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Attachment in young children with autism spectrum disorders: An examination of separation and reunion behaviors with both mothers and fathers

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Abstract

Most studies examining attachment in children with autism spectrum disorder used a strange situation paradigm and have found few significant group differences between children with autism spectrum disorder and comparisons. However, these studies predominantly used formal attachment categorizations (e.g. secure vs insecure), a method that may obscure more nuanced differences between groups. In this study, we utilized a qualitative approach to examine attachment behaviors in young children with autism spectrum disorder. Based on the results of previous studies, we looked at (a) parental gender, (b) child diagnosis, and (c) child cognitive skills to examine the role of these three factors on attachment behaviors elicited during a modified strange situation paradigm. Participants were 2- to 3-year-old children with autism spectrum disorder (n = 166) or nonspectrum disorders (n = 45), as well as a sample of 56 children with typical development. Over the three groups, 393 observations of a modified strange situation paradigm with mothers and 127 observations with fathers were collected. Parental gender, child diagnosis, and child cognitive skills each had significant main effects on attachment behaviors elicited during reunion. These results underscore the importance of the father's role in parent–child interactions, with implications for both clinical and research efforts. In addition, the results emphasize the importance of considering a child's diagnosis and cognitive skills when examining attachment behaviors.

Keywords

Autism Spectrum Disorders, Attachment, parents, fathers

Children with autism spectrum disorders (ASD) display social-communicative impairments that affect their ability to form relationships (American Psychiatric Association, 2000). Recently, there has been evidence supporting a strong genetic component (Abrahams and Geschwind, 2008) to ASD, although the precise etiology or etiologies are not known. In the 1960s, Bettelheim (1967) postulated that autism was a result of poor parenting—the consequence of a mother who lacked sensitivity and provided an unresponsive and unsympathetic environment for her child. However, in the past 40 years, studies have provided consistent evidence against this claim (Van Ijzendoorn et al., 2007). Regardless, the parent–child relationship remains a popular investigative area in ASD research.

Research studying typical development has emphasized the importance of the parent–child relationship in the emotional and social development of an infant and the health of future relationships (Ainsworth and Bell, 1970; Bowlby, 1958). The strange situation paradigm (SSP) was developed to measure the quality of the parent–child relationship (Ainsworth and Bell, 1970). During the SSP, the mother and child are separated and then reunited, eliciting behaviors that are believed to be indicative of different qualitative categories of emotional attachment. Behaviors believed to indicate a *secure* attachment such as distress upon the mother's exit combined with socially approaching the

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mother for comfort and being soothed upon the mother's return encourage the child and mother to maintain proximity and contact (Ainsworth and Bell, 1970). On the other hand, a child who is resentful, anxious or unaware of the mother's departure, unable or resistant to be soothed, avoidant of the mother, or visibly angry with the mother upon the mother's return is categorized as having *insecure* attachment patterns. Research has shown that children with insecure attachment patterns are more likely to display maladaptive social and emotional outcomes later in life (Belsky and Nezworsky, 1988; Matas et al., 1978).

In typically developing children, attachment is usually formed within the first 2 years of life (Ainsworth and Bell, 1970), the same critical period during which the earliest signs of an ASD are present. In fact, some of the earliest presented symptoms indicative of an ASD, such as impaired social responsiveness, decreased social approach, decreased shared enjoyment and social smiling, and difficulty regulating affect (Landa, 2008; Zwaigenbaum et al., 2009), are all behaviors deemed essential for judging the quality of an attachment relationship. Therefore, the nature of some of the earliest signs of ASD, regardless of parental sensitivity, may discourage the attachment relationship between the parent and the child. One study suggested that the severity of ASD may even influence the quality of the attachment relationship (Naber et al., 2007). Thus, given this overlap in early ASD symptoms and those behaviors used to measure attachment, it may be difficult to judge the attachment relationship between a child with ASD and his or her parent, particularly using traditional methods of attachment categorization.

Despite its challenges, many studies have investigated attachment behaviors in children with ASD, usually with older preschool children and their mothers (see Rutgers et al., 2004). Studies exploring the formal categorizations of the quality of attachment (secure or insecure) have had somewhat mixed results. Despite the social and communication deficits associated with ASD, many studies showed that individuals with ASD display attachment behaviors similar to typically developing or developmentally delayed children (Akdemir et al., 2009; Sigman et al., 2004; Taylor et al., 2008; Willemsen-Swinkels et al., 2000). However, using measures of attachment categorization (secure or insecure) may obscure more nuanced group differences compared to analyses of more specific behaviors. Considering the difficulties associated with assessing attachment in children with ASD, several authors have suggested that formal categorizations may not be the best strategy by which to judge the quality of this attachment relationship (Rogers et al., 1993; Rutter et al., 2009). Indeed, alternative metrics of attachment point to subtle differences in children with ASD. For instance, Hoppes and Harris (1990) assessed the mother's perception of the attachment relationship in 4- to 5-year-old children and found that mothers of children with ASD perceived their children's attachments to be less intense than the mothers of children with Down's syndrome; such findings were also supported by a more recent study (Seskin et al., 2010).

