

Mother–Stranger Comparisons of Social Attention in Jealousy Context and Attachment in HFASD and Typical Preschoolers

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Abstract Affective bonding, social attention, and intersubjective capabilities are all conditions for jealousy, and are deficient in autism. Thus, examining jealousy and attachment may elucidate the socioemotional deficit in autism spectrum disorders (ASD). Jealousy was provoked in 30 high-functioning children with ASD (HFASD) and 30 typical children (ages 3–6 years) through two triadic social (storybook-reading) scenarios – mother-child-rival and stranger-child-rival. A control nonsocial scenario included mother/stranger-book. For both groups, higher jealousy expressions emerged for mother than stranger, and for social than nonsocial scenarios. Attachment security (using Attachment Q-Set) was lower for HFASD than typical groups, but attachment correlated negatively with jealous verbalizations for both groups and with jealous eye gazes for HFASD. Implications for understanding jealousy’s developmental complexity and the socioemotional deficit in ASD are discussed.

Keywords Jealousy · HFASD · Emotional expression · Attachment

Jealousy is the emotion children experience in a triadic situation, when they lose exclusivity in significant relationships to

a “rival-third party” (e.g., Volling et al. 2002). Thus, the experience of jealousy reflects children’s perceived loss of love and of exclusive attention (e.g., Miller et al. 2000). Affective bonding with a significant other, attention to the social situation, and sociocognitive awareness of the goal underlying parties’ actions (understanding the beloved’s preferences for the rival) all seem to be important precursors for jealousy experiences (e.g., Volling et al. 2002). Jealousy’s affective and sociocognitive demands touch upon several basic deficiencies of children with autism spectrum disorder (ASD). This neurobiological disorder significantly impairs reciprocal social relations and verbal and nonverbal communication, and is characterized by stereotypical behaviors (*Diagnostic and Statistical Manual of Mental Disorders – DSM-IV-TR*; American Psychiatric Association 2000).

In contrast with prior estimates indicating that the majority of individuals with ASD (~75 %) show comorbid intellectual disabilities (i.e., IQ<70), recent estimates have reported a much lower comorbidity of ~41 %, ranging between 30 and 51 % (e.g., Centers for Disease Control 2009). The substantial remaining subgroup of individuals along the autism spectrum is defined as high-functioning (HF) based on IQ scores above retardation level (IQ>70), and it includes those children who meet the full criteria for autistic disorder according to the *DSM-IV-TR* (2000) but also have IQs above retardation level (often termed as high-functioning autism – HFA), as well as those with Asperger syndrome (AS) and pervasive developmental disorder not otherwise specified (PDD-NOS) per the *DSM-IV-TR*. This subgroup is of utmost research interest because these individuals demonstrate higher social-emotional functioning than their less cognitively able peers with ASD (e.g., Mazurek and Kanne 2010) but lower social-emotional functioning than their typically developing (TYP) age-mates (e.g., Kasari et al. 2011), which places them at greater risk for developing affective disorders such as anxiety and

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depression (e.g., White et al. 2009). Thus, early identification of individual differences in the ability to form such relationships is important in order to implement appropriate interventions preventing later development of affective disorders. Taken together, the study of jealousy's three presumed precursors (affective bonding, social attention, and sociocognitive awareness) in HF children with ASD has imperative theoretical as well as therapeutic implications regarding socioemotional functioning; hence, they were the participants of choice for the current empirical study on jealousy and attachment, in comparison to TYP children.

The first criterion for jealousy relevant to ASD deficits is the requirement that the child develop affective bonding with a significant other. Whereas social contact is considered a necessity for all human beings from very early developmental stages, this affective contact in children with autism poses a major theoretical puzzle. Kanner (1943) defined autism as "a disturbance of affective contact... an innate inability to form the usual, biologically provided affective contact with people" (p. 250). Despite wide consensus regarding the centrality of this affective bonding disturbance in children with ASD, the nature and breadth of this deficit in emotional closeness has yet to be discovered. One way to clarify the extent to which these children can achieve affective bonding is by observing their attachment-relationship patterns with their caregivers; another way is to observe children's reactions when faced with the possible loss of a relationship with a significant other to a potential peer rival. The current study encompasses both of these observations of affective contact, by exploring children's security of attachment in the context of the natural home (mother-child interaction) on the one hand and by exploring children's responses to a laboratory-induced jealousy situation where they lose the mother's exclusive attention to a peer-rival on the other hand.

