped during a 40-min session while participating in two different noncompetitive tasks: the "construction game" scenario and the "drawing" scenario.

Table 1 Sample characteristics for high-functioning children with autism spectrum disorder (HFASD) and children with typical development (TYP) in Israel and the USA

		HFASD		TYP		Group difference (1, 77)
		Israel (n=24)	USA (n=20)	Israel (n=23)	USA (n=15)	
Child age (in months)	Mean	116.00	125.20	122.87	123.80	1.50
	SD	14.10	15.17	16.71	16.04	
Range		98–151	98–146	98–144	99–151	
Receptive language	Mean	106.25	105.25	112.09	112.60	1.92
	SD	9.84	16.18	6.93	14.58	
Range		84–122	80–133	101–128	94–148	
Mother's education	Mean	4.66	5.05	4.63	5.00	0.81
	SD	1.07	0.78	1.33	1.03	
Male/female		23/1	19/1	22/1	14/1	

Receptive language scores are based on the Peabody Picture Vocabulary Test. Mother's education was calculated on a 6-point scale: 1=less than 8th grade; 2=some high school; 3=high school with diploma; 4=some college; 5=college degree (e.g., BA); 6=graduate degree (e.g., masters or above).

The construction game scenario followed Siperstein et al. (1997) procedure for the assessment of behavioral manifestations of friendship during task performance. This procedure was successful in differentiating friendship behaviors in children with and without learning disabilities (Siperstein et al. 1997). In this scenario, children were provided with a noncompetitive construction game—Discovery Toys' Super Marbleworks® Raceway Construction Set. Children were instructed to construct a shared design (a marble maze) while using ramps, connectors, funnels, and tunnels. After completion, children could roll the marbles down and through the maze.

To assess a longer duration of interaction, and to provide the children with a different activity option, a drawing scenario was also included. In this scenario, children were given a box of colored markers, magazines, scissors, glue, and stencils and a large blank sheet of paper. As in the construction scenario, children were asked to draw a shared design. Order of administration of the construction game and shared drawing scenarios was counterbalanced.

Children's videotaped interactions with their close friend were assessed using two coding scales. The first of these was designed to evaluate the behavioral manifestations of friendship. The second evaluated the quality and nature of dyadic interaction.

Observed Friendship Manifestations in Target Children

The first scale, the Friendship Observation Scale (FOS[1]) (Bauminger et al. 2005), was an interactional coding system designed to assess minute-by-minute and global evaluations of friendship manifestations in the target child, including behaviors, verbalizations, and affects identified as indicators of friendship by previous research (e.g., Asher et al. 1996). The FOS was adapted from the procedure used by Siperstein et al. (1997) to assess friendship manifestations during a construction game among children with and without learning disabilities. The FOS included two main scales: (a) positive social interaction scale and (b) global evaluation scale.

Positive social interaction scale. This scale consisted of 21 indices in 7 main categories: (a) goal-directed behavior, including cooperative behaviors directly related to performance of task (construction, drawing); (b) sharing behaviors such as experiences or emotions; (c) prosocial behavior such as comforting and helping; (d) conversation, as in small talk and negotiation; (e) nonverbal interaction such as the combination of eye gaze and a smile; (f) affect, including shared laughter and positive affect; and (g) play, tapping play complexity such as parallel or coordinated play (this last category was utilized only for the construction game scenario, because the drawing scenario was a

shared activity rather than game). The presence of each friendship index in each of the seven categories was assessed once per minute during a total of 40 min of observation time (20 min for the construction game and 20 min for the drawing). The observer watched the target child's behaviors for 50 s and then recorded them for 10 s. The number of observations in which a friendship index was detected was summed separately for each of the seven categories. Thus, a higher score in a particular category indicated a higher quantity of positive social interactions for that category.

For coding, two blind observers were trained to code the positive social interaction indices using videotapes of friendship dyads that were not associated with the current project. An inter-observer agreement level of 90% or higher was obtained for all items on the final scale. Coders then worked independently, checking ongoing inter-rater reliability by jointly coding 25% of the sample, randomly selected between the HFASD and TYP groups, obtaining an agreement level of 93%.

Global evaluation scale. Unlike the positive social interaction scale, the FOS's global evaluation scale involved a global evaluation of the target child's behavior during the whole scenario (construction game and drawing), along five main categories. Three of these categories (reported here) were coded for the target child only, and the other two categories were coded for the dyad together (reported below, in the section on dyadic relationships). The first category that was coded for the target child only, role-related behaviors, reflected children's general leader or follower role enacted during the interaction, rated on a 7-point scale ranging from *Child follows peer* (1) to *Child makes major decisions throughout activity* (7). The other two target child-only dimensions related to conversation skills. The second category, conversational flow, evaluated the child's speech according to its fluency, intonation, rhythm, and expressivity, rated on a 6-point scale ranging from *poor* (1) to *high* (6). The third category, conversational skills, assessed the to and fro use of words and phrases in social conversation, rated on a 3-point scale ranging from *No social conversation at all* (1) to *Child is able to continue a social conversation and develop it pertaining to what was said* (3).

For coding, at the end of their minute-by-minute coding for the positive social interaction scale, the same two coders evaluated the global scale, following the same training procedure as described above. They obtained an agreement level of 90% for the shared 25% videotapes.

Observed Dyadic Components

Two instruments—the Dyadic Relationships Q-Set and the aforementioned FOS Dyadic Qualities global rating system were used to assess the quality of dyadic relations.

---

[1] The FOS manual is available upon request from the first author.

Dyadic Relationships Q-Set (DRQ). The 55-item DRQ (Park and Waters 1989) was used to evaluate dyadic behavioral dimensions. Q-sorting is a technique for rating or sorting a large set of items (the Q-set) relative to one another (Waters and Deane 1985). The 55 items on the DRQ were sorted in a fixed distribution into 7 piles, with a 5–7–9–13–9–7–5 distribution. The 7 piles, in forced-choice format, ranged from *Least characteristic behavior* (pile 1) to *Most characteristic behavior* (pile 7) for each dyad. A score for an item equaled the pile in which it was placed (e.g., an item in pile 3 received a score of 3). The 55 items were grouped into the following seven dyadic relationship dimensions, which offered usefulness in describing the quality of interactions among friends: positive social orientation (e.g., "partners express enjoyment at playing together"); cohesiveness (e.g., "when one partner moves away, the other moves in coordination"); harmony (e.g. "partners' offers and suggestions guide dyadic play"); responsiveness (e.g., "partners endorse each other's attitudes and activity preferences"); coordinated play (e.g., "partners work together to produce more complex or organized play than either would engage in alone,"); control (e.g., "partners grab and take things from each other"); and self-disclosure (e.g., "partners share secrets"). In the current study, self-disclosure rarely emerged during either scenario for HFASD or TYP; therefore, we removed it from analyses.

For coding, two new blind coders were trained to code the DRQ on videotapes of friendship dyads not associated with the current project, with an (r) ranging between 0.70 and 0.90. Agreement between two observers was tested by correlating the observers' scores, where sorters were variables and items were cases (Waters and Deane 1985). These two coders coded all the videotapes, and the mean of the two observer scores was used as the variable of interest.

