Journal of Autism and Developmental Disorders, Vol. 33, No. 5, October 2003 (© 2003)

Peer Interaction and Loneliness in High-Functioning Children with Autism

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Social interaction with peers and the understanding and feelings of loneliness were examined in 18 high-functioning children with autism and 17 typically developing children matched for IQ, chronological age, gender, and maternal education. Observations were conducted on children's spontaneous social initiations and responses to their peers in natural settings such as recess and snack time, and children reported on their understanding and feelings of loneliness and social interaction. Overall, children with autism revealed a good understanding of both social interaction and loneliness, and they demonstrated a high level of social initiation. However, they spent only half the time in social interactions with peers compared with their matched counterparts, and they interacted more often with a typically developing child than with another special education child. Despite the intergroup differences in frequency of interaction, a similar distribution of interactions emerged for both groups, who presented mostly positive social behaviors, fewer low-level behaviors, and very infrequent negative behaviors. Children with autism reported higher degrees of loneliness than their typical age-mates, as well as a lower association between social interaction and loneliness, suggesting their poorer understanding of the relations between loneliness and social interaction. Research and practice implications of these findings are discussed.

KEY WORDS: Peer interaction; high-functioning autism; loneliness.

Social interaction is defined as a reciprocal process in which children effectively initiate and respond to social stimuli presented by their peers (Shores, 1987). Social interaction with peers comprises a major component of typically developing children's social competence (Parker, Rubin, Price, & DeRosier, 1995). Children who have poor social interactions with peers are considered at greater risk for experiencing loneliness (Asher, Parkhurst, Hymel, & Williams, 1990). Deficits in social interaction constitute a major characteristic of children with autism (American Psychiatric Association, 2000). Social interactions among children with autism range from a lack of awareness of others, for those with the most severe social impairment, to abnormalities in peer relations, for those who are less impaired (Volkmar, Carter, Grossman, & Klin, 1997).

Although peer interaction is considered a major area of difficulty for this population and has been extensively studied, knowledge in this area continues to be limited in several ways. The majority of experimental efforts have focused on improving the social interaction of children with autism by implementing various degrees of mediations (from a well-trained to less-trained social partner), using different social partners (e.g., adults or peers), and differently manipulating the child's social environment (from more structured, planned social activities toward more spontaneous ones centered around the provision of toys and games in close proximity; e.g., Brady, Shores, McEvoy, Ellis, & Fox, 1987; Dewey, Lord, & Magill, 1988; Gaylord-Ross, Haring, Breen, & Pitts-Conway, 1984; Gonzalez-Lopez & Kamps, 1997; Lord & Hopkins, 1986; Odem & Strain, 1984; Oke & Schreibman, 1990; Roeyers, 1996; Strain & Kohler, 1998; Wolfberg & Schuler, 1993; Zercher, Hunt,

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0162-3257/03/1000-0489/0 © 2003 Plenum Publishing Corporation

Schuler, & Webster, 2001). Indeed, children with autism as a whole demonstrated improvement in most studies, yet concerns were raised regarding long-term effects and the generalization of new social skills to the child's day-to-day social behaviors with peers at school. Thus far, nonmediated spontaneous peer interactions in natural settings such as school breaks and nonacademic activities, which comprise the focus of this study, have not been a central part of investigation.

Several studies did examine spontaneous social interactions in children with autism (e.g., Hauck, Fein, Waterhouse, & Feinstein, 1995; Lord & Magill-Evans, 1995; Sigman & Ruskin, 1999; Stone & Caro-Martinez, 1990). Hauck and her colleagues investigated positive, negative, and low-level social initiations among low-functioning children with autism mostly during lunchtime and free play in a multiple diagnosis classroom, as compared with the social initiations of language-matched children with mental retardation. Main findings revealed qualitative and quantitative differences between the groups. Children with autism initiated only one-third of the interactions with peers compared with interactions initiated by children with mental retardation. The former were also more likely to demonstrate ritualistic and developmentally lower initiations (e.g., close proximity, looking at another child) in contrast to the positive initiations of play and reciprocally interactive initiations demonstrated by the children with mental retardation. In addition, children with autism presented more social isolation in less structured social environments (e.g., free play vs. lunchtime). Hauck *et al.* (1995) found that two factors accounted for most of the initiations toward peers among children with autism: social cognition—particularly the ability to read affects and to understand affective situations—and cognitive abilities—specifically the ability to use language functionally and maintain a good vocabulary.

The notion that cognitive abilities play an important role in the social functioning of children with autism has been supported by other studies (e.g., Sigman & Ruskin, 1999; Stone & Caro-Martinez, 1990; Volkmar, Cohen, Bregman, Hooks, & Stevenson, 1989). Researchers have suggested that nonretarded individuals with autism compensate for their social deficits by using their relatively high cognitive abilities (Hermelin & O'Connor, 1985; Sigman & Ruskin, 1999). High-functioning children with autism display a greater capacity for social-emotional expressiveness and responsiveness compared with low-functioning children with autism (e.g., Bacon, Fein, Morris, Waterhouse, & Allen, 1998; Capps, Sigman, & Yirmiya, 1995; Capps, Yirmiya, & Sigman, 1992; Loveland *et al.,* 1997; Sigman & Ruskin, 1999). However, the performance of high-functioning children with autism is still lower than that of typically developing children, presenting major difficulties in social cognition, such as linking emotions to different social situations and in understanding the causes of emotions (e.g., Bormann-Kischkel, Vilsmeier, & Baude, 1995; Capps *et al.,* 1992; Jaedicke, Storoschuk, & Lord, 1994). In addition, understanding Theory of Mind under laboratory conditions does not manifest itself in everyday peer interactions, where high-functioning children with autism continue to fail to consider other's perspectives and to show a lack of reciprocity (Ozonoff & Miller, 1995; Sigman & Ruskin, 1999).

What might be the implications of the relatively high, but odd, social-emotional abilities of these youngsters on their peer interactions? On the one hand, these children may show more social involvement with peers compared with low-functioning children with autism, in light of the former's higher social skills. Thus, less social isolation or less involvement in purposeless activities may be expected. Yet by the same token, they may experience rejection from peers because of their peculiar social functioning (e.g., lack of reciprocity), and thus these youngsters may reveal less social involvement than expected on the basis of their social abilities. Another related question concerns how exposure to typically developing children in inclusive settings may influence these children's social participation in peer interaction. Furthermore, the quality and frequency of spontaneous social interactions in natural settings between the more able children with autism and a typical age-mate (mixed interaction) is yet unknown in comparison to their interactions with another included child with autism or a different developmental delay (nonmixed interaction). As a whole, high-functioning children with autism might experience major difficulties applying their relatively high social abilities within their social interactions with peers, resulting in poor peer interactions.

Hence, the examination of spontaneous peer interaction in natural settings such as school recess or outdoor activities among high-functioning children with autism may shed light on the extent to which cognitive abilities and social opportunities to meet with typically developing children help in the manifestation of social behavior with peers. Very few studies have examined nonmediated spontaneous peer interaction in high-functioning children with autism. Stone and Caro-Martinez (1990) observed the spontaneous communication initiations of high-functioning

(IQ scores above 50) and low-functioning (IQ scores below 50) children with autism in a special education setting during unstructured activities such as leisure time, lunch in the cafeteria, and physical education. Cognitive level was an important factor accounting for the variability in these children's spontaneous initiations. Children having higher cognitive abilities compared with children having lower cognitive abilities were more likely to use symbolic forms of communication (i.e., speech: 53% vs. 3%, respectively). The high-functioning children also communicated on a higher level of social intention, such as establishing joint attention by using comments and by giving information, whereas the lower-functioning children tended to use a lower level of social intentions such as requesting and engaging in social routines. In addition, high-functioning children were more likely to direct their initiations to individuals other than the teacher (i.e., peers). Nevertheless, although the importance of cognitive functioning for spontaneous social interaction was accentuated by this study, the IQs of the children in the higher-functioning group varied extensively (from 50 up to 102), excluding some of the sample from qualifying by definition as high-functioning children with autism. Also, because this study focused on children's initiations, and no typically developing children were included, it is difficult to estimate whether different partners (i.e., typical peer, another child with autism, or a child with another developmental delay) would have different roles or influences on the social interaction of children with autism.