Thus far, attachment studies on children with ASD have demonstrated that despite exhibiting a lower frequency of all behavioral attachment markers (e.g., looking at, smiling, vocalizing, proximity seeking, sharing) compared to their TYP peers, about half of these children with ASD (compared with two thirds in the normative population) were classified as "securely attached" to the mother, most likely those with higher IQ and less severe disability (e.g., see review in Rutgers et al. 2004). Nonetheless, the nature of secure attachment as affective bonding has yet to be explored in ASD. Cassidy (2008) highlighted two components in the quality of attachment as affective bonding: exclusiveness – discriminating the attachment figure as unique and irreplaceable, and closeness – emotionally connecting to the attachment figure. Exclusiveness has already been observed in ASD, where children revealed more frequent proximity seeking behaviors toward the mother than toward a stranger after their absence (Strange Situation Procedure; Ainsworth

et al. 1978). Yet, this finding does not necessarily indicate emotional closeness to the mother. Indeed, it was suggested that attachment security develops in ASD through different means (cognitive, instrumental) compared with TYP individuals, thereby serving an instrumental function but not an affective one (e.g., Waterhouse and Fein 1998). The current study aimed to tease apart the mother's affective meaning for the HF child with ASD, by comparing jealousy expressions toward the mother and toward a stranger as a reaction to a perceived threat to their emotional relationship from a third rival (rather than as a reaction to a concrete threat of danger, as in the Strange Situation after her absence). If the HF child with ASD directs more jealousy behaviors toward the mother than the stranger, it may designate affective closeness.

Examination of the links between jealousy expressions and attachment security in HF children with ASD may provide insight into the nature of these children's internal working models of attachment security and may substantiate the jealousy-attachment link previously found for TYP children. Interestingly, TYP children with secure attachment showed less jealousy protest against the loss of maternal selective attention than did children with insecure attachment (e.g., Teti and Ablard 1989; Hart and Behrens 2008). In Teti and Ablard (1989), insecure infants cried, protested, and aggressed toward mothers more than did secure infants, when their mothers played with only one sibling. In Hart and Behrens (2008), secure infants were more likely to react with moderate jealousy, insecure-avoidant infants showed low jealousy, and insecure-resistant infants showed heightened jealousy reactions. Underlying the presumption about close links between attachment and jealousy is Bowlby's (1969/1982) notion that internalized working models of secure attachment enable more stable, less fearful emotional states when confronting threats, especially the threatened loss of maternal exclusivity.

Attachment in ASD was investigated thus far almost solely through the use of the Strange Situation Procedure. Recently, Rutgers et al. (2007) highlighted the validation of the Attachment Q-Sort (Waters and Deane 1985) for children with ASD. In line with their recommendation, in the current study we collected data on this population's attachment security using the Q-Sort's prolonged naturalistic observations at home, to strengthen the soundness of findings on attachment in ASD yielded by prior Strange Situation research.

Two major capabilities appear to underlie the experience of jealousy: attention to social situations, specifically to interactions between the significant other (mother) and a rival, and intersubjective sharing, specifically the child's sociocognitive awareness of the goal motivating parties' actions, that is, of the beloved's preferences for the rival (Miller et al. 2000). If, indeed, children with ASD remain unaware of an interaction between the mother and peer-rival,

and/or are unaware of mother's preference for the rival, jealousy is unlikely to appear. Specific failure to orient to social situations or to an adult's expressions of negative affect (e.g., distress, fear) was suggested as characteristic of young children with ASD (e.g., Dawson et al. 2004). Likewise, the core defining characteristics of joint attention (JA) – social partners' coordination of attention and sharing of a common point of view – were considered deficient in young children with ASD (e.g., Clifford and Dissanayake 2009).

To tease apart the interpersonal characteristics of the experience of jealousy in children with ASD, in the current study we compared three scenarios. In the first – the personal scenario – the child was exposed to selective affectionate attention given by the mother to the child's peer-rival. In the second – the nonpersonal scenario – the child was exposed to selective affectionate attention given by a stranger to the peer-rival. In the third – the nonsocial scenario – the mother/stranger read a book to herself, which enabled comparison to loss of attention in the two social scenarios (mother/stranger with child's peer-rival). The latter also aimed to help tease apart the contribution of the object (i.e., book) to children's attentive behaviors, due to vast interest in object versus human interaction for children with ASD.