Another factor to consider when judging the quality of attachment is cognitive development, which is often delayed in children with ASD. Some studies have suggested that higher cognitive abilities are associated with a greater preference for mother during reunion (Rogers et al., 1993; Rutgers et al., 2004; Sigman and Ungerer, 1984). Conversely, lower cognitive age equivalents are associated with less appropriate attachment quality in both ASD and typically developing samples (Greig and Howe, 2001; Naber et al., 2007), even after accounting for chronological age (Rutgers et al., 2004, 2007). Thus, overall cognitive development may be at least partly responsible for observed differences in attachment-related behaviors between children with ASD and typical development (Koren-Karie et al., 2009).

The attachment bond is a transactional relationship influenced by characteristics of both the parent (Rutgers et al., 2004) and the child. In addition, many researchers have proposed that mothers and fathers have differing parenting styles and thus potentially differing relationships with their children (see Page and Bretherton, 2001). In typical development, boys tend to choose their fathers as a playmate over their mothers (Paquette, 2004) and fathers have been shown to influence the development of future social relationships (McElwain and Volling, 2004; Volling et al., 2002). Despite the possibly differing relationships a child has with his or her mother versus father, most studies of attachment have focused on the infant's attachment with his or her mother, due to the mother's role as the primary caregiver for most children. The few studies that exist with both mothers and fathers examining attachment in typical development suggest high concordance in attachment quality between the mother and the father (see Fox et al., 1991; see Monteiro et al., 2008), while other investigations have reported differing attachment patterns (i.e. Lamb, 1977; Steele et al., 1996). Even less is known about the attachment between children with ASD and their fathers. Therefore, this gap in the literature suggests that it is necessary for researchers to study the relationship children have with their fathers, particularly for children with ASD. This is particularly critical when one considers the preponderance of males with ASD (Centers for Disease Control and Prevention, 2007) and that mothers are described, on average, as much more involved in the care of children with ASD than fathers (Baker and Drapela, 2010).

The present investigation is an exploration of attachment behaviors in young children with and without ASD, with both mothers and fathers, taking into account cognitive abilities. Analyses explore qualitative behaviors elicited during both separation and reunion of a modified SSP.

Hypotheses for the present project were generated based on consideration of previous findings and the methods used to obtain these findings. Speculating that our focus on specific behaviors would be more likely to yield group differences (e.g. Dissanayake and Crossley, 1997), we predicted that diagnosis would predict the behaviors of children during a modified SSP, such that children with ASD would display fewer pro-social behaviors than comparison groups during reunion. The second hypothesis was that cognitive age equivalents would be associated with child's response to the modified strange situation for all diagnostic groups. Finally, the unique inclusion of fathers in this study allows for the examination of the role parental gender may have on attachment behaviors in children with ASD. Based on literature suggesting that mothers play a larger role in the lives of children with ASD, we hypothesized that children with ASD would show stronger pro-social attachment behaviors with their mothers than with their fathers.

Method

Participants

ASD and nonspectrum participants. Data from a modified SSP were collected as part of an ongoing longitudinal study examining the development of children suspected of having ASDs at very young ages. Eligible participants were referred before 37 months of age from agencies serving young children with developmental delays throughout North Carolina and metropolitan Chicago. A modified SSP was collected as part of a diagnostic evaluation at Time 1, approximate age of 2 years, and Time 2, approximate age of 3 years. Due to the potential instability of specific diagnoses at these early ages, final diagnostic classification was obtained from a follow-up visit at the age of 9 years. For 34 ASD cases and 36 nonspectrum (NS) cases, an earlier diagnostic classification was used because of incomplete data collection at the age of 9 years. Clinicians used all available information—most recent cognitive testing, autism diagnostic interview–revised (ADI-R; Lord et al., 1994), Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2000), and informal observations—to make a diagnosis at each time point. Other data analyzed in this study, such as the modified SSP, ADOS scores, and measures of cognitive functioning, were obtained at Time 1 and Time 2 (Figure 1).

Children with ASD. The current investigation includes 166 (142 males, 24 females) children with an ASD. Children were diagnosed with autism (n = 115) or pervasive developmental disorder, not otherwise specified (n = 51). Children were initially seen at Time 1 (mean = 29.7 months, SD = 5.01 months), and 134 children in the ASD group were reevaluated at Time 2 (mean = 42.56 months, SD = 5.3 months). Overall, 300 observations were gathered for children with ASD across Time 1 and Time 2.

NS children. Forty-five children (27 males, 18 females) were diagnosed with a disorder not on the autism spectrum (NS). Diagnoses of NS disorders were based on ADOS and ADI-R administrations, cognitive testing, observations of the parent and child, Vineland-I (Sparrow et al., 1984) several parent and teacher questionnaires (such as measures of general child psychopathology, internalizing symptoms, and externalizing behaviors), and clinical judgment. Of the children in the NS group, none of whom had an ASD, approximately 38% (n = 17) were diagnosed with intellectual disabilities, 33% (n = 15) were diagnosed with a language disorder, and 7% (n = 3) had attention deficit hyperactivity disorder or oppositional defiant disorder. The remaining 22% had Down's syndrome, another genetic disorder or a physical disability, mood or anxiety disorder, or a behavioral disorder. Consistent with the ASD group, 45 NS children were initially seen at Time 1 (mean = 27.62, SD = 6.0), and 18 children in the NS group were reevaluated at Time 2 (mean = 41.22, SD = 5.6). Overall, 63 observations were gathered for children in the NS group for Time 1 and Time 2.