Inasmuch as the Q-set required an evaluation of the quality of interactions in the 20-min scenarios, we only coded videos in which the friends interacted for at least 30% of the episode (a minimum of 6 min of dyadic interaction time along the 20 min total). Nine dyads were dropped because they did not fulfill this coding rule, 6 from the HFASD sample and 3 from the TYP sample.

FOS dyadic categories of global evaluation scale. Two categories of the FOS global evaluation scale were rated for dyadic components across the entire interactive period (construction game/drawing). Shared fun was rated on a 3-point scale: *Not having fun at all* (1), *Working on the task equaled the social interaction in importance* (2), and *Social interaction was more important than the task* (3). Affective closeness was rated on a 5-point scale ranging from *Very few or no signs of closeness* (1) to *Very close and intimate friendship* (5).

Child's and Friend's Self-Perceived Friendship Qualities

The Friendship Qualities Scale (FQS) (Bukowski et al. 1994) was a self-report assessing children's perception of various qualities of their friendship. Target children and their friends were asked to think about their friendship with each other when answering the questionnaire. The FQS self-report contained 23 items, rated on a 5-point scale ranging from *Not true at all* (1) to *Very true* (5). The items reflected five categories of friendship qualities: companionship (e.g., "My friend and I spend all our free time together"); security–intimacy and trust (e.g., "If there is something bothering me, I can tell my friend about it even if it is something I cannot tell other people"); closeness (e.g., "I think about my friend even when he is not around"); help (e.g., "My friend would help me if I needed it"); and conflict (e.g., "My friend and I can argue a lot"). The five subscales presented adequate internal reliability (Cronbach α coefficients between 0.71 and 0.86 for Bukowski et al. 1994; and between 0.57 and 0.86 in the current study).

Maternal Interview

All mothers were interviewed for the following information: any developmental problems of the friend; whether the parents of the friends were also friends; duration of the friendship; and frequency of meetings, calculated on an 8-point scale where *Meeting less than once a week* received a score of 1, and 2–8 represented meeting frequency during the week (i.e., 2=once a week, 3=twice a week, 8=seven times a week).

Procedure

The study was conducted in each site under the authority of the Institutional Review Board for each university. This study was part of a larger study and included several additional measures not reported here. Families and children were recruited from past research studies, schools, and mailers. The initial contact involved a telephone screen regarding inclusion/exclusion criteria and a description of the study. Then a lab visit was scheduled, during which we obtained written parental consent and child assent. The families themselves recruited the friend and their family, who called us, volunteered for the study, and also attended the lab visit to complete consent and assent forms. Research data were collected in each PI's laboratory, one in the MIND Institute at UC Davis (Rogers), and the other at the School of Education, Bar-Ilan University (Bauminger).

The research session included the target child, his/her friend, and the target child's mother. First, we executed the experimental friendship scenarios, counterbalanced be-

tween construction and drawing. Next, each child was interviewed separately by a researcher, during which time the FQS was completed, and the reading and vocabulary measures were administered. This study comprised part of a larger study, and the current participants completed several questionnaires and tasks beyond the focus of the current report. The order of administration of study measures was counterbalanced. The mothers were interviewed and completed demographic questionnaires during the interactive scenarios.

The current binational study included participants from Israel and the USA. Several procedures were followed to assure that data collection and management did not differ by site. First, the research team developed a very detailed study protocol with written instructions for administration of all measures and the experimental scenario. This was carefully followed for all assessments. Second, the Israeli PI (N.B.) visited the US PI (S.R.) and team annually to train and review all aspects of the study. Third, the Israeli PI reviewed a random sample of the videos throughout the study and immediately informed the US team of any drift. Finally, all data coding procedures were executed in Israel by bilingual coders fluent in Hebrew and English.

Results

In line with study's aims and hypotheses, in this section we report diagnostic group (HFASD/TYP) differences in: (a) descriptive information about the friend and friendship characteristics; (b) observed friendship manifestations based on target child's behavior while interacting with a friend; (c) observed friendship dyadic components; (d) self-perceptions of the friendship's qualities of target child and friend, and (e) associations between friendship, the child's age, and PPVT-receptive language. To control for possible nationality influences, we executed 2 (diagnostic group)×2 (nationality) analyses of variance (ANOVAs) for all our measures. Given the lack of marked or consistent nationality differences in our binational sample, our report will focus on diagnostic group comparisons including significant interactions of diagnostic group×nationality.

Friend and Friendship's Characteristics

The friend's characteristics The groups were similar in gender, familial status of friend, and age. In both diagnostic groups, most friendship pairs were same-gender (HFASD: 77.2%, $n=34$ pairs; TYP: 94.7%, $n=36$ pairs) and involved a friend who was not a relative (2 pairs in the HFASD group had a relative as the friend—6.82%, and 1 pair—2.63% in the TYP sample). Regarding age, the majority of children in both groups had friends their own age; mean child age was 120.5 months for HFASD children (SD=

14.63) and 115.40 for their friends (SD=16.35). Mean child age was 123.33 months in the TYP group (SD=16.37) and 119.45 for their friends (SD=17.77).

In contrast to the group similarities found for gender, familial status of friend, and friend's age, a significant difference emerged for the friend's diagnostic group. Friends of children with HFASD more often had a disability than friends of children in the TYP group, X^2 (1, 81)=9.49, $p<0.05$ (16 pairs for ASD, 36%, compared to 4 pairs for the TYP group, 9.3%).

Friendship characteristics We examined friendship duration and frequency of meetings using a 2 (diagnostic group)×2 (nationality) univariate analyses of variance (ANOVAs) that revealed greater frequency of meetings for children in the TYP group than children in the HFASD group, F (1, 77)= 19.47, $p<0.001$, $\eta^2=0.20$, TYP group mean=2.70 (SD= 1.25), HFASD group mean=2.15 (SD=.87). Duration of friendship did not differ between the groups, F (1, 77)=1.64, $p>0.05$, $\eta^2=0.02$, HFASD mean=40.00 months (SD= 28.32), TYP group mean=49.11 months (SD=36.78).

Observed Friendship Manifestations in the Target Children

Behavioral data for the target children involved: (a) minute-by-minute positive social interactions; (b) global evaluations of child's role in the interaction (leader or follower); and (c) global evaluations of child's conversational capabilities (flow and social conversation). In the construction scenario, we also examined children's play skills.

Construction game: positive social interactions A series of 2 (diagnostic group)×2 (nationality) ANOVAs was computed to examine target children's differences on the following positive social interaction categories (based on the FOS): goal-directed behaviors; sharing; prosocial behaviors; conversation skills; nonverbal positive interaction; and positive affect. As can be seen in Table 2, univariate ANOVAs revealed significant group differences in goal-directed behaviors, sharing, and positive affect, involving lower frequencies of behaviors for the group of children with HFASD than for the children in the TYP group. There was also a significant interaction of nationality×diagnostic group for prosocial behaviors, F (1, 77)= 6.69, $p<0.05$, $\eta^2=0.08$. Simple effect tests revealed a significant group difference only in the Israeli sample, F (1, 45)=15.38, $p<0.001$, $\eta^2=0.25$, in which the TYP group revealed a lower frequency of child's prosocial behaviors than the HFASD group.