Sigman and Ruskin (1999) observed spontaneous interactions—both initiations and responses—of children with autism (low and high functioning) in natural settings such as structured classroom activities and unstructured activities such as recess time on the playground, free time in class, lunch, and physical education. Similar to Stone and Caro-Martinez's (1990) findings, this study demonstrated a higher level of social engagement with peers in high-functioning children with autism than in low-functioning children with autism. Mental age and language age were significantly positively related with the level of social play. However, when high-functioning children with autism were compared with high-functioning children with developmental delays, the two groups differed in their frequency of social engagement. Children with developmental delays were engaged socially more than in solitary activities, whereas the children with autism spent equal time in high-level play and nonsocial play. Sigman and Ruskin's study also provides a partial answer to questions about the influence of typically developing children on the interaction of children with autism. In their study, children with autism who had more exposure to typically developing children were found to engage in more high-level interactions, as compared with children with autism who had no such exposure. This finding, however, is inconclusive, in that the children's higher social involvement may correspond more with their level of functioning than with their exposure to typically developing children's characteristics (i.e., children with higher abilities might be placed in schools offering greater opportunities for exposure to typical peers). Other questions that remain open concern the nature of children's initiations and responses in mixed social interaction (autism and typical peers) versus nonmixed social interaction (high-functioning children with autism between themselves and typically developing children between themselves).

Lord and Magill-Evans (1995) compared free-time social interactions among high functioning children with autism, children with behavioral disorders, and typically developing children throughout a 2-week day camp that provided planned social opportunities for the children with autism. This study highlighted the differences in frequency and quality of social interaction among the high-functioning children compared with the typically developing children. The former group was significantly less involved in social interaction with peers and more likely to be involved in purposeless activities during free time. These differences were consistent throughout the camp period, although familiarity (during the second week) helped the children with autism (mainly the older ones) become less involved in purposeless activities and also to increase their constructive play. The nature of initiations was also tested, and findings revealed no differences in eye gaze between children with autism and typically developing children. However, significant differences emerged in smiling to peers and in the more integrated social behaviors that reflect communicative intent such as combinations of eye contact and a smile. In sum, this study provided information regarding the differences between children with autism and typically developing children, as well as important information regarding the nature of these children's initiations. However, the day camp was arranged around social engagement, which provided an intensive social environment that could influence children's social behavior in several ways. For example, these children with autism may have perceived free time as rest time from social engagement, when they preferred to remain alone or do nothing in between activities. Also, as the authors noted, it may have been too demanding for the children with autism

to learn new games and interact with unfamiliar peers in such a short duration. Taking the unique setting conditions into account, social interactions in this study likely differed from school settings in several ways, calling for further study on the nature of social interactions in school settings between high-functioning children with autism and their peers with typical and atypical development. This study strives to examine spontaneous peer interaction of high-functioning youngsters with autism in the school setting, with an emphasis on the quality and frequency of their interaction with a typical child (mixed interaction) versus their interaction with an atypical child (mostly children with high-functioning autism). In addition, in light of these children's difficulties in social cognition, we were particularly interested in investigating how their peer interaction behaviors linked with their understanding of peer interactions.

In typical development, social interaction is highly associated with loneliness, where a lack of social involvement with peers or rejection by peers is reflected in a higher degree of loneliness (Burgess, Ladd, Kochenderfer, Lambert, & Birch, 1999). Loneliness is associated with undesired isolation and with negative feelings; therefore, reporting loneliness might indicate the child's social desire for involvement with peers. Although inherently related to autism, loneliness has rarely been empirically examined in these children. Moreover, most of the social interaction studies reviewed above have raised the question of whether children with autism simply do not want to participate in peer interactions or whether they want to but do not know how to do so. The study of loneliness in autism may contribute an answer to this still-open question. In a recent study, Bauminger and Kasari (2000) investigated loneliness in a group of high-functioning preadolescents and adolescents with autism. Differences were found between children with autism and their typically developing peers in their understanding of the emotion, yet the former group reported higher degrees of loneliness than did the latter. The findings of this study called for further investigation on the nature of loneliness among children with autism. Loneliness in typical development might arise when children lack an intimate, close social bonding such as a friend, termed by Weiss (1973) as emotional loneliness. Alternatively, children may feel left out of their peer group, which was termed by Weiss as social loneliness. Thus, friendship in children may be viewed as more related to the emotional aspect of loneliness, whereas peer interaction is more related to social loneliness. In the Bauminger and Kasari study (2000), children with autism demonstrated a better understanding of the social aspect rather than the emotional aspect of loneliness. However, the questionnaire examining feelings (rather than understanding) of loneliness did not differentiate between its social and emotional aspects; consequently, the social versus emotional nature of these feelings remains unclear. Because the different types of loneliness likely reflect different social experiences (relationships vs. more sporadic peer interaction), uncovering the nature of these children's loneliness will help obtain a more accurate conceptualization of their social desire for different forms of social engagement. Therefore, in this study, the nature of loneliness is examined through the examination of children's feelings and understanding of loneliness, as well as through the examination of the link between loneliness and peer interaction.

This report comprises part of a more extensive research project examining social and emotional features in high-functioning children with autism. More specifically, this study focused on the following objectives: first, to assess the quality and quantity of spontaneous social interaction (initiations and responses) in natural settings (school recess and snack time) among high-functioning children with autism as compared with typically developing age-matched children; second, to assess the differences between social interactions of two types: mixed (the child with autism and a child with typical development) and nonmixed (the child with autism and a partner with autism or other atypical development); third, to evaluate the social understanding of social interaction in children with autism compared with typically developing children; fourth, to assess the understanding and feelings of loneliness in high-functioning children with autism; and fifth, to examine the association between the understanding and experiences of social interaction and the understanding and feelings of loneliness in each group (typical and autism).

On the basis of the literature just described, we hypothesized that differences would emerge in the frequency and quality of social interaction between children with autism and with typical development. We expected children with autism to demonstrate a lower frequency of social interaction and a lower quality of social interaction, manifesting the largest difference in the more complex integrated social behaviors such as the combination of eye gaze and smile. Because differences between mixed and nonmixed interactions have not been previously examined, it was difficult to hypothesize whether children with autism would be more likely to interact with another high-functioning

child with autism or another child with atypical development (nonmixed interaction) or with a typical child (mixed interaction). However, based on Sigman and Ruskin's (1999) study, we speculated that mixed interactions would entail a higher quality of social behaviors compared with nonmixed interactions. Again, because of the paucity of previous research, forming a hypothesis regarding the nature of loneliness was challenging. However based on these children's difficulties in establishing affective bonds (Hobson, 1993), we suggest that intergroup differences are characterized by a lower emotional loneliness (rather than social loneliness), compared with typical controls. Also, based on high-functioning children's difficulties relating emotions with social situations, we expected to find a less coherent understanding of social interaction and of loneliness among these children compared with typically developing children.

METHOD

Participants

Participants in this study included 35 preadolescents and adolescents: 18 (two girls) high-functioning individuals with autism between the ages of 8;1 (8 years and 1 month) and 17;2, and 17 (two girls) typically developing individuals between the ages of 8;8 and 16;3 ($M = 11.00$, SD = 2.83; $M = 11.51$, SD = 2.62, respectively). Mean full-scale IQ scores, as measured on the WISC-R (Wechsler, 1974), were $M = 93.61$ (SD = 13.61) for the children with autism and $M = 98.35$ (SD = 7.19) for the typically developing group.