Typically developing children. An additional 56 typically developing children (35 males, 21 females) were recruited in North Carolina and were each seen only once. These children were recruited through flyers distributed in the community and word of mouth. The typically developing children had a mean chronological age of 19 months (SD = 5 months). These children were recruited to be younger than ASD and NS children in order to match the comparison groups in terms of cognitive and language functioning; Table 1 shows that differences in IQ and full-scale mental age (FSMA) were observed despite this attempt to decrease differences.

ASD, NS, and typical children. Children were from both rural (i.e. half the North Carolina observations) and urban areas (i.e. most of the Chicago observations). There were no differences between verbal and nonverbal cognitive age equivalents or in ADOS total scores by site. Of the children, 170 (65%) were Caucasian, 85 (33%) were African-American, 2 (0.01%) were Asian/Pacific Islander, 2 (0.01%) were biracial, and 1 (0.004%) was American Indian (7 families did not provide race/ethnicity information). About one-third (33.8%) of the children had mothers with a high school education or less. The remaining mothers had educations ranging from some college (23%) to professional/graduate degrees (18%). Ethnicity and maternal education did not differ between the diagnostic groups. Exclusionary criteria included moderate to severe sensory impairments or cerebral palsy and poorly controlled seizures (children on antiseizure medication and who were seizure-free for 6 months were included). All the families provided informed consent to participate in the study, using institutional review board (IRB)–approved consents from the appropriate participating institution.

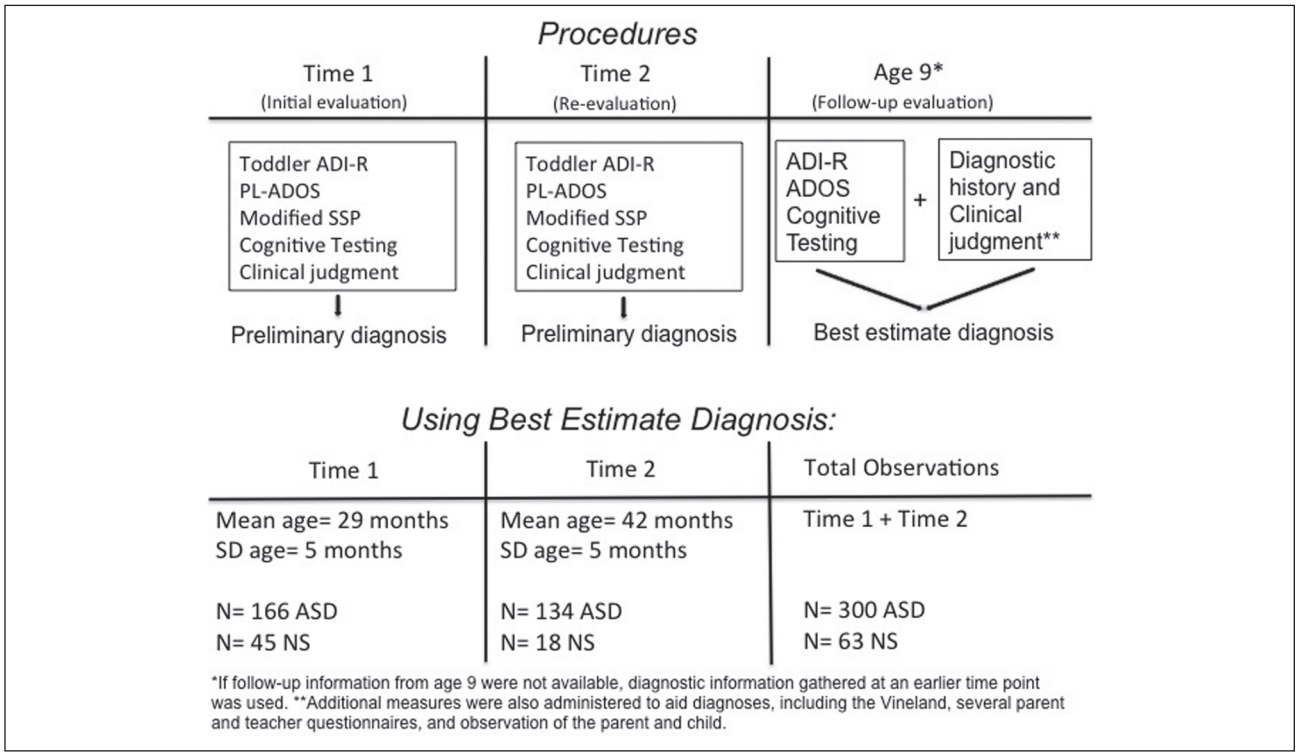

Figure 1. Description of the procedures and timeline for the study. Longitudinal diagnostic information was used to define the diagnostic groups with the idea that the most recent diagnosis is the most accurate.
ASD: autism spectrum disorder; NS: nonspectrum; ADI-R: autism diagnostic interview–revised; PL-ADOS: Prelinguistic Autism Diagnostic Observation Schedule; SSP: strange situation paradigm; SD: standard deviation.

Table 1. Time 1 chronological ages, intelligence quotients, age equivalents, and verbal and nonverbal mental ages.