Three studies examined jealousy in ASD and showed jealousy manifestations in these children, albeit probably with different qualities compared to TYP peers. In Bauminger (2004), preadolescents with HFASD displayed clear indications of jealousy, as did TYP age-mates during each of two different jealousy-provoking situations – one in which the child's parent praised another child's picture while ignoring his or her own child's, and another in which the parent engaged in affectionate play exclusively with the other child. Yet, group differences emerged on jealousy manifestations, with TYP children demonstrating more eye gazes toward the parent or rival, whereas children with HFASD displayed more actions (i.e., taking the rival's objects, hugging the caregiver, answering questions addressed to the rival, attempting to correct the rival), which resembled the less mature, more explicit jealousy-provoked behaviors reported for younger TYP children (e.g., Masciuch and Kienapple 1993; Miller et al. 2000). In Bauminger et al. (2008), jealousy was examined in preschoolers with high- and low-functioning ASD using a scenario where the mother affectionately read aloud to and cuddled a child-rival. In this study, only two-thirds of the participants with ASD expressed clear jealousy (those with high IQs) versus 94.5 % of their TYP age-mates. Positive correlations with IQ emerged only for the ASD group. Also, contrary to Bauminger's (2004) findings for older HF children with ASD, younger children with ASD revealed fewer actions to attract

maternal attention than TYP preschoolers. An important complementary source of information about jealousy in ASD derives from Hobson et al.'s (2006) study, where parents reported that half of their children with ASD showed clear signs of jealousy, and only a small number showed no signs of jealousy at all.

Current Study

How do these recent results fit in with the conception that children with ASD have difficulties in developing affective bonding with others, an interest in social-interpersonal interactions, and the secondary intersubjectivity necessary for jealousy? To explore jealousy's affective qualities and their implications for understanding early socioemotional development in TYP and ASD, the current study examined the correlation between jealousy and attachment and compared jealousy expressions with the mother (personal) versus a stranger (nonpersonal). If indeed jealousy reflects the existence of a close personal relationship or distinctive affective bond with the mother in children with ASD, then more expressions of jealousy would emerge in the personal scenario (toward the mother) than in the nonpersonal scenario (toward the stranger), and likewise more expressions of jealousy would emerge in the social than the nonsocial scenario; also, jealousy would associate significantly with attachment security.

The current study aimed to examine: (a) group similarities and differences in jealousy (HFASD/TYP); (b) similarities and differences in jealousy expressions in a personal situation (mother—target-child—peer-rival) versus nonpersonal situation (stranger—target-child—peer-rival) for the two groups; (c) differences in reactions to a social scenario (mother/stranger—peer-rival) versus nonsocial scenario (mother/stranger—book) for the two groups; (d) group differences in security of attachment; (e) links between jealousy in the personal situation (with mother) and attachment security; and (f) links between jealousy, attachment, chronological age (CA), mental age (MA), verbal MA (VMA), and nonverbal MA (NVMA).

This study aimed to add to the literature on jealousy and attachment in ASD and TYP in at least four ways: (1) The mother versus stranger paradigm may uncover more about jealousy's affective nature in HFASD and TYP. (2) Use of the Q-Sort may validate attachment data deriving from Strange Situations in children with HFASD. (3) Links between attachment and jealousy may help crystallize understanding of interpersonal capabilities in HFASD. (4) The more homogeneous group of HF preschoolers with ASD (all high-functioning) compared to Bauminger et al. (2008) and the precise matching to TYP on CA, VMA, and NVMA will

prevent confounding CA or MA variables as explaining any group differences.

Method

Participants

Sixty preschoolers participated: 30 HF preschoolers with ASD (4 female) and 30 with TYP (4 female) from central Israel. Groups were matched on sex, CA, MA, VMA, NVMA, IQ (Mullen Scales of Early Learning—AGS Edition, Mullen 1997), maternal education, and age (see Table 1).

All HF participants with ASD were previously diagnosed by licensed psychologists unassociated with the current study, based on the *DSM-IV-TR* (American Psychiatric Association 2000). Clinical diagnoses were: $n=2$ with PDD-NOS (6.6 %), $n=10$ with autistic disorders (33.3 %), and $n=18$ with Asperger syndrome (60.1 %). All 30 children met criteria for autism on the Autism Diagnostic Interview—Revised (ADI-R; Lord et al. 1994). Based on the perception of autism as a spectrum lacking reliable diagnostic boundaries between subgroups without intellectual disability (e.g., Lord et al. 2012), we combined these three diagnostic subgroups into a single group of high-functioning ASD (HFASD). The Mullen Scales (Mullen 1997) were administered to all participants to assess IQ and MA, except 5 children with ASD who came to the study with prior Wechsler IQ scores from within one year of the study interval using either the WISC-R-95 (Wechsler 1995) or the WIPPSI (Wechsler 1989). Standard scores of all IQ tests had a comparable mean (100) and standard deviation (15).