Drawing scenario: positive social interactions As seen in Table 3, univariate ANOVAs revealed significant diagnostic

Table 2 Diagnostic group differences for target children's friendship manifestations during observed construction task

	HFASD		TYP		F (1, 77) diagnostic group	η^2
	Mean	SD	Mean	SD		
Positive social interaction						
Goal-directed	13.16	4.80	15.75	4.31	6.17[b]	0.07
Sharing	3.77	2.39	6.16	3.17	13.71[a]	0.15
Prosocial	1.99	1.78	0.91	1.16	8.74[b]	0.10
Nonverbal	5.41	3.06	6.34	3.80	1.44	0.02
Conversation	2.30	3.07	1.77	1.89	0.80	0.01
Positive affect	4.89	4.15	8.53	5.31	10.91[a]	0.12
Play scale						
Parallel	5.63	6.00	0.65	1.35	23.74[a]	0.24
Social	1.30	2.72	1.27	2.05	0.00	0.00
Cooperative	8.66	6.26	15.27	5.38	24.40[a]	0.24
Unoccupied	0.31	0.64	0.00	0.00	5.68[c]	0.07
Global evaluation						
Role	3.19	1.01	3.47	0.83	1.70	0.02
Conversation flow	3.00	1.15	4.33	1.08	27.74[a]	0.26
Social conversation	1.80	0.76	2.38	0.53	14.54[a]	0.16

Several SDs were higher than their means; therefore, an additional nonparametric Mann–Whitney test for independent samples was performed for these cases, which mirrored the ANOVA results.

HFASD: high-functioning children with autism spectrum disorder, *TYP*: children with typical development.

[a] $p < 0.001$
[b] $p < 0.01$
[c] $p < 0.05$

group differences in goal-directed behaviors, nonverbal behaviors, and positive affect. Children with HFASD demonstrated a lower frequency of these behavioral manifestations than children in the TYP group.

Construction game: play scale A 2×2 ANOVAs for differences in the target children's play skills (parallel, social, coordinated, and unoccupied) revealed significant diagnostic differences on all play categories but social play. Children with HFASD demonstrated a higher frequency of parallel play, spent a longer time unoccupied, and revealed a lower frequency of coordinated play compared to children in the TYP group (see Table 2). However, for the unoccupied measure, the diagnostic group×nationality

Table 3 Diagnostic group differences for target children's friendship manifestations during observed drawing task

	HFASD		TYP		F (1, 77) diagnostic group	η^2
	Mean	SD	Mean	SD		
Positive social interaction						
Goal-directed	10.69	4.60	13.65	4.02	9.21[b]	0.11
Sharing	4.60	3.78	5.89	3.43	2.34	0.03
Prosocial	0.76	1.27	0.52	0.92	0.68	0.00
Nonverbal	7.16	4.39	10.56	4.39	11.38[a]	0.13
Conversation	5.09	5.12	5.05	3.61	0.00	0.00
Positive affect	4.56	4.83	7.10	4.48	5.91[b]	0.07
Global evaluation						
Role	3.02	0.84	3.33	0.83	2.87	0.04
Conversation flow	2.92	1.37	4.21	1.25	19.15[a]	0.19
Social conversation	1.73	0.82	2.30	0.63	11.93[a]	0.13

Several SDs were higher than their means; therefore, an additional nonparametric Mann–Whitney test for independent samples was performed for these cases, which mirrored the ANOVA results.

HFASD: high-functioning children with autism spectrum disorder, *TYP*: children with typical development.

[a] $p < 0.001$
[b] $p < 0.01$

interaction was significant, F (1, 77)=3.96, $p<0.05$, $\eta^2=$ 0.05. Simple effect tests revealed a significant difference only in the Israeli sample, F (1, 45)=6.96, $p<0.01$, $\eta^2=$ 0.13, in which the HFASD group was more frequently unoccupied compared to the TYP group. This variable was not rated in the drawing scenario.

Construction game: global evaluations of role and conversation A series of 2×2 ANOVAs was computed for differences in the FOS global evaluations of the target children's role and conversation skills. As seen in Table 2, ANOVAs were significant for conversational flow and social conversation, but not for follower/leader role. Children in the HFASD group revealed a more rigid conversational style and manifested less social conversation during the construction scenario compared with children in the TYP group.

Drawing scenario: global evaluations of role and conversation As in the construction task, the 2×2 univariate ANOVAs for diagnostic group differences were significant for conversational flow and for social conversation. Children in the TYP group demonstrated higher mean scores than children in the HFASD group (see Table 3).

Comparison of Construction and Drawing Scenarios

We computed two separate 2 (diagnostic group)×2 (nationality)×2 (scenario: construction/drawing) MANOVAs with repeated measures on scenario, to examine differences in

positive social interaction and in global evaluations of role and conversation between the two social scenarios. Only the MANOVA for positive social interactions yielded a significant scenario effect, F (6, 72)=19.57, $p<0.001$, $\eta^2=$ 0.62, and a significant interaction of scenario×diagnostic group, F (6, 72)=2.75, $p<0.05$, $\eta^2=0.18$. Thus, we computed univariate ANOVAs only for that scale. As seen in Table 4, the ANOVAs detected a higher frequency of goal-directed behaviors and of prosocial behaviors and a lower frequency of nonverbal interactions and conversations in the construction scenario than in the drawing scenario.

Observed Dyadic Components in Construction and Drawing Scenarios

Dyadic relationship dimensions Similar to our analyses above, we computed the diagnostic groups' effect for the six dyadic relationship dimensions of the DRQ (positive social orientation, cohesiveness, harmony, responsiveness, coordinated play, and control), separately for construction and drawing, followed by an examination of the differences between construction game and drawing scenarios. Diagnostic group differences were similar across the two settings (construction/drawing). Therefore, we performed a series of 2 (diagnostic group)×2 (nationality) ANOVAs to examine differences for the six dyadic relationship dimensions on the mean of the two scenarios (construction, drawing). Significant effects emerged for all dimensions

Table 4 Differences in friendship manifestations between observed construction and drawing scenarios for high-functioning children with autism spectrum disorder (HFASD) and children with typical development (TYP)

Target child's positive social interaction		HFASD		TYP		F (1, 77) scenario	F (1, 77)[scenario X diagnostic group]
		Construction	Drawing	Construction	Drawing	η^2	η^2
Goal-directed	Mean	13.17	10.69	15.99	13.86	23.53[a]	0.13
	SD	4.85	4.57	4.34	4.03	0.23	0.00
Sharing	Mean	3.78	4.64	6.35	6.02	0.37	1.51
	SD	2.45	3.90	3.33	3.48	0.00	0.02
Prosocial	Mean	2.07	0.81	0.92	0.54	17.68[a]	4.70[c]
	SD	2.03	1.53	1.14	0.96	0.19	0.06
Nonverbal	Mean	5.41	7.16	6.40	10.56	45.98[a]	7.86[b]
	SD	3.08	4.50	3.73	4.49	0.37	0.09
Conversation	Mean	2.31	5.10	1.79	5.12	44.43[a]	0.28
	SD	3.10	5.03	1.84	3.63	0.37	0.00
Positive	Mean	4.98	4.56	8.54	7.11	3.31	0.98
Affect	SD	4.15	4.77	5.26	4.35	0.04	0.01

Several SDs were higher than their means; therefore, an additional nonparametric Mann–Whitney test for independent samples was performed for these cases, which mirrored the ANOVA results.