The children with autism were recruited through the Special Education Department in the Israeli Ministry of Education. Typical children were recruited from local public schools. As shown in Table I, the group of typically developing children was matched to the children with autism on chronological age; verbal, performance, and full-scale IQ scores; gender; and maternal education. Student *t* tests revealed no differences between groups regarding any demographic variables. The children came from middle-class Caucasian families in large urban areas throughout Israel.

Before participation in the study, all of the children with autism were diagnosed by a licensed psychologist not associated with this study. All children met the criteria for autistic disorder recommended by the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; American Psychiatric Association, 1994), including onset before 36 months of age, qualitative impairment in social interaction, qualitative impairment in communication (e.g., deficits or abnormalities in language development or deficits in play, particularly symbolic play), and restricted and repetitive stereotyped behaviors, which may include bizarre responses to various aspects of the environment, such as resistance to change.

The Autism Diagnostic Interview–Revised (ADI-R; Lord, Rutter, & Le Couteur, 1994) was administered to the parents of the children by the first and second authors of this article to verify diagnosis and to provide additional information about the children's developmental

Table I. Sample Characteristics

	Autism ($n = 18$)	Typical ($n = 17$)	Significance
Chronological age (in years)			
Mean (Standard deviation)	11.00 (2.83)	11.51 (2.62)	*ns*
Range	8.08–17.16	8.66–16.25	
Full-scale IQ			
Mean (Standard deviation)	93.61 (13.61)	98.35 (7.19)	*ns*
Range	77–117	83–111	
Verbal IQ			
Mean (Standard deviation)	92.44 (14.44)	95.06 (5.38)	*ns*
Range	76–128	87–104	
Performance IQ			
Mean (Standard deviation)	96.22 (14.64)	102.53 (11.50)	*ns*
Range	77–131	82–122	
Male/Female	16/2	15/2	*ns*
Mother's education (*M*/SD)	6.68 (1.35)	5.75 (1.30)	*ns*

Note: IQ scores are based on the WISC-R. Mother's education was calculated on a 1–8 scale (1 = less than 7th grade; 2 = junior high; 3 = some high school; 4 = high school; 5 = some college; 6 = special training after high school; 7 = college; 8 = graduate/professional training).

histories. The ADI-R focuses on meeting criteria for autism in three main areas: reciprocal social interaction; communication and language; and repetitive, restrictive, and stereotyped behaviors. The child also needs to show evidence of developmental delay or deviance before the age of 36 months. All 18 children met criteria for autism on all four ADI-R domains.

All but one of the children in the autism sample were included in regular schools. Among these 17 children, the majority (13 children = 76.5%) were in special classes for high-functioning children with autism, three children (17.6%) were in special classes for children with learning disabilities, and one child was fully included in a regular class in a regular school. All the children with autism who were placed in special classes within a regular education setting (16 children = 89%) were also included in a regular class for at least 50% of their time in school, in different lessons and activities on an individual basis. The lessons that children attended included nonacademic lessons (e.g., sports, art) and academic lessons (e.g., science, English). Thus, the majority of children in the autism sample had similar opportunities for both mixed interactions with typically developing children and for nonmixed interactions (mostly with another child with autism but a few with learning disabilities or another developmental delay) during academic and nonacademic lessons and during recess time. With regard to age and school grade distribution, 72% of the group of children with autism studied in elementary school ($n = 13$; age range: 8.08–11.25 years); 22.5% ($n = 4$; age range: 13.91–15.16 years) studied in junior high school; and one child (5.5%, chronological age [CA] = 17.16) studied in high school. Within the group with typical development, 65% attended elementary school ($n = 11$; age range: 8.66–11.75 years), 29% were in junior high school ($n = 5$, age range: 13.08–16 years), and 6% attended high school ($n = 1$, CA = 16.25). To the best of our knowledge, at the time of the study, children were not receiving any specific social interventions in school.

Assessment Measures

Social Interaction Understanding—Picture Recognition

To assess children's understanding of peer interaction, they were shown a colored drawing picture depicting a peer interaction scenario, which was developed for the purpose of this present study. The drawing depicted a situation of peer entry, where two children were standing and talking with each other, while a nearby third child was looking at them. A prior pilot study with 15 typically developing preadolescents and adolescents (unrelated to the present sample) revealed that these youngsters could easily identify that the third child wanted to join the two talking children, and that he felt left out.

Children were asked three questions regarding the picture: (1) What does the (third) child in the picture want? (2) How does he feel? and (3) What can he do to join the two talking children? The first question aimed to assess children's ability to recognize the child's social intention and desire, reflecting comprehension of the scenario. A score of 1 was given to any answer indicating that the third child wanted to join the two talking children, and a score of 0 was given to answers that did not include recognition of social desire. The second question, regarding the third child's feelings, aimed to assess the participant's ability to accurately recognize the emotions associated with being left out. Coding ranged from 0 to 2: A score of 0 was given to inaccurate identification of the child's emotion (e.g., "happy that he's not with them"; "he doesn't feel anything") or to a reply of "I don't know." Answers including an accurate recognition of the child's emotion but the indication of a simple emotion (e.g., "sad," "afraid," "bad") were scored 1, and responses including a correct complex emotion (e.g., "lonely," "jealous," "hurt," "disappointed," "frustrated") scored 2. The third question provided an indication of the child's repertoire of social alternatives for performing a peer entry. Children's social alternatives were counted, and the score reflected the number of different relevant social entry suggestions (e.g., "He could go over and say 'hello may I join you?'"; "he could offer them to do something together") provided by the child.

Social Interaction Observations

To assess children's social interaction behaviors, each child was observed for a total of 1 hour during school recesses and snack times, divided into four 15-minute periods. For the children with autism, recesses and snack times provided a unique, open opportunity to observe them interacting spontaneously among a pool of classmates (who had typical development or who had autism or other developmental disorders). For the children with typical development, partners for interaction were schoolmates in their regular school setting. Observations were conducted on at least two different days. For each 15-minute period, a single child's social behavior was recorded. The observer watched the child's behaviors for 50 seconds and

then recorded them for 10 seconds, thus yielding 60 observed intervals per child. Two observers underwent training in observing high-functioning children with autism and children with typical development who were not associated with the current project, over a period of 2 weeks, until an interobserver agreement level of 85% was obtained. Then one observer, a graduate student in special education, observed the entire sample. The observer maintained close proximity to the children during recess and snack time, whether in their classes or outdoors; however, the observer did not interact with children and politely rejected any overture made toward her. Children were told that the observer was interested in learning about their play and activity habits with their friends.

A coding scale was developed based on Hauck *et al.*'s (1995) Behavior Coding Scheme for children with autism. This scheme was designed for observations in the child's natural school environment, and it coded social initiations in three main behavioral categories: positive social interaction, negative social interaction, and low-level social interaction. For the purpose of our study, the coding scale was adapted to suit high-functioning children with autism. Two modifications were executed: first, the scale was extended to include not only social initiations but also social responses. Second, each of the three behavioral categories was expanded to include a broader variety of prosocial and aggressive behaviors appropriate to the higher social abilities of the current participants in comparison with Hauck and her colleagues' project. Behaviors such as sharing and social communication were added to the positive interaction scale. Teasing and controlling were added to the negative interaction scale. Functional communication and idiosyncratic language were added to the low-level interaction scale. The appendix presents a description of the observation categories and behaviors.

Observations were made on the specific behaviors in each of the three global social interaction scales (positive, negative, and low-level). The observer coded children's initiations and responses in each of these specific behaviors. Initiations and responses were mutually exclusive within each 50-second interval. However, in each interval, a child could initiate one behavior and respond using a different behavior (e.g., the child could initiate eye contact and respond with eye contact and a smile). Thus, each of the specific behaviors could be observed between 0 and 60 times during the 1-hour period.