	Typical Mean (SD)	Nonspectrum Mean (SD)	ASD Mean (SD)
N (Male/female)	56 (35/21)	45 (27/18)	166 (142/24)
Number of observations	56	63	300
Chronological age***	19.38 (5.70)	31.51 (8.50)	35.43 (8.25)
Full-scale IQ***	112.88 (16.23)	71.60 (22.68)	53.24 (19.97)
Full-scale age equivalents***	21.27 (6.25)	22.65 (10.06)	18.17 (9.00)
Verbal MA***		20.59 (10.39)	13.24 (9.80)
Nonverbal MA		24.27 (10.49)	22.65 (9.20)

ASD: autism spectrum disorder; SD: standard deviation; MA: mental age; IQ: intelligence quotient.
Typical children received the *Bayley Scales of Infant Development* (2nd ed.; *BSID-II*; Bayley, 1969), which does not yield separate verbal and nonverbal scores. The Mullen yields separate verbal and nonverbal scores, which are reported here for the ASD and nonspectrum observations. For children with repeated observations (both Time 1 and Time 2), chronological age, cognitive age (full-scale age equivalents) are included for each observation.
***Groups significantly different, $p < 0.001$.

Measures

Diagnostic instruments

The ADI-R. The ADI-R is a standardized parent interview (Lord et al., 1994) that provides a thorough assessment for ASD in approximately 3 hours. The ADI-R contains 93 items and focuses on the three core diagnostic domains for an ASD diagnosis: communication impairment, social reciprocity impairment, and restricted, repetitive behaviors/interests (RRBs). Both the standard ADI-R (Lord et al., 1994) and a toddler version of the ADI-R (Lord et al., 2004) were used in the present investigation.

The Prelinguistic Autism Diagnostic Observation Schedule. The Prelinguistic Autism Diagnostic Observation Schedule (PL-ADOS) (DiLavore et al., 1995) and ADOS (Lord et al., 2000) are standardized observations of the child in a semi-structured environment. A trained clinician administers play activities that vary based on the language level and age of the child. The PL-ADOS or ADOS can be completed in less

than 1 hour. Every member of the research/clinical team established inter-rater reliability exceeding 80% exact agreement on all codes for the PL-ADOS and ADOS for three consecutive administrations prior to the beginning of the study (DiLavore et al., 1995). Ongoing reliability was maintained through consensus coding approximately every administration with a second rater who was blind to the referral status of the child. Using the revised diagnostic algorithms (Gotham et al., 2007), summary scores were computed in two domains: social affect (SA) and RRBs.

Psychometric instruments. Several psychometric instruments were used to obtain IQs, FSMA (cognitive age equivalents), verbal mental age (VMA), and nonverbal mental age (NVMA). Various instruments were used depending on the abilities of each child. The instruments are described below.

The Mullen Scales of Early Learning (Mullen). The Mullen (Mullen, 1985) is a normed measure of verbal and nonverbal cognitive skills for children under the age of 68 months. Domain scores are calculated in the areas of gross motor, fine motor, nonverbal cognition, receptive language, and expressive language. The Early Learning Composite score is calculated using the scores gathered from each domain score. Of the ASD and NS observations gathered at Time 1 and Time 2, all received the Mullen Scales except for 6 observations of children who did not reach ceilings (the discontinue rule was not met as the child did not receive three incorrect answers before the completion of the section) and thus received either the Differential Ability Scales (DAS; Elliott, 1990) or the Merrill-Palmer Scale of Mental Tests (Stutsman, 1948).

The Bayley Scales of Infant Development. The *Bayley Scales of Infant Development* (2nd ed.; *BSID-II*) (Bayley, 1969) were used to assess the developmental functioning of the typically developing children. Unlike the Mullen, the *BSID* does not yield separate verbal and nonverbal scores (see Table 1).

Modified SSP. A modified SSP was incorporated into the PL-ADOS to create an environment in which attachment behaviors of the child could be observed in a semi-structured setting. The modified SSP was explained to the parents prior to the commencement of the PL-ADOS and took place about two-thirds of the way through the PL-ADOS, after about 20 min of semi-structured play.

Details of separation. After a minute of unstructured play, the "target" parent was instructed to leave the room, making sure to exit in front of the child but without speaking to him/her. The parent was asked to say, "I'll be right back," to the child only if the child spoke or tried to prevent the parent from leaving the testing room. During and after the parent left the room, if the child was involved in play, the examiner did not initiate interaction. If the child became upset, the examiner attempted to redirect the child to a toy and/or soothe the child with reassuring statements; the examiner did not pick up or touch the child. If the child was upset for 30 seconds, the parent was asked to return to the testing room. Otherwise, the parent remained outside the testing room for 2 minutes, then knocked on the door and loudly called the child's name.

Details of reunion. The parent then entered the room and, at our request, stood by the door. The examiner noted if the child oriented toward the door or went to the door to greet the parent and coded the child's affect. If the child did not approach the parent within 30 seconds, the parent was asked to approach the child. If the child approached him/her, the parent could pick up the child.

If both parents were present, the modified SSP for each parent was treated as distinct from the other parent. If both parents attended the assessment, first, the nontarget parent left the room. Then, various play and PL-ADOS activities were undertaken while the clinician and target parent were in the room with the child. After about 10 minutes, the target parent left the room (Separation 1). The separation lasted 2 minutes (as described above) and then the target parent returned to the room (Reunion 1). At least 20 minutes passed before the same procedure was repeated with the other parent (Separation 2 and Reunion 2). The order of the parents' departures was counterbalanced for mothers and fathers and there were no order effects.