[a] $p<0.001$
[b] $p<0.01$
[c] $p<0.05$

Table 5 Means and standard deviations for dyadic relationship dimensions during observed construction and drawing scenarios

Dyadic relationship	HFASD		TYP		F (1, 69) diagnostic group	η^2
Q-set dimension	Mean	SD	Mean	SD		
Positive social orientation	4.71	0.72	5.10	0.62	5.91[b]	0.08
Cohesiveness	4.08	0.77	4.42	0.58	4.35[c]	0.06
Harmony	4.85	0.68	5.25	0.56	7.26[b]	0.09
Coordinated play	3.22	0.85	3.90	0.64	14.10[a]	0.17
Responsiveness	4.82	0.77	5.33	0.47	10.83[b]	0.14
Control	2.32	0.52	2.19	0.57	0.95	0.01

HFASD: high-functioning children with autism spectrum disorder, TYP: children with typical development.
[a] $p < 0.001$
[b] $p < 0.01$
[c] $p < 0.05$

except control, with pairs of friends in the HFASD sample demonstrating a lower dyadic quality of friendship than in TYP dyads (see Table 5 for F values, means, and SDs).

Global friendship evaluation of shared fun and affective closeness A series of 2 (diagnostic)×2 (nationality)×2 (scenario) ANOVAs was executed to examine diagnostic group effects for the dyadic FOS global evaluations of the shared fun and affective closeness categories. Results of the ANOVAs showed a significant diagnostic group effect for both shared fun, F (1, 78)=6.38, $p < 0.05$, $\eta^2 = 0.08$, and for affective closeness, F (1, 78)=8.56, $p < 0.01$, $\eta^2 = 0.10$. The HFASD friendship dyads revealed less shared fun (mean= 1.70, SD=0.82) than the TYP friendship dyads (mean=2.11, SD=0.70). In a like manner, the HFASD dyads showed a lower degree of affective closeness (mean=2.62, SD=1.28) compared with the TYP dyads (mean=3.35, SD=1.06).

Univariate ANOVAs for scenario, F (1, 78)=10.40, $p < 0.01$, $\eta^2 = 0.11$, and for scenario×diagnostic group, F (1, 78)= 4.20, $p < 0.05$, $\eta^2 = 0.05$, were significant only for shared fun.

Simple effect tests indicated that the TYP dyads had more fun during the construction game than during the drawing scenario, F (1, 37)=9.86, $p < 0.01$, $\eta^2 = 0.21$; M (SD)=2.27 (0.65); M (SD)=1.93 (0.75), respectively. Level of shared fun did not differ between construction and drawing for the HFASD dyads.

Self-Perceptions of Friendship Qualities

Diagnostic differences in target children's perceptions of their friendship's qualities were examined through a series of 2 (diagnostic group)×2 (nationality) univariate ANOVAs for the five self-perception categories (companionship, help, intimacy, closeness, and conflict). As can be seen in Table 6, target children in the HFASD dyads perceived their friendship qualities as lower on the dimensions of help, intimacy, and closeness than target children in the TYP dyads.

Table 6 Diagnostic group differences for the target children's self-perception of friendship qualities by high-functioning children with autism spectrum disorder (HFASD) and children with typical development (TYP) in Israel and USA

Self-perceived mutual friendship qualities	HFASD		TYP		F (1, 78) diagnostic group η^2
	Mean	SD	Mean	SD	
Companionship	3.55	.66	3.56	0.62	0.00 0.00
Help	3.35	.91	4.02	0.74	12.18[a] 0.13
Intimacy	3.59	0.73	4.03	0.62	8.17[b] 0.10
Closeness	3.92	0.66	4.32	0.49	8.15[b] 0.10
Conflict	2.25	0.88	2.38	1.05	0.52 0.00

[a] $p < 0.001$
[b] $p < 0.01$

Comparison between Target Child and Friend's

Perceptions of Friendship Quality

We computed 2 (diagnostic group)×2 (nationality)×2 (child/friend) univariate ANOVAs for the five perception categories: companionship, help, intimacy, closeness, and conflict. Results demonstrated a significant main effect of child/friend only for intimacy, F (1, 76)=18.09, $p<0.001$, $\eta^2=0.19$. The target groups of children, both HFASD and TYP, perceived their friendship as more intimate than did their friend (mean=3.80, SD=0.76; mean=3.38, SD=0.59, respectively). However, for intimacy, the interaction of child/friend×diagnostic group was also found to be significant, F (1, 76)=5.42, $p<0.05$, $\eta^2=0.07$. A simple effect test to explore the interaction's source revealed that, in the TYP sample only, (F (1, 37)=20.87, $p<0.001$), target children reported their friendship to have a significantly higher intimacy quality (mean=4.04, SD=0.62) than their friends reported (mean=3.39, SD=0.50). Children with HFASD reported a similar intimacy level as their friends, F (1, 41)=1.20, $p>0.05$; target child: mean=3.56, SD=0.59; friend: mean=3.37, SD=0.62.

Relations among Friendship, Child Age, and PPVT-Receptive Language

Having examined group effects on all the data, we now turn to the last set of analyses. We used partial correlation analyses controlling for nationality to examine the correlations between friendship (all measures) and the child's age and PPVT-receptive language in each diagnostic group separately.

First, partial correlations were computed for the link between the self-perception of friendship qualities and the child's age and PPVT-receptive language. For the HFASD sample, younger children reported higher self-perceived qualities of friendship. Child age was linked negatively with companionship ($r=-0.40$, $p<0.01$) and with help ($r=-0.26$, $p<0.05$) and positively with conflict ($r=0.27$, $p<0.05$). For the TYP group, younger children reported a more intimate ($r=-0.30$, $p<0.05$) and closer friendship ($r=-0.33$, $p<0.05$). PPVT-receptive language was linked negatively with companionship for HFASD ($r=-0.41$, $p<0.01$) but was linked positively with intimacy for TYP ($r=0.29$, $p<0.05$).