In addition, in each 50-second interval, mixed and nonmixed types of observed social interactions were coded. Mixed social interaction was coded when the child with autism was observed interacting with a typically developing child. Nonmixed social interaction was coded when the child having autism was observed interacting with another child having atypical development (i.e., autism, learning disability, mental retardation).

Loneliness-Understanding Interview

To examine the understanding of the emotional aspect of loneliness among children with autism, Bauminger and Kasari (2000) asked the children to define loneliness and then analyzed their answers according to the inclusion or exclusion of the emotional and social aspects of loneliness. In our study, the children were interviewed using two different questions to directly examine these children's understanding of the emotional aspect of loneliness. The first question, based on Margalit and Levin-Alyagon (1994), asked; "Can a child feel lonely when s/he is in the company of other children?" The second question, developed for this study, inquired; "Can a child feel lonely when he/she is with his/her close friend?" Further, the children were asked to justify their answers. These questions aimed to explore whether children with autism would understand that the presence of a close friend may protect children from experiencing loneliness and, in contrast, that the presence of many children may not protect children from being left out.

Loneliness Self-Report—The Experience of Loneliness

The Loneliness Rating Scale (Asher, Hymel, & Renshaw, 1984) is a standardized self-report assessing children's feelings of loneliness. The questionnaire contains 24 items rated on a 5-point scale from not true at all (1) to always true (5). Sixteen items focus on feelings of loneliness and social dissatisfaction (e.g., "I have nobody to talk to in class," "I don't have any friends in class," and "I feel left alone at school"). Eight filler items cover hobbies, interests, and school subject preferences. The child obtained a total loneliness score based on the 16 items. The higher the score, the lonelier the child.

Considerable evidence has suggested that the loneliness self-report is psychometrically sound with different ages of typical children (Asher & Wheeler, 1985; Cassidy & Asher, 1992; Renshaw & Brown, 1993). This instrument has demonstrated internal consistency ($\alpha = .90$) and stability across a 12-month time frame

(Asher & Wheeler, 1985; Cassidy & Asher, 1992). Also, this instrument was successfully implemented with a sample of high-functioning preadolescents and adolescents with autism (Bauminger & Kasari, 2000).

The original questionnaire did not differentiate between the social and emotional aspects of loneliness, and it also included more questions focusing on the social aspect. In line with the theoretical distinction between emotional and social loneliness (Weiss, 1973), and with the specific goal of examining the different types of loneliness in autism (see also, Bauminger & Kasari, 2000), the original questionnaire was modified for our research. The modified questionnaire retained the original 16 loneliness items and eight filler items, added six additional loneliness items (five items on the emotional aspect and one item on the social aspect), and classified the loneliness items into two subscales.

The emotional loneliness subscale included five new questions ("I don't have any friend in class who really know me," "I have at least one friend in class that I'm important to," "I feel very sad in class," "I have no one in class who is really close to me," "I have at least one friend in class who I love") and four original questions (e.g., "I feel alone in school," "I can find a close friend when I need one"). This 9-item subscale demonstrated good internal consistency (Cronbach's α) of .83 for the total sample, .80 for autism, and .67 for typically developing children. The social loneliness subscale included one new item ("I feel bored during most of the free time in school") and 12 original items (e.g., "I have many friends in class," "I work well with other children"). This 13-item subscale showed high internal consistency (Cronbach's α) of .91 for the total sample, .88 for autism, and .77 for typically developing children. In addition, a global loneliness category was defined, including both the emotional and the social loneliness subscales. The modified global scale demonstrated high internal consistency (Cronbach's α) of .93 for the total sample, .92 for autism, and .82 for typically developing children.

RESULTS

Social Interaction Understanding—Picture Recognition

The first set of analyses focused on the child's understanding of social interaction along three main dimensions: recognition of social desire, emotion recognition, and the ability to provide relevant social alternatives for peer entry. The majority of children in both groups could recognize the child's social desire to perform peer entry (75% of children with autism vs. 94% in the control group, Fisher's exact test, ns). In terms of children's level of emotional complexity, although children with autism presented lower complexity compared with their typically developing age mates, Fisher's exact test was nonsignificant. Only 37.5% of the children with autism could offer complex emotions (e.g., frustration, disappointment) as the feelings experienced by the child in the social interaction scenario, versus 58.8% of the children in the typically developing group. An ANOVA on the children's number of social alternatives to peer entry yielded a significant effect of group [$F(1, 31) = 7.35$, $p < .01$]. Compared with typically developing children, children with autism suggested a lesser number of social alternatives ($M = 2.71$, SD = 1.26, range, 1–6; $M = 1.56$, SD = 1.15, range, 0–4, respectively). Forty-seven percent of the typically developing group could provide three or more social alternatives, whereas only 18.75% of the autism group could do so. Also, three children with autism (18.75%) could not offer any social alternative, whereas all of the typically developing children could offer at least one additional option.

Social Interaction Observations

The second set of analyses consisted of an examination of the social interaction behaviors that were observed for the children in both groups. Results will be reported separately for an examination of the differences between, first, children with autism and typically developing children and, second, the mixed and nonmixed interactions performed by children with autism. Data will first be reported on global social interaction categories (positive, negative, and low-level), followed by the specific behaviors in the positive and low-level social interaction subscales. Specific behaviors in the negative subscale were too few to be included in the analyses. In addition, several specific behaviors were noted so seldom among the children with autism (twice at most) that they were excluded from the analyses: affection and help in the positive category; temper tantrum in the negative category; and imitation, echolalia, idiosyncratic language, and repetitive behavior in the low-level category. The majority of excluded behaviors were from the low-level category.

Autism versus Typical Social Interaction

Overall, the majority of children's social interactions in both groups (autism and typical) were coded as positive ($M = 50.88$, SD 23.25 in autism;

$M = 118.35$, SD = 41.94 in typical). Children less often initiated or responded to interactions classified as low level ($M = 22.5$, SD = 10.32 in autism; $M = 46.73$, SD = 13.47 in typical), and very few negative social interactions were noted ($M = 4.33$, SD = 4.28 in autism; $M = 6.96$, SD = 5.74 in typical).

The two groups demonstrated a similar distribution of social interaction, most frequently evidencing positive social interaction, less frequently evidencing negative social interaction, and evidencing low-level social interaction in between. Yet the typically developing children performed behaviors in the positive and low-level social interaction scales twice as much as children with autism. Indeed, a 2 (autism/typical) × 2 (initiations/responses) multivariate analysis of variance (MANOVA) to examine group differences for the three global social interaction subscales (positive, negative, and low-level), yielded a significant difference between groups [F (Wilks criterion) (3,31) = 17.95, $p < .001$]. As seen in Table II, univariate ANOVAs demonstrated that, compared with children with autism, typically developing children were more likely to show positive and low-level social interactions (initiations and responses). The MANOVA for the differences between initiations and responses and for the interaction effect (group by initiations/responses) was nonsignificant. Children in both groups tended to initiate and respond in similar frequency across all three social interaction subscales when examined globally.