SSP observations for ASD, NS, and typical. For observations of children with diagnoses of ASD, 198 observations were gathered with mothers only, 84 with fathers only, and 18 with both mothers and fathers. For the NS children, 43 observations were gathered with mothers only, 7 with fathers only, and 13 with both mothers and fathers. For the typically developing children, 49 observations were gathered with mothers only and 7 with both mothers and fathers. Children were more likely to be brought by only their mother than with both their mother and father, despite encouragement from study staff that children come with both parents. Children with ASD who were brought by both mother and father were younger than children who were brought by mother only. No differences were found with respect to VMA (NS and ASD only), NVMA, FSMA, and child's gender with respect to whether the child was brought by mother only or by both mother and father.

Attachment behaviors were coded during and immediately after the modified SSP for each parent. The coding system is consistent with PL-ADOS categorical coding of 0 (least abnormal) through 3 (most abnormal), and a code of 7 was given when the separation had to be discontinued. Reliability was established at 80% exact agreement using pilot participants and then monitored throughout data collection by double coding approximately every sixth evaluation. Inter-rater reliability was obtained consistent with the other PL-ADOS activities (see DiLavore et al., 1995). This modified SSP coding is different from traditional SSP coding in several ways. First, traditional SSP scoring is based

Table 2. Summary of coding scale in modified strange situation paradigm for both separation and reunion.

Code	Separation	Reunion
0 or 1 (some pro-social response)	Child orients toward parent; change in behavior/affect (within 1 min); looks around for the parent.	Orients toward parent's voice outside; change in facial expression and pro-social behavior (i.e. smiling and vocalizing, requesting to be touched, holding arms out).
2 or 3 (little or no pro-social response)	Child may or may not orient toward the parent but does not move toward the door. Child continues with activity without noticeable change in behavior. Child may not notice that the parent left the room.	Child responds to the parent's return, but the response is dampened (facial expression does not change, child does not look up or reach). Or child moves toward parent with negative affect; child moved toward door to try to leave, not greet parent. Or child does not notice parent or respond to parent's attempts to get attention.
7	(not applicable; reunion code only)	Child was too upset to allow the separation to occur (accompanying 0 code in separation).

on the entire separation and reunion procedure; in our modification, both separation and reunion episodes were coded discreetly based on specific behaviors displayed by the child during each episode. Traditional SSP coding derives scores based on video observation of the session; coding of our modified SSP is done in "real-time." Traditional SSP codes are based on "best" instances of behavior and a more global view or "impression" of the interactive behavior; coding on our scale focuses on specific behaviors that the child presents rather than "best" behaviors or an "overall impression." See Table 2 for information on the coding scale for both separation and reunion.

Statistical analyses

Because the codes represent ordinal rather than continuous variables and we had relatively small sample sizes for fathers and for the non-ASD groups, we combined the codes of 0–1 (pro-social response) and the codes of 2–3 (no pro-social response) for separation and reunion, separately, to conduct the analyses. A code of 7 during reunion indicates that the child was too upset to continue the separation and the SSP was stopped with a separation of less than 2 min; these codes were analyzed separately. Only data from fathers of NS and ASD observations were included in analyses because of the small sample of observations of typically developing observations with fathers ($n = 7$). Logistic regressions were fit to the data, using Generalized Estimating Equations, to control for repeated measures (152 children were assessed at Time 1 *and* again at Time 2).

Time (1 and 2) was included as a factor in the statistical models. Models 1, 2, and 3 were fitted sequentially to assess main effects, two-way interactions, and three-way interactions, respectively. The reference group for the time predictor was the second assessment; for the diagnosis, the reference group was ASD, and for parental gender, the reference group was fathers.

Results

Separation

Chi-squared tests fit to the data indicated that child response to separation was not affected by ethnicity or gender of the child.

Models 1, 2, and 3. A logistic regression model was fit to the separation data using Generalized Estimating Equations to model the correlation of the repeated measurements (up to four, Time 1, Time 2 and one for each parent) on each child. Model 1 examined the main effects of FSMA, diagnosis, and parental gender on child's response to separation. Model 2 examined the main effects included in Model 1 and included two-way interactions of FSMA by diagnosis, FSMA by parental gender, and diagnosis by parental gender. Model 3 examined the main effects included in Model 1, the two-way interactions included in Model 2, and the three-way interactions of FSMA by parental gender by diagnosis.

No main effects or interactions in models 1, 2, or 3 were statistically significant for separation. For separation from mother, in 36 NS (64%), 40 typically developing (71%), and 179 ASD observations (64%), children displayed pro-social responses to mothers leaving the room. For separation from father, 13 NS observations (65%) and 55 ASD observations (56%) included pro-social reactions to the father's departure from the room. No statistically significant effects were found for parental gender during separation.

Reunion. Chi-squared tests fit to the data indicated that child's response to reunion was not affected by ethnicity or gender of the child. Similar to analyses of the separation data, Model 1 examined the main effects of FSMA, diagnosis, and parental gender on child's response to reunion. Model 2 examined the main effects included in Model 1 and included two-way interactions of FSMA by diagnosis, FSMA by parental gender, and diagnosis by parental gender. Model 3 examined the main effects included in

Table 3. Estimated relationships of specific groups with probability of reunion.

	Model 1
Effects	*B* (SE), exp(*B*)
Intercept	−1.53 (0.40)***, 0.22
Appointment	
Appointment 1	<−0.01 (0.23), 1.00
Appointment 2	—
FSMA	0.08 (0.01)***, 1.08
DX	
Typ	1.60 (0.52)**, 4.97
NS	0.50 (0.29), 1.65
ASD	—
Parent	
Mom	0.71 (0.21)**, 2.03
Dad	—

ASD: autism spectrum disorder; DX: diagnosis; FSMA: full-scale mental age; NS: nonspectrum; Typ: typical; "-" indicates reference group; SE: standard error.
**$p < 0.01$, ***$p < 0.001$.