We then examined the correlations between observed friendship manifestations (positive social interaction; global evaluation of role and conversation) and dyadic components with child age and PPVT-receptive language. As can be seen in Table 7, there were relatively few significant correlations that emerged with child age for either group. Those that were significant demonstrated that older children

Table 7 Correlations between friendship manifestations, dyadic components, child age, and PPVT-receptive language

		CA		PPVT receptive language	
		HFASD	TYP	HFASD	TYP
Observed friendship manifestations (target child)					
Positive social interaction					
Goal-directed	C	0.15	0.26	0.16	0.04
	D	0.06	0.08	0.16	−0.03
Sharing	C	0.19	−0.17	0.05	0.10
	D	0.16	0.22	0.07	−0.02
Prosocial	C	0.33[b]	−0.25	0.22	0.48[b]
	D	−0.02	−0.05	0.00	0.32[c]
Nonverbal	C	−0.02	0.06	0.19	−0.18
	D	0.08	−0.05	−0.02	−0.08
Conversation	C	0.12	−0.05	−0.10	−0.08
	D	0.23	0.16	0.08	−0.03
Positive affect	C	−0.16	−0.13	0.31[c]	−0.09
	D	0.21	0.28[c]	0.28[c]	−0.19
Play scale (C only)					
Parallel		−0.40[b]	−0.17	−0.38[b]	−0.11
Social		−0.19	−0.04	0.03	−0.22
Cooperative		0.23	0.31[c]	0.32[c]	0.19
Unoccupied		0.13	−0.02	0.07	0.23
Global evaluation					
Role	C	−0.02	0.05	−0.25	−0.07
	D	−0.10	0.16	−0.19	0.29[c]
Conversation flow	C	0.26[c]	0.31[c]	0.16	0.27[c]
	D	0.17	0.29	−0.07	0.34[c]
Social conversation	C	0.15	0.18	0.05	0.27[c]
	D	0.09	0.29[c]	−0.13	0.33[c]
Observed dyadic components (dyad)					
Dyadic relationship dimensions					
Positive orientation		0.05	0.62[a]	0.23	−0.14
Cohesiveness		0.29[c]	0.02	0.40[b]	0.13
Harmony		0.04	0.35[c]	0.26[b]	−0.02
Responsiveness		0.14	0.42[b]	0.39[b]	0.19
Coordinated play		0.35[c]	0.28	0.53[a]	0.22
Control		−0.01	−0.59[a]	0.12	0.08
Global evaluation					
Shared fun	C	0.14	0.09	0.37[b]	0.19
	D	0.12	0.06	0.28[c]	0.00
Affective closeness	C	0.27[c]	0.16	0.38[b]	0.12
	D	0.16	0.03	0.31[c]	0.11

C: construction, D: drawing, HFASD: high-functioning children with autism spectrum disorder, TYP: children with typical development.
[a] $p<0.001$
[b] $p<0.01$
[c] $p<0.05$

presented a higher friendship quality. For example, for the HFASD group, older children demonstrated more prosocial behaviors, a lower level of parallel play, a higher level of conversational flow, more affective closeness (all during construction), and higher cohesiveness and coordinated play (during construction and drawing), in comparison to

younger children. For the TYP group, older children showed more positive affect (during drawing), more coordinated play (during construction), and higher conversational skills (flow during construction and drawing, and small talk skills during drawing) than did younger children. Older children in the TYP group demonstrated a more positive social orientation, more harmony and responsiveness, and fewer controlling behaviors in their dyads than did younger children (see Table 7).
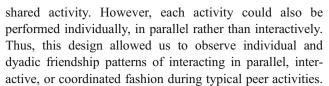
PPVT-receptive language correlated closely with both individual and dyadic friendship behavior for the HFASD group. PPVT-receptive language correlated positively with positive affect (drawing and construction), coordinated play (construction), shared fun (construction and drawing), affective closeness (construction and drawing), and higher levels of cohesiveness, harmony, responsiveness, and coordinated play in their friendship dyads. Children with higher PPVT-receptive language demonstrated less parallel play than did children with lower PPVT-receptive language. For the TYP sample, PPVT-receptive language correlated positively only with prosocial behaviors (both scenarios), with conversation skills (flow and small talk skills, during both scenarios), and with role taking during the drawing scenario (see Table 7).

Discussion

The current binational, multidimensional study provided the first opportunity to look "inside friendship" in children with HFASD at its individual manifestations, dyadic components, and self-perceived qualities. Our participants provided an opportunity to examine long-term, sustained friendship patterns in action, during activities with high and low internal structure—a game with rules and a free form art activity, and to follow these interactions with individual interviews of participants and friends, so that the relationships could be examined from both perspectives. The main results portrayed not only differences in friendship patterns between HFASD and TYP, as we predicted following the interpersonal and theory of mind difficulties characterizing ASD (e.g., Hobson 2005; Tager-Flusberg 2001), but also some interesting similarities. Following our hypotheses regarding group differences both in observed individual and dyadic components and in perceived friendship qualities, we will first discuss observed individual and dyadic components, and then follow with a discussion of the children's own perceptions.

Individual and Dyadic Friendship Patterns

The two play activities invited the children to work cooperatively with their friend, to plan and execute a shared activity. However, each activity could also be performed individually, in parallel rather than interactively. Thus, this design allowed us to observe individual and dyadic friendship patterns of interacting in parallel, interactive, or coordinated fashion during typical peer activities.

In the construction game, the typical group dyads demonstrated greater frequency of coordinated play than the HFASD dyads, who demonstrated greater frequency of parallel play. Parallel play requires less reciprocal, contingent interaction and less joint planning and execution than does parallel play, and it lacks the quality of a "goal-corrected partnership" (Stern 1985) that is foundational to companionship, which is considered to be a key friendship function (e.g., Buhrmester 1996). This finding is consistent with other observational studies that reported a higher frequency of parallel than cooperative activities in children with ASD (e.g., Bauminger and Shulman 2003; Church et al. 2000; Sigman and Ruskin 1999). Importantly, during these play activities, children with HFASD were actively involved in social interaction with their friends.

An unexpected finding was the similarity in leader–follower roles of the two diagnostic groups in their interactions with friends. One might expect that in the HFASD dyads, the friend may adapt to their HFASD partner's difficulties by scaffolding the interaction and taking more of a leadership role. However, there was great similarity in each member of the dyad's tendency to either lead or follow the partner. In both diagnostic groups, the target children and their friends were balanced in their initiations and responses to the partner, following in approximately half of the interactions and leading in the other half, based on group means.

The significant differences seen in the HFASD group means in several behaviors mirrored previous findings concerning the neuropsychological profile of autism that has emerged. Children with HFASD as a group demonstrated fewer friendship-related behaviors like goal-directedness and positive affect, and lower global ratings of conversational flow and social conversation in both the construction and the drawing scenarios. The goal-directed difficulties may reflect the HFASD group's executive function problems (e.g., Frith 2004; Liss et al. 2001). This skill tapped children's ability to co-construct and problem solve challenges like suggesting and deciding on the drawing topic, organizing roles involving joint drawing or building of an organized and integrated whole, and designing the marble structure so that the marbles would descend.