Second, a similar 2 × 2 MANOVA was conducted to investigate group differences on the specific social behaviors within the positive and low-level social

Table II. Means, Standard Deviations, and F Values for the Differences between Children with Autism and Children with Typical Development for Social Interaction

		Autism		Typical				
		Initiation	Response	Initiation	Response	F group (1,33)	F type (1,33)	F interaction (1,33)
Global social interaction								
Positive subscale	*M*	52.44	49.33	120.82	115.88	36.64***	3.07	.15
	SD	24.08	22.42	41.43	42.46			
Negative subscale	*M*	4.11	4.55	6.17	7.76	3.14	1.33	.42
	SD	5.41	3.16	5.90	5.58			
Low-level subscale	*M*	24.16	20.83	44.88	48.58	43.42***	.01	4.33
	SD	10.41	10.24	12.81	14.14			
Positive social interaction subscale								
Eye contact	*M*	30.22	29.22	38.47	39.06	3.77	.06	.97
	SD	17.40	17.55	8.59	8.98			
Eye contact with smile	*M*	4.66	5.05	21.53	22.71	26.30***	2.73	.69
	SD	3.74	3.82	13.58	14.19			
Smile—no eye contact	*M*	3.39	8.05	27.47	30.06	59.60***	19.36***	1.58
	SD	3.50	6.67	12.72	11.11			
Sharing	*M*	6.72	4.11	12.58	9.64	13.27***	15.20***	.05
	SD	5.08	2.29	5.92	6.19			
Social communication	*M*	5.22	1.72	14.88	9.58	21.17***	30.31***	1.26
	SD	3.73	1.80	7.90	8.54			
Talk with interest in another child	*M*	2.22	1.16	5.88	4.82	8.23**	5.86*	.00
	SD	2.39	1.38	5.78	4.88			
Low-level social interaction subscale								
Looking	*M*	12.66	12.89	28.94	30.29	35.08***	.59	.30
	SD	7.63	8.79	9.31	9.92			
Close proximity	*M*	6.88	3.61	12.06	8.64	9.85**	24.65***	.00
	SD	4.29	2.52	6.57	6.49			
"Yes" or "no"	*M*	0.33	3.83	1.53	9.17	21.34***	75.89***	10.50**
	SD	0.59	2.30	1.80	4.85			
Functional communication	*M*	4.28	0.50	2.35	0.47	4.80*	38.05***	4.26*
	SD	2.86	0.70	2.14	0.94			

Note: Group = autism/typical; Type = initiations/responses. Several SDs were higher than their means; therefore, an additional Mann–Whitney for independent sample and Wilcoxon for related sample nonparametric test were performed for these cases, and the same significant differences emerged.

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

interaction subscales (as described in the appendix). Results of the MANOVA indicated significant differences between groups for the specific behaviors within the positive social interaction scale [$F(6,28) = 9.37$, $p < .001$] and within the low-level social interaction scale [$F(4,30) = 20.21$, $p < .001$]. Univariate ANOVAs revealed significant group differences on most of the specific behaviors within both subscales, except for eye contact. Means, standard deviations, and F values are presented in Table II. In general, typically developing children demonstrated a higher frequency of both positive and low-level specific social behaviors, with the exception of functional communication (in the low-level subscale), in which high-functioning children with autism showed a higher frequency of communication than did their typical age-mates. In addition, the two groups presented a similar frequency of eye contact.

Unlike the global results for the positive interaction subscale, outcomes of the MANOVA for the differences between initiations and responses for the specific positive social behaviors revealed significant differences [$F(6,28) = 9.82$, $p < .001$]. The MANOVA for interaction effect (group by initiations/responses) was not significant. Univariate ANOVAs revealed significant differences between initiations and responses for smile with no eye contact, sharing, social communication, and talk that reflected interest in another child. Except for smile with no eye contact, children in both groups tended to initiate more than they responded.

In the low-level interaction scale, results of the MANOVA for the differences between initiations and responses also differed from the global subscale findings, indicating significant differences between initiations and responses of the specific low-level behaviors [$F(4,30) = 24.8$, $p < .001$]. Univariate ANOVAs revealed significant differences between initiations and responses in close proximity, functional communication, and "yes" and "no" behaviors. For close proximity and functional communication, children tended to initiate more than they responded, and in "yes" and "no" behaviors, the opposite pattern was noted. The MANOVA revealed a significant group × initiations/responses interaction [$F(4,30) = 5.77$, $p < .001$]. Univariate ANOVAs were significant for "yes" and "no" and for functional communication. Simple effect tests revealed that typically developing children were significantly more likely to respond with "yes" and "no" behaviors, in comparison to children with autism [$F(1,33) = 34.99$, $p < .001$], whereas no significant differences were found in the two groups' frequency of initiations for this behavior. The opposite pattern emerged for functional communication, where differences between the groups were noted in their initiations [$F(1,33) = 8.85$, $p < .01$] but not in their responses. Children with autism were more likely to initiate functional communication compared with typically developing children. Means, standard deviations, and F values are presented in Table II.

Within-Group Examination: Mixed versus Nonmixed Social Interaction

A series of analyses were executed within the group of children with autism to test for differences between mixed (children with autism and typically developing children) and nonmixed (children with autism and children with autism or other atypical development) social interaction. Overall, children with autism showed a tendency for a higher frequency of social interaction behaviors when interacting with typically developing children (mixed social interaction) as compared with interactions with another child with autism (nonmixed social interaction) for positive social interaction ($M = 29.55$, SD = 16.03 in mixed; $M = 21.33$, SD = 23.33 in nonmixed), for negative interaction ($M = 2.86$, SD = 3.30 in mixed; $M = 1.47$, SD = 2.24 in nonmixed), and for low-level interaction ($M = 15.80$, SD = 10.05 in mixed; $M = 6.69$, SD = 7.48 in nonmixed). Indeed, results of the repeated measure 2 (mixed/nonmixed) × 2 (initiation/responses) MANOVA for the three global subscales (positive, negative, and low-level) indicated significant differences between mixed and nonmixed social interactions [$F(3,15) = 6.40$, $p < .01$]. However, ANOVAs revealed a significant difference only for the low-level subscale (see Table III). The MANOVA for the difference between initiations and responses was nonsignificant. The MANOVA for the interaction effect (mixed and nonmixed interaction × initiations/responses) was significant [$F(3,15) = 3.62$, $p < .05$]. Univariate ANOVAs indicated a significant interaction effect only for the negative social interaction. Simple effect tests revealed significant differences in the responses [$F(1,17) = 12.89$, $p < .001$], but not in the initiations. Children with autism were more likely to respond using a negative social interaction when they interacted with typically developing children as compared with their interactions with children with autism. Rates of initiations were similar in mixed and nonmixed social interactions.

The results of the MANOVA for the examination of specific social interaction behaviors within the

Table III. Means, Standard Deviations, and *F* Values for the Differences between Mixed and Nonmixed Social Interactions

		Nonmixed (Autism = Atypical)		Mixed (Autism = Typical)				
		Initiation	Response	Initiation	Response	*F* Group (1,33)	*F* Type (1,33)	*F* Interaction (1,33)
Global social interaction								
Positive subscale	*M*	22.83	19.83	29.61	29.50	1.14	1.03	1.83
	SD	25.61	21.06	13.92	18.14			
Negative subscale	*M*	1.83	1.11	2.27	3.44	3.94	.10	4.23*
	SD	3.25	1.23	3.30	3.03			
Low-level subscale	*M*	7.00	6.39	17.16	14.44	7.62**	2.24	1.52
	SD	7.83	7.14	9.39	10.72			
Positive social interaction subscale								
Eye contact	*M*	13.44	13.28	16.78	15.94	.37	.80	.40
	SD	16.36	15.16	10.46	11.67			
Eye contact with smile	*M*	1.61	1.61	3.05	3.39	4.22*	.88	.92
	SD	2.25	2.11	2.73	2.89			
Smile—no eye contact	*M*	1.11	2.72	2.27	5.33	2.30	17.00***	1.76
	SD	1.45	3.78	3.19	5.91			
Sharing	*M*	2.66	1.16	4.05	2.94	3.45	6.81**	.16
	SD	3.56	1.75	3.31	2.43			
Social communication	*M*	2.83	.55	2.38	.44	.20	31.51***	.23
	SD	3.16	1.04	2.14	.92			
Talk with interest in another child	*M*	1.16	.44	1.05	.72	.03	3.31	.67
	SD	1.72	.70	1.92	1.17			
Low-level social interaction subscale								
Looking	*M*	4.22	4.00	8.44	8.88	3.75	.02	.39
	SD	5.28	4.80	6.87	8.62			
Close proximity	*M*	1.83	.88	5.05	2.72	8.74**	15.40***	2.83
	SD	2.12	1.18	4.12	2.39			
"Yes" and "no"	*M*	.28	1.44	.05	2.38	.77	50.31***	2.76
	SD	.46	1.94	.23	2.00			
Functional communication	*M*	.66	.05	3.61	.44	29.82***	29.29***	17.16***
	SD	.84	.23	2.54	.70			