Model 1, the two-way interactions included in Model 2, and the three-way interactions of FSMA by parental gender by diagnosis.

Model 1. Similar to the analyses of separation, a logistic regression model was fit to the reunion data using Generalized Estimating Equations to model the correlation of the repeated measurements (up to four) on the same child. Model 1 examined the main effects of diagnosis, FSMA, and parental gender. In contrast to the analyses of the separation data, significant main effects were found for diagnosis, FSMA, and parental gender for attachment behaviors displayed during reunion.

Specifically, 91% of the typically developing, 75% of the NS, and 58% of the ASD observations displayed a pro-social response during reunion; there were fewer pro-social responses from children with ASD to their parents than the other two groups (NS and typically developing children), ($\chi^2 = 35.43$, $p < 0.001$). The odds of a pro-social response to reunion were nearly 5 times greater for a typically developing child relative to a child with ASD; $\beta = 1.60$, odds ratio (OR) = 4.97, and $p < 0.01$.

Additionally, children's responses during reunion with mothers differed significantly from children's responses to their fathers over both the NS and ASD groups. Specifically, the odds of a pro-social response were 2.03 times greater for a reunion with mother than for a reunion with father; $\beta = 0.71$, OR = 2.03, and $p < .001$. For ASD observations, 48% of them displayed a pro-social response to reunion with the father and 62% with the mother. For NS observations, 55% had a pro-social response to reunion with the father and 82% with the mother (see Table 3). Thus, main effects of analyses suggest that children with ASD show fewer pro-social responses during reunion than typically developing comparisons and that children, both NS and ASD, show fewer pro-social responses to their father than their mother.

FSMA and diagnosis. For illustration purposes, Figure 2 depicts the proportion of observations with a pro-social response within each diagnostic group as FSMA increased. As Figure 2 shows, as FSMA increased, diagnostic differences decreased. When the cognitive age equivalent was below 18 months of age, fewer observations in the ASD group had pro-social responses than the observations in the other groups. By 24 months of cognitive age equivalent, the proportion of pro-social responses was nearly at the ceiling for observations of the ASD group, similar to the typical and NS observations. Typically developing and NS observations with reunion responses to father were not included in this graph due to the small sample sizes ($n = 7$ and $n = 20$, respectively).

Models 2 and 3. In Models 2 and 3, the main effects of Model 1 remained statistically significant. Model 3 yielded one significant two-way interaction: the effect of FSMA in typically developing children, $\beta = -0.28$, standard error (SE) = 0.12, OR = 0.76, and $p < 0.05$, but this was not the case for the NS and ASD groups.

Exploratory analyses

ASD severity. Using the revised ADOS algorithms (Gotham et al., 2007) for the ASD observations, Spearman correlations were found to be statistically significant between ADOS total score and child's response to reunion with mother, $r = 0.40$, $p < 0.001$, and with father, $r = 0.51$, $p < 0.001$. More specifically, higher ADOS total scores (indicating greater autistic severity) were associated with fewer pro-social responses.

Examination of modified SSP codes 3 and 7. As described in the method above, a reunion code of 7 was given when a child was too upset to allow the separation to continue; thus, the separation was ended prematurely and a reunion score of 0–3 could not be accurately determined. Although the numbers were small, six children, all with ASD, received a code of 7 with mothers (1%, $n = 4$) or fathers (2%, $n = 2$).

A code of 3 was given during reunion when a child did not notice the parent leave or did not respond at all to the parent's attempts to get the child's attention upon return. There was a statistically significant effect of diagnosis on the number of children who received codes of 3 for reunion with mothers ($\chi^2(8, N = 394) = 38.12$, $p < 0.001$), such that the ASD children had the largest proportion of codes of 3 (7%, $n = 19$), compared to none (out of 56) of the typically developing children and only 2 (out of 63) NS observations. A similar pattern was found with fathers, such that the ASD group again had the largest proportion of codes of 3 (17%, $n = 17$), compared to only 1 out of 20