A second aspect of the autism profile seen here involved the children's decreased frequency of expression of positive affect. This was reflected in multiple aspects of our measurement system. Less expression of positive affect observed during interactions was consistent with the lower level of shared fun seen in the global ratings and the lower

self-reported ratings of intimacy and closeness in both members of the HFASD dyads. These findings support theories and findings concerning children's core affective difficulties in intersubjective personal engagement with others (Hobson 2005; Rogers and Pennington 1991). They also provide support for the contention that children with HFASD demonstrate less mature friendship functions (e.g., closeness).

A third aspect of the classic autism neuropsychological profile involves difficulties with social cognition, reflected in theory of mind performance and pragmatics of communication (Tager-Flusberg 2001). We observed global conversational skill deficits in our HFASD group during peer interactions, supporting previous findings concerning autism deficits in conversational pragmatics (see review in Landa 2000). Our interactional paradigm exposed many examples of the neuropsychological profile of autism, even though the tasks involved only social friendship interactions. This highlights the multifaceted nature and integrative complexity of building and sustaining social interactions with social partners.

Examination of dyads yielded both similarities and differences. Given the complex and integrative neuropsychological processes involved in activity-based interactions, it is not surprising that the dyadic relationship dimensions in the HFASD group differed from the TYP group on so many measures. In fact, they differed significantly in all dimensions except control. This occurred even though the majority of the HFASD dyads ($n=28$ pairs, 63.36%) involved a friend with typical development. Autism greatly influenced the nature of friendship interactions in the dyad.

Given this, the findings regarding similarities in the dyads are more surprising than the findings regarding differences. First and foremost is the finding of the lengthy duration of friendships, verified by both the mother of the child with HFASD and the best friend. The lower degrees of shared fun in the HFASD dyads raises the question of motivation and reward for the friend in the HFASD dyads, but the high durability of these HFASD friendships attests to rewards that both children in the dyad experience in their relationship and their ongoing interactions.

A second area of similarity between the two diagnostic groups involved the partners' leader–follower roles, as discussed earlier. This finding suggests an egalitarian style of exchange, in which children maintain a balance in the degree to which each partner assumes dominant or subordinate roles during the interaction. Two findings further support this relatively balanced style of interaction between the two friends. One involves the low rate of controlling behaviors such as grabbing, pushing, or dominating toys, which appeared similarly in both the HFASD and TYP dyads. The second involves the age of the friends, which did not differ between the groups. One might have expected younger and thus more immature friends providing

simpler interactional demands and a less egalitarian relationship in the HFASD dyads. On the other hand, the history of these friendships and the established interaction patterns among the friends suggests that the dyad has developed some supports for the interactional demands on the child with HFASD. Interacting with unfamiliar age-mates in this paradigm might be far more difficult for the children with HFASD and may reveal far more social impairments.

Data from the separate social scenarios revealed additional areas of similarity among the two diagnostic groups. During the construction scenario, nonverbal behaviors involving eye contact and smiles were similar in the two groups. During drawing, sharing experiences, emotions, and attention were similar between groups. Additionally, despite differences in global evaluation of conversational flow and social conversation, the minute-by-minute coding for conversation, composed of small talk, silly talk, persuasion, negotiation, and talk that reflected interest in another child, were similar in the groups over the two social scenarios.

Perceived Friendship Qualities

Results from the children's friendship perceptions also yielded informative findings. The HFASD group perceived their friendships as less close, helpful, and intimate compared with friendships of the TYP group. This supports our hypothesis and our observations of lower dyadic relationship dimensions obtained through the Q-sorting, involving less responsivity and lower levels of positive social orientation and cohesiveness in HFASD dyads. The self-perceptions also corroborate our global rating of observed lower affective closeness in HFASD dyads compared with TYP dyads, demonstrating convergence between raters' objective observations and the children's own perceptions.

We were puzzled that the friend's perceptions of friendship mutuality showed no diagnostic group differences. We expected such differences based on difficulties experienced by children with HFASD in their interpersonal awareness and understanding of friendship (e.g., Carrington and Graham 2001). Both the children with HFASD and their close friends perceived their mutual friendship to be lower in closeness, intimacy, and help than seen in the TYP dyads. This may imply that the children with HFASD were sensitive to the affective influences of autism on friendships. This intriguing finding merits further exploration in future studies, as does a deeper understanding of the extent of interpersonal awareness in HFASD. Former research has demonstrated differences on intimacy and help but not on closeness (e.g., Bauminger and Kasari 2000). However, given the convergence of multilevel data in the present study, the current findings strongly indicate that closeness—a major friendship function—is affected in HFASD dyads.
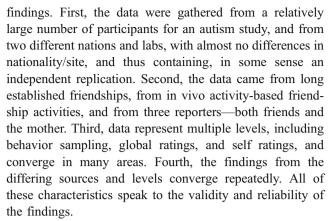
Links between Friendship, Receptive Language, and Child Age

Finally, we examined associations among the various measures reported here with age and receptive language ability. Although the age span for all participants was only 4 years, age had a marked effect on findings. Younger children with HFASD perceived their friendships to be higher on companionship and help but lower on conflict, whereas older children revealed higher performance on observed friendship manifestations and dyadic components. Similarly, the older children with HFASD demonstrated less parallel play and more coordinated play, as well as higher levels of conversational flow, cohesiveness, and affective closeness in their friendships, than the younger children with HFASD. These results may reflect the simpler interactive demands of younger children's friendships. Or, it may imply delayed development of interpersonal awareness in children with HFASD, in which younger children may perceive their friendship qualities as possibly higher than they are in reality, while older children with HFASD understand relationships more deeply and can evaluate their friendships more accurately and more negatively, even in the face of more sophisticated social abilities than the younger children. Longitudinal examination of friendship perceptions, manifestations, and components will help us uncover the relations between increasing age and friendship relations.

PPVT-receptive language exhibited stronger relations with observed friendship manifestations and dyadic components than with self-perceptions of friendships in the HFASD group only, for whom higher receptive language capabilities correlated positively with positive affect, shared fun, affective closeness, coordinated play, cohesiveness, harmony, and responsiveness, and negatively with parallel play. This finding, whereby stronger receptive language capabilities were linked with more typical performance in both observed behavior in individuals and in dyads, is consistent with our hypothesis and adds support to the cognitive compensation hypothesis (Hermelin and O'Connor 1985; Kasari et al. 2001). The latter asserts that children with HFASD lean on some different neuropsychological processes involving language and reasoning capacities, rather than affective capacities, to conduct their relationships and it underscores the importance of cognitive functioning, especially language, but likely also EFs, for supporting social skill development in children with HFASD.

Conclusions, Future Directions, and Limitations

The current study provides significant new contributions to the understanding of friendship in children with HFASD. Several aspects of this study increase the strength of its findings. First, the data were gathered from a relatively large number of participants for an autism study, and from two different nations and labs, with almost no differences in nationality/site, and thus containing, in some sense an independent replication. Second, the data came from long established friendships, from in vivo activity-based friendship activities, and from three reporters—both friends and the mother. Third, data represent multiple levels, including behavior sampling, global ratings, and self ratings, and converge in many areas. Fourth, the findings from the differing sources and levels converge repeatedly. All of these characteristics speak to the validity and reliability of the findings.