Note: Group = mixed/nonmixed; Type = initiations/responses. Several SDs were higher than their means; therefore, an additional Wilcoxon nonparametric test was performed for these cases, and the same significant differences emerged.
$*p < .05$ $**p < .01$ $***p < .001$.

positive subscale revealed a significant difference for mixed versus nonmixed social interaction [$F(6,12) = 3.17$, $p < .05$]. Univariate ANOVAs demonstrated significant differences only for eye contact with a smile, whereas children with autism were more likely to direct this behavior toward typically developing children than toward another child with autism. Even if not statistically significant, this tendency was noted in most of the specific positive social behaviors (see means, standard deviations, and *F* values in Table III). The MANOVA for the difference between initiations and responses within the positive subscale was significant [$F(6,12) = 6.25$, $p < .01$], but the MANOVA for interaction was not significant. ANOVAs revealed significant differences for smile with no eye contact (more responses rather than initiation in both groups), and for sharing and social communication (more initiations than responses).

In the low-level subscale, a significant difference was found for mixed versus nonmixed on the specific social interactions behaviors [$F(4,14) = 7.77$, $p < .01$]. Univariate ANOVAs revealed that children with autism demonstrated significantly more physical proximity and functional communication toward typically developing children than toward children with autism. Also, the differences for looking showed a tendency toward statistical significance ($p = .07$).

The MANOVA for the examination of the difference between initiations and responses on the specific behaviors within the low-level subscale revealed a significant difference [$F(4,14) = 17.08$, $p < .001$]. ANOVAs revealed significant differences between initiations and responses for yes or no behaviors (more responses in both groups) and for close proximity and functional communication (more initiations in both groups). The MANOVA for interaction effect was also

significant [$F(4,14) = 4.21$, $p < .05$], but univariate ANOVAs revealed a significant interaction between mixed and nonmixed behavior type only for functional communication. Simple effect tests for this behavior revealed that the main intergroup difference (mixed vs. nonmixed) was in initiations rather than responses, whereby children with autism were more likely to initiate functional communication toward typically developing children than toward children with autism [$F(1,17) = 45.80$, $p < .001$]. Also, no significant difference was found in the frequency with which children with autism responded to the functional communication of typically developing children and of children with autism.

Within-Group Associations for Social Interaction: Understanding and Behaviors

The associations between the understanding of social interaction and the observed manifestation of social interaction were examined in each group. Overall, few significant correlations emerged between understanding and behavior for the two groups. For children with autism, the identification of social desire was positively associated with the initiation of low-level social interactions ($r = .46$, $p < .05$) and with negative social interactions (responses: $r = .41$, $p < .05$; global score including responses and initiations: $r = .44$, $p < .05$). Also, the correlation between the number of social alternatives provided for peer entry by the children with autism and their global low-level social interaction subscale score (initiation and response) approached significance ($r = .32$, $p = .09$). For the typically developing children, the ability to offer social alternatives to peer entry was significantly correlated with the ability to perform positive social interactions (initiations, $r = .58$, $p < .01$; responses, $r = .71$, $p < .001$; and global score $r = .65$, $p < .001$).

Loneliness

Loneliness Understanding Interview

In examining children's answers to the following two questions of the loneliness interview—whether a child can feel lonely when he or she is in the company of other children and whether a child can feel lonely when he is with his close friend—Fisher's exact test was nonsignificant for both answers. Children with autism revealed as complex an understanding as did typically developing children of the more emotional aspect of loneliness. The majority of children in both groups understood that a child might experience loneliness in the company of other children (72.2% in autism and 94.1% in typical); in a similar manner, most children in both groups understood that a child might not feel lonely if he or she is with his or her close friend (66.7% in autism and 76.5% in typical).

The five children with autism who provided a wrong answer to the first loneliness question were also unable to explain their answer. The other 13 children with autism, who answered the first question correctly, were also able to provide accurate justification to their answers. For example, "Yes, many of the children that he sees around could be strangers," "Maybe, because he is still by himself, not with his friends.'' In terms of the second question, four typically developing children replied that a child could experience loneliness when with a friend, and they were able to provide accurate justification: "They might be in a fight,'' "Yes, if we meet a third friend and he and my friend start to talk about an issue that I'm not familiar with.'' Similarly, three out of the six children with autism who answered that a child with a friend could still feel lonely justified their answers accurately. They maintained, "Yes, if his friend ignores him,'' "Sometimes he might feel that he wants more than one friend.'' In conclusion, children with autism as a group revealed a good understanding of the more emotional aspect of loneliness, as reflected in their answers to the two questions described above.

Loneliness Self-Report—The Experience of Loneliness

In order to examine group differences (autism vs. typical) on the Loneliness Rating Scale, a MANOVA was conducted with grouping as the independent variable and each of the loneliness subscales (emotional, social) as the dependent variables. The significant MANOVA [F (Wilks criterion) $(2,32) = 10.79$, $p < .001$] was followed up with univariate ANOVAs. Results indicated that, in comparison to typically developing children, children with autism presented higher feelings of emotional loneliness [$M = 1.53$, SD $= .47$; $M = 2.44$, SD $= .87$, respectively; $F(1,33) = 14.35$, $p < .001$] and social loneliness [$M = 1.64$, SD $= .43$; $M = 2.73$, SD $= .85$, respectively; $F(1,33) = 22.17$, $p < .001$]. In addition, the ANOVA executed on the global loneliness scale revealed the same pattern [$M = 2.61$, SD $= .82$ in autism; $M = 1.59$, SD $= .39$ in typical; $F(1,33) = 21.11$, $p < .001$].

Within-Group Associations between Loneliness and Social Interaction

The correlations between loneliness and social interaction were examined separately for each group. Overall, in children with autism, loneliness was more closely related with their understanding of social interaction than with their social behaviors. Children with autism who could provide a greater number of social alternatives to initiate an interaction and who could identify a social desire to join peers reported lower feelings of loneliness (emotional, social, and global loneliness score). In a similar manner, typically developing children who provided a greater number of social alternatives to peer entry reported less loneliness. However, for typically developing children, loneliness was also negatively correlated with the level of emotion recognition; children who demonstrated a higher level of emotion recognition reported less loneliness.

Although the associations between loneliness and all of the social interaction behavior subscales (positive, negative, and low-level) were in the same negative direction, none of them were significant for the group with autism (see Table IV). In contrast, for typically developing children, positive social interaction was negatively correlated with the overall loneliness scale and with the social loneliness subscale (see Table IV).

DISCUSSION

This study focused on examining the nature of spontaneous peer interactions in natural settings (school recesses and snack time) among high-functioning children with autism. Also, by investigating loneliness in these children, we aimed to explore their social motivation to take part in peer interaction. Regarding children's peer interaction, we expected to find a lower quality and quantity of social interactions among children with autism compared with typically developing children, as well as more complex social behaviors in mixed interactions (interactions between children with autism and their typical peers) than in nonmixed interactions (interactions between children with autism and children with disabilities, mostly other children with autism).