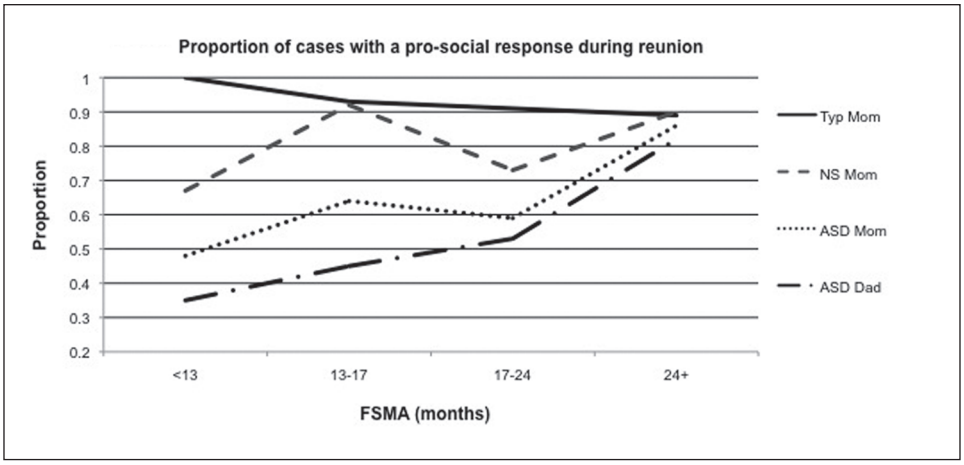

Figure 2. The proportion of observations with pro-social responses to reunion with mother and father (for the ASD observations only) as FSMA increases is depicted in this graph. Graph includes 56 typically developing observations (56 participants) with reunion from mother, 278 ASD observations (157 participants) with reunion from mother, 98 ASD observations (65 participants) with reunion from father, and 56 NS observations (42 participants) with reunion from mother. NS children with their father were not included in the graph due to small cell sizes in each age group. The three-way interaction of FSMA × gender × DX was not statistically significant.
ASD: autism spectrum disorder; NS: nonspectrum; DX: diagnosis; FSMA: full-scale mental age.

NS children and none of the typical children, though these differences were not statistically significant ($\chi^2(8, N = 128) = 9.01$), $p = 0.34$). Altogether, these findings suggest that a small, but consistent, proportion of children with ASD displayed unique attachment patterns, including either over-reactivity to separation and under-reactivity to reunion.

Discussion

Overall, children from all diagnostic groups were more similar than different in their separation and reunion behaviors. In a simple model of attachment based on the modified SSP, most children with ASD responded when their parents left them for a few minutes with a stranger (separation), as did typically developing children. However, compared to children of similar mental ages with typical development or NS disorders, 2- and 3-year-old children with ASD displayed different reunion behaviors with parents. Specifically, children with ASD were less likely to go to their parents or to show pleasure and be soothed upon their parents' return. In addition, though they represented a small proportion of the observations (42 out of over 300), more children with ASD showed very clearly unusual responses to separation or reunion than children from other diagnostic groups. This suggests that the phenomenon of a child with ASD who does not react to separation or reunion with his/her mother or father does exist, but it is not representative of the majority. Therefore, although this lack of responsiveness may be an indicator for an ASD, the absence of this indicator does not necessarily indicate the absence of an ASD.

The most unique aspect of the study was the inclusion of fathers in the observations of children with ASD and NS disorders. Fewer children both with ASD and with NS disorders showed pro-social responses to reunion with their fathers than with their mothers. Only a subset of fathers came to the assessments, although all fathers were strongly encouraged to come. Consequently, one would expect the difference between mothers and fathers to be attenuated by selection (e.g. fathers who were more involved in their children's care may have been more likely to come to assessments); the finding emerged even though we might have expected self-selection to create a bias against it. It is unfortunate that we did not have enough fathers of typically developing children in order to make comparisons with the other groups.

Another important finding was the strong relationship between developmental level and reunion behaviors in the children with ASD and NS disorders. For every month in mental age gained, the odds of a clear pro-social response to reunion with a parent went up about 8%. Thus, differences of 3 or 9 months of mental age are substantial in accounting for variability in pro-social behaviors among young children with ASD and with developmental disorders. Ceiling effects meant that group differences were more apparent in children with younger developmental levels. The ceiling effects found with typically developing children precluded findings of differences in attachment behaviors associated with development.

Nevertheless, the fact that many children with ASD, like the children with NS disorders, often showed typical reunion patterns is encouraging. It underscores the need to take into account general levels of developmental functioning

when assessing children with ASD and interpreting social-communicative behaviors. It should also be encouraging to families with young children with ASD that by a mental age of 24 months, children with ASD did not differ from the other groups in pro-social behaviors at reunion and differences at separation were never significant.

One caveat is that modifications of the classic SSP in this study, such as having it occur during a play-based assessment and using behavioral rather than standard qualitative codes, may have limited the comparability of our observations. Separation and reunion have been important means to study attachment-related behaviors. However, ongoing differences in the quality and quantity of pro-social and communicative behaviors in many children with ASD with their parents during ordinary activities may be just as important in the parents' perception of their children's attachments as are responses to departures and arrivals (Hoppes and Harris, 1990). In fact, response to reunion with both mothers and fathers in the children with ASD was strongly correlated with total ADOS scores, suggesting that these attachment behaviors may be related to children's autism-specific difficulties in social-communication and repetitive behaviors, rather than a separate transactional phenomenon.

Limitations

The results of the present investigation should be considered in light of several limitations. The small number of fathers, especially of children with typical development, limits the ability to determine if the parental gender effect in ASD was more general. As mentioned above, although both parents were always requested to come, the sample of fathers of children may not have been representative of all fathers given their "self-selection" bias; nevertheless, if this bias were present, we would most likely expected results in the direction of decreasing differences between mothers and fathers, the opposite of what was observed. In addition, the context of the evaluation visit could have affected the results of the modified SSP. Specifically, although receiving the same protocol as the children with ASD, the typically developing children came to participate in a research project as community volunteers, whereas parents of children with ASD were participating in research, but were also obtaining diagnostic information and therapeutic recommendations for their children. The effect that the context of the evaluation, which differed for those children coming as community volunteers from those coming for a diagnostic evaluation, had on the results is unknown.

The modified SSP in this study was part of a larger diagnostic evaluation session (PL-ADOS) and used a categorical coding system consistent with other PL-ADOS activities. Given the modifications to the traditional SSP and its administration within the context of the PL-ADOS, use of the traditional coding system for "secure" versus "insecure" attachment patterns does not seem valid. However, the comparison between our coding system and the traditional coding system would have been aided had the data also been coded using the traditional system. The use of ordinal SSP codes was consistent with the other PL-ADOS tasks; however, the use of continuous SSP codes may have been more informative for this study.