Four limitations should also be noted. First, the participants represent a specific subgroup within autism spectrum disorders: children without intellectual disability, with receptive language abilities in the normal range, and with a close friend of 6 months or longer duration, with whom regular contact is maintained outside of school. It is reasonable to assume that this subgroup has the mildest social impairment of the various autism subgroups of this age. Thus, the findings apply to this subgroup, and not to all children with autism spectrum disorders, even those in this functioning range. However, given that autism contains multiple subgroups with different profiles (e.g., Volkmar et al. 2004), the homogeneity of the sample is also a strength of this study by allowing for a thorough description of this particular subgroup.

Second, current groups of participants were matched according to verbal performance based on the PPVT (Dunn and Dunn 1997). Results from this test correlate strongly with overall measures of both intelligence and language comprehension (Sattler 1988); however, a more comprehensive examination of cognitive and language functioning would have formed more solid matching criteria. Third, we only measured interactions between pairs of children who were friends; a descriptive study of social interactions with acquaintances versus friends in autism needs to be conducted. Fourth, our findings cannot be generalized to girls with HFASD, due to the small number of female participants in this research.

Overall, as predicted, friendship behaviors of individuals, dyadic interactions, and perceptions differed among children in the HFASD group versus children in the TYP group in many areas, supporting clinical as well as theoretical perspectives on friendship as a challenging social relationship for the child with HFASD. Children's perceptions of their own relationships revealed limitations in their friendships' closeness and helpfulness. However, the similarities that emerged in the friendship behaviors and perceptions between the two groups document that meaningful and abiding friendships are within the capacity for children in this subgroup, and perhaps for others as well.

Given the developmental importance of friendship as a source of growth in relationship skills in typical development, we would expect that friendship in children with HFASD also facilitates social development.

Children with HFASD cooperate more easily with one particular child than with a group of peers, and it is easier for them to interact with a familiar than an unfamiliar peer (e.g., Lord 1984). Friendship, thus, may offer a one-on-one social experience with a familiar peer over a long period—providing the child an opportunity to develop and practice social skills (e.g., cooperation, social initiations, sharing) within an ongoing, secure social experience. However, it may also be that adult mediation or guidance may assist the developmental impact of friendship in children with HFASD, as found in Bauminger and Shulman (2003).

The present study thus raises many new questions about friendships in children with HFASD for future studies. The first involves comparisons between friendship patterns depending on whether the friend has a disability or not. Significantly more children with HFASD in this sample had friends with a disability than in the typical group, perhaps reflecting their increased exposure to children with disabilities, among other factors. The second involves comparisons between interactions with unfamiliar peers, interactions with familiar peers who are not close friends, and interactions with close friends. This contrast may demonstrate the specific contributions of close friends to social development. Third, predictors for adequate friendship should be identified in children with HFASD through longitudinal designs. Such predictors may include HFASD children's affective expression and understanding, executive function capabilities, and intersubjective capacities for empathy and theory of mind, as well as intellectual and language abilities. Fourth, the effect of friendships on later relationship abilities in children with HFASD or friendship capacities and interests of other ASD subgroups should be examined, using ecologically valid activities and multilevel measures. Finally, intervention studies should be conducted to investigate effective ways to facilitate friendship development in autism.

References

American Psychiatric Association (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: American Psychiatric Association.

American Psychiatric Association (2000). *Diagnostic and statistical manual of mental disorders* (4th-TR ed.). Washington, DC: American Psychiatric Association.

Asher, S. R., Parker, J. G., & Walker, D. L. (1996). Distinguishing friendship from acceptance: Implications for intervention and assessment. In W. M. Bukowski, A. F. Newcomb, & W. W. Hartup (Eds.), *The company they keep: Friendships in childhood and adolescence* (pp. 366–406). Cambridge: Cambridge University Press.

Attwood, T. (1998). *Asperger's syndrome: A guide for parents and professionals.* London: Jessica Kingsley.

Bagwell, C. L., Newcomb, A. F., & Bukowski, W. M. (1998). Preadolescent friendship and peer rejection as predictors of adult adjustment. *Child Development, 69*, 140–153.

Bauminger, N., & Kasari, C. (2000). Loneliness and friendship in high-functioning children with autism. *Child Development, 71*, 447–456.

Bauminger, N., & Shulman, C. (2003). The development and maintenance of friendship in high-functioning children with autism: Maternal perception. *Autism, 7*, 81–97.

Bauminger, N., Rogers, S. J., Aviezer, A., & Solomon, M. (2005). *The friendship observation scale (FOS).* Unpublished manual, Bar Ilan University, Israel and University of California, Davis, CA.

Brachfield-Child, S., & Schiavo, R. S. (1990). Interactions of preschool and kindergarten friends and acquaintances. *Journal of Genetic Psychology, 151*, 45–57.

Brody, G. H., Stoneman, Z., & McKinnon, C. E. (1982). Role asymmetries in interactions among school-age children, their younger siblings and their friends. *Child Development, 53*, 1364–1370.

Buhrmester, D. (1996). Need fulfillment, interpersonal competence, and the developmental context of early adolescent friendship. In W. M. Bukowski, A. F. Newcomb, & W. W. Hartup (Eds.), *The company they keep: Friendship in childhood and adolescence* (pp.158–185). Cambridge, UK: Cambridge University Press.

Bukowski, W. M., Boivin, M., & Hoza, B. (1994). Measuring friendship quality during pre- and early adolescence: The development and psychometric properties of the friendship qualities scale. *Journal of Social and Personal Relationships, 11*, 471–484.

Burgess, K. B., Wojslawowicz, J. C., Rubin, K. H., Rose-Krasnor, L., & Booth-LaForce, C. (2006). Social information processing and coping strategies of shy/withdrawn and aggressive children: Does friendship matter? *Child Development, 77*, 371–383.

Capps, L., Sigman, M., & Mundy, P. (1994). Attachment security in children with autism. *Development and Psychopathology, 6*, 249–261.

Carrington, S., & Graham, L. (2001). Perceptions of school by two teenage boys with Asperger syndrome and their mothers: A qualitative study. *Autism, 5*, 37–48.

Carrington, S., Templeton, E., & Papinczak, T. (2003). Adolescents with Asperger syndrome and perceptions of friendship. *Focus on Autism and Other Developmental Disabilities, 18*, 211–218.

Church, C., Alinsanski, S., & Amanullah, S. (2000). The social, behavioural, and academic experiences of children with Asperger syndrome. *Focus on Autism and Other Developmental Disabilities, 15*, 12–20.

Dunn, J. (1993). *Young children's close relationships: Beyond attachment.* London: Sage.

Dunn, L. M., & Dunn, L. M. (1997). *Examiner's manual for the Peabody picture vocabulary test third edition.* Circle Pines, MN: American Guidance Service.