Several findings are of particular interest regarding differences found between the children with autism and their typically developing peers. Indeed, as expected, children with typical development revealed a higher level of participation in peer interaction (both initiations and responses) compared with high-functioning children with autism, both in the general categories of social interaction (positive, negative, and low-level) and in most of the specific social behaviors in each general category. However, the distribution of social interaction behaviors was identical for the two groups, whereby the majority of behaviors were positive (eye contact, sharing, social communication); second were low-level interactions (mostly looking, functional communication, and close proximity); and last, very few negative behaviors (such as physical or verbal aggressiveness) were noted in either group. This profile corroborates Hauck *et al.*'s (1995) findings regarding low-functioning children with autism, suggesting that, similar to the typical children, this profile may universally characterize autism regardless of

Table IV. Within-Group Correlations between Loneliness and Social Interaction

	Loneliness					
	Autism			Typical		
Social interaction	Loneliness total	Emotional subscale	Social subscale	Loneliness total	Emotional subscale	Social subscale
Understanding						
Identification of desire[a]	−.45*	−.43*	−.43*	—	—	—
Level of emotions	−.18	−.02	−.25	−.49*	−.42*	−.45*
Number of alternatives	−.44*	−.44*	−.40*	−.40*	−.37	−.34
Behaviors						
Positive interaction	−.21	−.31	−.13	−.43*	−.29	−.45*
Negative interaction	−.35	−.36	−.32	−.12	.19	−.33
Low-Level interaction	−.27	−.27	−.28	−.04	−.08	.00

[a] Correlations with social desire were not examined for the typical group because, except for one child, all of the children's responses were scored 1.

*$p < .05$.

functioning level. However, in contrast with the low-functioning children in Hauck's research, the high-functioning children in our study were much more socially active with peers. In Hauck and her colleagues' study, most initiations of low-functioning children were toward adults, and initiations were made toward peers (atypical children with multiple diagnoses) only one-third as much as initiations by a control group of children with mental retardation, mostly during indoor social activities. In this study, high-functioning children with autism initiated and responded to peers at about half the rate of typical controls, even during unstructured outdoor recess activity, which is considered the most challenging social framework for these children. The finding that high-functioning children with autism were more socially involved with peers than their lower-functioning counterparts substantiates other studies on peer interaction (e.g., Sigman & Ruskin, 1999; Stone & Caro-Martinez, 1990).

Nevertheless, even if the distribution of social behaviors in autism resembled that of the typical group, as expected, the quality of social interaction did differ between the groups. Combined and complex social behaviors were shown to constitute a major area of difficulty, even for high-functioning children with autism. For example, significant differences were found between the typical and atypical groups in this study on the vast majority of communicative, complex, positive social behaviors (e.g., sharing, eye contact with a smile), corroborating Lord and Magill-Evans's (1995) research. Indeed, functional communications were more likely to appear in the autism group than in the typical group, indicating that, for these high-functioning children with autism, instrumental interactions may be easier than social engagement with peers.

A surprising finding was the relatively high rate of social initiations revealed by children with autism in this study. Past findings indicated that, among children with autism, difficulties centered mostly on initiating social interactions, whereas they were generally able to maintain interactions that had already begun (Sigman & Ruskin, 1999). In this study, for three out of the 10 different social behaviors in the positive and low-level interaction scales (eye contact, eye contact and smile, and looking), children with autism initiated and responded to a similar degree. Furthermore, for five out of the 10 behaviors (sharing, social communication, talk to express interest in another child, close proximity, and functional communication), children with autism even initiated more than they responded. This finding may support the fact that high-functioning children are socially expressive and that they want to take part in social interaction (e.g., Bacon *et al.,* 1998), but it may also indicate that they need to initiate with peers more often because they do not receive enough initiations from peers. Future studies may want to explore more deeply the characteristics of spontaneous social initiation and the role of the partner for high-functioning children with autism.

The role of the partner in interaction is especially significant considering that most of these children were included in regular schools primarily with the goal of providing them with opportunities to interact with typical age-mates. The high-functioning children with autism were found to interact with typically developing children more often than they interacted with other children with autism. As was hypothesized, children with autism both initiated and responded using a higher frequency of complex positive behavior (eye contact with a smile) toward typical children than toward atypical children. Also, these children initiated close proximity and functional communication more toward typically developing children than toward children with autism. It should be noted that, although a clear tendency to interact with typical peers was demonstrated, group differences between these two types of interactions (mixed vs. nonmixed) were not statistically significant for the majority of the specific behaviors tested. Thus, it is important to accentuate that high-functioning children with autism interacted with both typically developing children and children with special needs.

High-functioning children with autism may gain benefits from exposure to typically developing children, but proximity to other children with autism continues to hold importance. Perhaps each type of interaction (mixed and nonmixed) satisfies different needs of the child with autism, such as the need to learn about normative social interaction and the need to feel belonging. Because the majority of children in this sample were in special classes for high-functioning children, and only four were placed in classes with children having learning disabilities or mental retardation, it was not possible to make comparisons based on diagnoses of atypical interaction partners. This comprises an important question for future study, which might help identify optimal classmates in the social domain for high-functioning children with autism.

Based on studies that have highlighted the cognitive manner in which high-functioning children with autism learn about their social world (see review in Kasari, Chamberlain, & Bauminger, 2001), another major focus of interest in this study was the correlation between the cognitive awareness of social interaction and its behavioral manifestation. Even if correlations

in this study require careful consideration because of the relatively small sample size, an important tendency was noted that was in line with our hypothesis: Children with autism revealed a good understanding of the peer entry situation, but their understanding was not clearly linked to their behaviors. In typically developing children, the ability to generate more social alternatives was related with the ability to perform more positive interactions, yet this association was not found for the autism sample. In autism, the ability to identify social desire was linked with more low-level and negative social interaction behaviors, and the number of social alternatives provided by the child reached significance with only the overall (initiations and responses) low-level behaviors. Thus, in autism, understanding of social interactions was not very closely related with the child's positive social behavior. Although future studies would do well to increase the sample size to verify the current findings, the gap found between understanding and behavior suggests the limitation of cognitive compensation in the manifestation of social behavior. Perhaps these children require mediation between their understanding and their social behavior in day-to-day social interactions with peers (Sigman & Ruskin, 1999).

The last issue to be considered in this study concerns whether children with autism interact less with peers simply because they do not want to interact with them, or whether they want to but do not know how. The examination of loneliness was expected to provide insight into this dilemma. Loneliness is a strong social motivation—actually the strongest drive in typically developing children to initiate or to take part in social relationships and interactions with peers (Asher *et al.,* 1990). This study probed whether children with autism would be able to understand the complexity of loneliness, including its more emotional aspect of closeness and affective ties. Surprisingly, these children were as good as their typically developing counterparts in understanding that a close friend might protect them from loneliness and that the presence of many people without a close friend would not protect them from lonely feelings. To some extent, this finding differs from those of Bauminger and Kasari (2000), in which high-functioning children with autism were less likely to include the more emotional aspect while defining loneliness. Methodology may account for this difference, where children asked to come up with their own definitions of loneliness had more difficulty relating to emotional aspects, whereas children asked directly could reply accurately. It might be that these children have learned the complexity of loneliness through cognitive compensation, and thereby were able to relate to this aspect when directly asked, but could not relate to it when spontaneously generating thoughts about it on their own. This finding might help in understanding the limitations of cognitive compensation in facilitating an understanding of complex emotions such as loneliness, which involve both emotional and social-cognitive features. Cognitive compensation might help in dealing with emotional tasks in a more direct cognitive way, but it is less helpful when the child needs to demonstrate a more inner, spontaneous understanding.