In addition, the results of the present investigation did not consider the effects of current treatment or interventions on a child's response. At the age of 2 years, few of the children with ASD had had any treatment, but by the age of 3 years, children were beginning to receive some intervention. We also did not measure behaviors or characteristics of parents. Several recent studies have suggested that subtle social-communicative deficits in some parents of children with ASD, particularly fathers, may affect the transactional attachment relationship (Piven et al., 1997; Scheeren and Stauder, 2008). Also, in this study, we utilized a chronologically younger typically developing sample that was only seen on one occasion. Although this sample was chosen in order to be cognitively similar to the developmentally delayed ASD and NS sample, we must consider that the results may be affected by the chronological age differences.

For some children in the ASD and NS groups, diagnoses at the age of 9 years were unavailable. For these cases, best estimate diagnoses were used from either age of 5 years, 3 years, or 2 years (choosing the oldest age diagnosis as the most accurate). For this subset of children whose diagnoses were chosen from younger ages, it is possible that the diagnoses are less stable and less accurate than the diagnoses at the age of 9 years. Nevertheless, this accounted for a small proportion of the ASD sample, and an article published using a sample that overlaps this one indicated that diagnoses of ASD tend to be stable over time (Lord et al., 2006). Due to constraints in the study, many of the NS children were not evaluated at the approximate age of 3 years (Time 2); therefore, repeat assessments are only available for a subset of NS children.

Implications

Maternal synchrony has been an area of much interest in autism research in the last few years (Feldman, 2007; Kochanska et al., 2008; Raikes and Thompson, 2008; Siller and Sigman, 2002). Although we did not measure maternal or paternal behaviors in this study, the limited ways in which the chronologically and developmentally youngest children with ASD responded to reunion with their parents suggests the challenge that some families face in trying to synchronize their behaviors with that of a young, socially undirected child. Interventions for very young children that stress synchrony may need to find ways to help parents build interactions when they are not occurring spontaneously or

when the priorities of the child are not to interact but to do something else (e.g. some children with ASD responded to the reunion by trying to leave out the same door from which their parents arrived, rather than by acknowledging their parent's arrival). Research should focus on finding ways to improve parent–child interactions. Showing parents how to promote positive interactions could have drastic effects on parent-based interventions and the overall well-being of the family.

The relationship the father has with his child with ASD is an area that requires additional attention. Results of this study suggest that the child with autism has a different relationship with his or her mother than with his or her father. Yet we know little about how children with autism interact with their fathers and how fathers interact with their children with autism. This study is a first step in encouraging research in this area. Research should also examine how fathers interpret their relationship with their child with autism or how characteristics of the father may influence the development of a sound father–child relationship. Examinations of the relationship between the child with autism and his or her father and how this relationship may differ from the relationship between a typically developing child and his or her father may have implications in treatment, overall family well-being, and the mother–father relationship. In children with typical development, studies have found that boys tend to choose their father as a playmate over their mothers (Paquette, 2004) and fathers play differently and more physically with their children than do mothers. The observation that fathers in this study, despite being a self-selected group, consistently received fewer pro-social behaviors than mothers from the children with ASD, may be part of a cycle in which fathers become less and less involved with their children as mothers take the role of advocate, communication facilitator, teacher and more involved parent; this is purely speculative as there did not appear to be fewer fathers participating at Time 2 than at Time 1—across both time points, mothers singly were more likely to bring their children than both mothers and fathers together. There are clearly notable exceptions to this as there are many devoted fathers of children with ASD. Nevertheless, it seems important to recognize that the behavior of the children may contribute to widening this gap, which may also affect the perceptions of mothers and fathers about their relationship with their child with ASD; perhaps this discord between parent and child may even exacerbate marital disagreements (Brobst et al., 2009; Higgins et al., 2005; Lee, 2009; Lickenbrock et al., 2010; Myers et al., 2009). More direct ways to address how fathers can interact with their young children with ASD may be useful in preventing some of these difficulties for families. Involving fathers specifically in interventions may help to foster this relationship.

Results of this study have implications for the assessment of attachment and treatment of children with ASD, especially with respect to parent–child interventions. Other than reactions of extreme upset (which were rare, but occurred only in children with ASD), response to separations from parents did not differ for children with ASD, NS developmental delays, or typical development, and thus it is not a diagnostic indicator. Less clear positive responses to reunion with both mothers and fathers were associated with more severe social-communicative deficits in other contexts in children with ASD and differentiated them from other children, particularly at the youngest developmental levels. Both children with ASD and those with NS disorders showed more affect when reunited with their mothers than fathers, calling our attention to the need for clinicians to make a point of considering the particular ramifications of ASD and other developmental delays in father–child relationships.

In conclusion, this study underscores the importance of studying the parent–child relationship in children with autism. In general, it is encouraging that most children with autism responded similar to children with NS disorders or typical development to the separation and reunion with parents. This contrasts the stereotypical view of the child with autism as socially aloof and unaware. This study also suggests that future research examining the relationship of the child with autism with his or her father is important as results of this study suggest a unique relationship pattern with fathers. Our results also underscore the importance of considering cognitive abilities when studying attachment in all children.

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