Field, T., Greenwald, P., Marrow, C., Healy, B., Foster, T., Guthertz, M., et al. (1992). Behavior state matching during interactions of preadolescent friends versus acquaintances. *Developmental Psychology, 28*, 242–250.

Frith, U. (2004). Emanuel Miller lecture: Confusion and controversies about Asperger syndrome. *Journal of Child Psychology and Psychiatry, 45*, 672–686.

Green, J., Gilchrist, A., Burton, D., & Cox, A. (2000). Social and psychiatric functioning in adolescents with Asperger syndrome compared with conduct disorder. *Journal of Autism and Developmental Disorders, 30*, 279–293.

Hermelin, B., & O'Connor, N. (1985). Logico-affective states and nonverbal language. In E. Schopler, & G. B. Mesibov (Eds.), *Communication problems in autism* (pp. 283–309). New York: Plenum.

Hinde, R. (1979). *Towards understanding relationships*. New York: Academic Press.

Hobson, P. (2005). Autism and emotion. In F. R. Volkmar, R. Paul, A. Klin, & D. Cohen (Eds.), *Handbook of autism and pervasive developmental disorders* (pp. 406–422). Hoboken, NJ: Wiley.

Hobson, P., Chidambi, G., Lee, A., & Meyer, J. (2006). Foundations of self-awareness: An exploration through autism. *Monographs of the Society for Research in Child Development, 71*(1, Serial No. 284).

Howes, C. (1996). The earliest friendships. In W. M. Bukowski, A. F., Newcomb, & W. W. Hartup (Eds.), *The company they keep: Friendship in childhood and adolescence* (pp. 66–86). Cambridge, UK: Cambridge University Press.

Kanner, L. (1943). Autistic disturbances of affective contact. *Nervous Child, 2*, 217–250.

Kasari, C., Chamberlain, B., & Bauminger, N. (2001). Social emotions and social relationships in autism: Can children with autism compensate? In J. Burack, T. Charman, N. Yirmiya, & P. Zelazo (Eds.), *Perspectives on development in autism* (pp. 309–323). Hillsdale, NJ: Erlbaum.

Koning, C., & Magill-Evans, J. (2001). Social and language skills in adolescent boys with Asperger syndrome. *Autism, 5*, 23–36.

Landa, R. (2000). Social language use in Asperger syndrome and in high-functioning autism. In A. Klin, F. R. Volkmar, & S. S. Sparrow (Eds.), *Asperger syndrome* (pp. 121–155). New York: Guilford Press.

Lemerise, E. A., & Arsenio, W. F. (2000). An integral model of emotion processes and cognition in social information processing. *Child Development, 71*, 107–118.

Liss, M., Fein, D., Allen, D., Dunn, M., Feinstein, C., Norris, R., et al. (2001). Executive functioning in high-functioning children with autism. *Journal of Child Psychology and Psychiatry, 42*, 261–270.

Lord, C. (1984). The development of peer relations in children with autism. In F. J. Morrison, C. Lord, & D. P. Keating (Eds.), *Advances in applied developmental psychology* (pp. 165–229). New York: Academic.

Lord, C., Rutter, M., DiLavore, P. C., & Risi, S. (1999). *The autism diagnostic observation schedule: The manual*. Los Angeles: Western Psychological Services.

Lord, C., Rutter, M., & LeCouteur, A. (1994). Autism diagnostic interview-revised: A revised version of a diagnostic interview for caregivers of individuals with possible pervasive developmental disorders. *Journal of Autism and Developmental Disorders, 19*, 185–212.

Macintosh, K. E., & Dissanayake, C. (2004). Annotation: The similarities and differences between autistic disorder and Asperger's disorder: A review of empirical evidence. *Journal of Child Psychology and Psychiatry, 45*, 421–434.

Newcomb, A. F., & Brady, J. E. (1982). Mutuality in boys' friendship relations. *Child Development, 53*, 392–395.

Orsmond, G., Krauss, M., & Seltzer, M. (2004). Peer relationships and social and recreational activities among adolescents and adults with autism. *Journal of Autism and Developmental Disabilities, 34*, 245–256.

Park, K. A., & Waters, E. (1989). Security of attachment and preschool friendships. *Child Development, 60*, 1076–1081.

Parker, J. G., & Gottman, J. M. (1989). Social and emotional development in a relational context: Friendship interaction from early childhood to adolescence. In T. Brendt, & G. Ladd (Eds.), *Peer relationships in child development* (pp. 95–131). New York: Wiley.

Parker, J. G., Rubin, K. H., Price, J. M., & DeRosier, M. E. (1995). Peer relationships, child development, and adjustment: A developmental psychopathology perspective. In D. Cicchetti, & D. J. Cohen (Eds.), *Developmental psychopathology* (pp. 96–161). New York: Wiley.

Rogers, S. R., & Pennington, B. F. (1991). A theoretical approach to the deficits in infantile autism. *Development and Psychopathology, 3*, 137–162.

Sameroff, A. J. (1983). Developmental systems: Contexts and evolution. In P. H. Mussen & W. Kessen (Eds.), *Handbook of child psychiatry: Vol. 1. History, theories and methods* (pp. 237–294). New York: Wiley.

Sattler, J. M. (1988). *Assessment of children* (3rd ed.). San Diego: Author.

Shany, M., Lachman, D., Shalem, Z., Bahat, A., & Zeiger, T. (2003). "*Ma'akav:" Current mapping of reading and writing based on Israeli norms*. Tel Aviv: Yesod. (Hebrew).

Sigman, M., & Ruskin, E. (1999). Continuity and change in the social competence of children with autism, Down Syndrome, and developmental delays. *Monographs of the Society for Research in Child Development, 64*(1, Serial No. 256).

Siperstein, G. N., Leffert, J. S., & Wenz-Gross, M. (1997). The quality of friendships between children with and without learning problems. *American Journal of Mental Retardation, 102*, 111–125.

Stern, D. (1985). *The interpersonal world of the infant: View from psychoanalysis and developmental psychology*. New York: Basic Books.

Sullivan, H. S. (1953). *The interpersonal theory of psychiatry*. New York: Horton.

Tager-Flusberg, H. (2001). A reexamination of the theory of mind hypothesis of autism. In J. Burack, T. Charman, N. Yirmiya, & P. Zelazo (Eds.), *Development and autism: Perspectives from theory and research* (pp. 173–193). Hillsdale, NJ: Erlbaum.

Volkmar, F. R., Lord, C., Bailey, A. Schultz, R. T., & Klin, A. (2004). Autism and pervasive developmental disorder. *Journal of Child Psychology and Psychiatry, 45*, 135–170.

Waters, E., & Deane, K. E. (1985). Defining and assessing individual differences in attachment relationships: Q—methodology and the organization of behavior in infancy and early childhood. In I. Bretherton, & E. Waters (Eds.), *Growing points in attachment theory and research*, *Monographs of the society for research in child development* (pp. 41–65). 50(1–2, Serial No. 209).

Wilkinson, G. S. (1993). *WRAT-3: Wide range achievement test administration manual*. Wilmington, DE: Wide Range.