In terms of the social versus emotional nature of loneliness feelings, contrary to our expectations, children with autism in this study reported themselves to be lonelier compared with typically developing children on both the emotional and social dimension of loneliness. The dual roots of these children's loneliness hold implications for conceptualizing the social-emotional deficit in autism. Emotional loneliness reflects a deficit in affective bonding; thus, the ability to experience emotional loneliness reflects the capacity to develop an affective tie with a friend. Social loneliness is related more to a cognitive interpretation of loneliness that is linked to the children's quality of peer interaction in their social network (Weiss, 1973). The hypothesized difficulty in establishing affective bonds in children with autism (Hobson, 1993) may indicate that higher social loneliness and lower emotional loneliness would be expected, compared with typical controls. The finding that children with autism experience emotional loneliness in greater intensity compared with typically developing children is interesting and deserves careful evaluation to determine whether it may stem from methodology rather than the quality of these children's loneliness. A high internal consistency was found for the modified questionnaire, but because of the small sample size, factor analyses were not applicable for all questionnaire items to verify the differential characteristics of each of the two loneliness subscales (emotional and social). Some support for the distinctive characteristics of each of the subscales appears in the negative association found between positive social interaction in typically developing children and the social subscale on the loneliness questionnaire, but not the emotional subscale. Yet, as mentioned earlier, future studies with greater sample sizes are needed to examine the methodological characteristics of the modified loneliness questionnaire to conclude that children with autism indeed experience emotional loneliness.

Typically developing children revealed a coherent pattern of associations between loneliness and the understanding and behavioral manifestation of peer

interactions. Children who reported less loneliness were those who provided greater numbers of social alternatives to peer entry, demonstrated a higher level of emotional knowledge, and revealed higher rates of positive peer interaction. Thus, social-emotional understanding and social behaviors with peers were consistently associated with loneliness. As expected, in autism, associations were less coherent. Children with autism who demonstrated a higher level of social but not emotional understanding (a greater number of social alternatives and the ability to recognize social desire) reported less loneliness; however, none of the associations between social interaction behaviors were significant for the autism group (although they were all in the negative direction). Overall, participating in social interaction for children with autism was not found to be linked with a reduction in their level of loneliness. This finding may be understood in several ways: First, high-functioning children with autism may want more than the interactions they actually have. Second, these children do not feel good about the interactions they have. Third, there is a discrepancy between social behavior and loneliness in these children, and they do not understand or experience either one of them in the same way as typically developing children do. Also, in Bauminger and Kasari's (2000) study, closeness in friendship was not related with lower feelings of loneliness in high-functioning children with autism, whereas it was so for typically developing children. Future studies investigating a larger number of children with autism can broaden our understanding of the nature of the associations between loneliness and peer interactions in children with autism. In addition, because of large diversity regarding children's CAs in this study, further research with a more limited age group is recommended to examine peer interaction and loneliness among children with autism. Finally, it is recommended that we expand our methodology in examining peer interaction and related affects in these children, perhaps through the combination of qualitative modes of inquiry in addition to more traditional quantitative methods, to be able to tap more closely the process and dynamics of these children's interactions, including documentation of chains of ongoing interactions.

We would like to conclude the study with an emphasis on several of its implications, both for research and practice. The lower frequency and quality of social interaction, combined with the higher reported loneliness in high-functioning children with autism as compared with typical controls, may indicate that these children would like to take part in more satisfying social interactions—but probably do not have the knowledge of how to do so. Furthermore, the poor associations between a good understanding both of peer interaction and of loneliness with the actual manifestations of social interactions with peers found for the children with autism may suggest that these children lack an intersubjective understanding of social relationships and interactions with peers (Bauminger & Kasari, 2000; Hobson, 1993), which makes it difficult for them to grasp the full complexity of the interrelations between different aspects in their social-emotional world. Intervention studies for these children might focus on enhancing their ability to interact with peers in a more complex communicative way as well as helping them to make the link between their acquired social-emotional knowledge and their day-to-day social behavior with peers. An evolving mode of cognitive behavioral intervention for children with autism has aimed at facilitating both the child's social cognitive processes and their link to his or her communicative-social behavior, seeming to provide a promising line of intervention for high-functioning children with autism (an interested reader may look at Bauminger, 2002; Gray, 1998; Hadwin, Baron-Cohen, Howlin, & Hill, 1996, 1997; Ozonoff & Miller, 1995).

Because of the relatively high frequency of both mixed and non-mixed interactions, the differential roles possibly played by each of the partners (typical or atypical) in social interaction for the child with autism deserves careful examination in future studies. Peers with autism or other disabilities may serve, for example, the function of identification with someone similar to oneself, with conceivable implications for the self-esteem of the child with autism, or the function of interacting with a more familiar peer. Typically developing peers, however, may provide a role model for well-adjusted social behavior, with possible implications for the social competence of the child with autism. Also, the current data do not permit the determination of chains of interactions and the durability of the different permutations of interaction between children. Future research would do well to pursue this significant line of study, which holds ramifications for social skills intervention.

ACKNOWLEDGMENT

This research was supported by the Internal Grants Program of Bar-Ilan University, Israel. Special thanks are extended to the children who took part in this study. The author would like to express her appreciation to

Dee B. Ankonina for her editorial contribution and to Dov Har–Even for his statistical assistance.

APPENDIX A

Definitions of Observed Social Behaviors

1. *Social initiation:* The child begins a new social sequence, distinguished from a continuation of a previous sequence by a change in activity.
2. *Social response:* The child responds verbally or nonverbally to social stimuli directed toward him or her by peers.
3. *Positive social interaction:* The child exhibits verbal and nonverbal social behaviors that lead to an effective social process with peers; behaviors that serve to start or maintain social interaction.
   - Eye contact—The child looks into the eyes of another child
   - Eye contact combined with smile—The child looks at and smiles toward another child
   - Smile with no eye contact—The child smiles at another child but does not look into the peer's eyes
   - Affection—The child expresses affection toward another child, either verbally (e.g., "You're nice," "I like you") or nonverbally (e.g., hugs, touches)
   - Sharing objects or experiences—The child offers to share his or her objects with another child or accepts another child's offer, or the child tells peers about an experience or asks them about their experiences (e.g., "What did you do over the weekend?")
   - Social communication—The child approaches or responds to another child with a social rather than functional intention (e.g., "Let's play" or accepting a child's offer to play; saying hello to another child or replying appropriately to such a greeting)
   - Talk that reflects an interest in another child—The child expresses an interest in another child's hobbies (e.g., "What's your favorite game/object?"), mood (e.g., "Are you sad?"), and so forth.
   - Help—The child offers or gets help from another child
4. *Negative social interaction:* The child exhibits unpleasant social behaviors that operate to stop or decrease the likelihood of the development of an adequate social interaction.
   - Physical or verbal aggressiveness—The child behaves in malicious intrusive ways toward peers (e.g., yells, screams, makes fun, hits, pushes, pinches, slaps)
   - Temper tantrum—The child expresses anger in an extreme way (e.g., screams and shouts, hits other children, hits objects/walls, and so forth).
   - Teasing—The child tries to drag another child into a fight or conflict
   - Controlling—The child dominates other children without respecting their needs
   - Avoidance—The child avoids social overtures made toward him or her by peers
   - Looking away—The child actively avoids social contact by looking away from the initiator
5. *Low-level interaction:* The child exhibits behaviors that indicate social intention, but with minimal social enactment, such as close proximity to children without initiating a positive social interaction. Also includes behaviors typical of the autistic syndrome (e.g., echolalia, idiosyncratic language)
   - Looking—The child looks at the other child's face or body, or child's action, without establishing eye contact
   - Close proximity—The child stands in close proximity to another child (3 feet or less) but does not approach the peer
   - "Yes" or "no"—The child only nods his or her head for yes or shakes it for no
   - Imitation—The child imitates another child's activities
   - Idiosyncratic language—The child uses utterances with no clear meaning
   - Echolalia—The child uses echoed phrases
   - Repetitive behavior—The child behaves in a repetitive manner with no clear communication intent, but with close proximity to another child
   - Functional communication—The child approaches or responds to another child with an intention to fulfill his/her own needs, and with no social intention (e.g., "It's my turn on the computer now" or, in replying to a peer's question, "Yes, I need to use the computer now.")

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