Table 1 Sample characteristics

	HFASD ($n=30$) <i>M (SD)</i>	TYP ($n=30$) <i>M (SD)</i>	<i>F</i> (1, 57)
Chronological age (months)	57.76 (11.72)	55.07 (10.56)	0.86
Mental age (months) ^a	57.66 (8.31)	57.30 (10.79)	0.02
Verbal MA ^a	57.02 (9.15)	58.55 (10.76)	0.34
Nonverbal MA ^a	58.29 (9.13)	56.07 (11.43)	0.68
Full-scale IQ ^a	103.45 (16.72)	106.80 (14.43)	0.68
Mother education ^b	4.93 (1.03)	5.16 (0.46)	0.83
Mother age (years, months)	36.32 (4.44)	37.57 (5.22)	0.97

^a Based on the Mullen Scales (except $n=5$ based on Wechsler in the HFASD group)

^b Calculated on a 6-point scale: 1=less than 8th grade; 2=some high school; 3=high school with diploma; 4=some college; 5=undergraduate degree; 6=graduate degree

Measures

Assessment of Children's Jealousy Expressions Provoked by Experimental and Control Laboratory Scenarios

Jealousy-Provoking Experimental Social Scenario: Story-book Reading to Rival Based on Masciuch and Kienapple (1993) and Bauminger et al. (2008), the story-reading scenario included a triad comprising the target child (HFASD or TYP), an adult (the mother or a stranger), and another child (the “rival”) who was a familiar preschool classmate. Each social jealousy-provoking scenario was enacted twice, once with the mother and once with a stranger, along two different meetings, in counterbalanced order. The stranger was a research assistant unfamiliar to the target child.

The session began with the child, mother/stranger, and peer seated at different sides of a low rectangular table. The experimenter encouraged the two children to play with the age-appropriate toys on the table and instructed the mother to ignore the children while completing a demographic questionnaire (2 min). Upon the experimenter’s signal, the mother/stranger placed the rival child on her lap and embraced the rival while reading a story aloud to that child (2 min). At the end of the 2 min, or if the target child showed substantial distress before that time, the mother/stranger was signaled to take the target child, hug the target child, and read the story to him/her. At the end of each scenario, the mother/stranger invited the target child to sit on her lap and hear the story. Mothers received detailed verbal and written instructions for performing each scenario, prior to the implementation of the jealousy procedure; children could not overhear instructions.

Control Nonsocial Scenario: Book Interest To control for the possibility that the child’s attention toward the mother/stranger-rival dyad related to mere interest in the book stimulus, we also implemented a nonsocial scenario where the mother/stranger read the story aloud to herself. During this scenario, only the mother/stranger and target child were present in the room. The child was encouraged to play with available toys; the mother/stranger read aloud from the same children’s book as above (30 s), ignoring the child.

Coding of Jealousy Expressions from Experimental Scenarios Children’s videotaped jealousy-provoked behaviors, verbalizations, and affects were assessed using four coding scales: hierarchical explicitness, quantity of jealousy behaviors, affect, and responsiveness. The same two trained coders coded all four scales.

1. *Explicitness: Hierarchical jealousy scale.* This scale (Bauminger 2004; Bauminger et al. 2008) derived from the behaviors, verbalizations, and affects identified as

jealousy indices by previous research (e.g., Masciuch and Kienapple 1993; Miller et al. 2000). This 7-point scale ranked explicitness of actions, verbalizations, and affective expressions of jealousy in hierarchical order, from *no interest at all* (1) up to *direct indication of the children's comparison and lack of equality, accompanied by negative affect* (7) (see Bauminger 2004; Bauminger et al. 2008 for detailed descriptions of this scale). Coders assigned the child the highest score evidenced over the 2-minute scenario. A score of 4 and above indicated explicit actions (e.g., pushing the rival aside and standing between the mother and peer), verbalizations (e.g., making comments like “Mom, read me the story;” “I want too;” “Mom, do it with me”), and affects (e.g., shouting “Enough!”) that reflected jealousy, whereas a score below 4 indicated only eye gaze in different degrees. Two trained coders separately assigned scores to each child, and then inter-coder discrepancies were discussed and clarified until reaching 100 % agreement for both the mother and the stranger scenarios.

2. *Quantity of different jealousy manifestations: Behavioral coding category scale.* This scale assessed the frequency of 8 indices of jealousy comprising three main categories: (1) the child's *gaze direction* (mother/stranger, book, peer, interaction); (2) *verbalizations*, including attention-seeking comments (e.g., “I have a tummy ache”) and interactive comments (e.g., repeating words from the story being read or answering questions aimed at the peer); and (3) *actions* including attention-seeking actions (e.g., caressing mom's hair) and involvement actions (e.g., telling the mom a secret; putting one's head between the book and the peer, to block the peer's view). Scores were calculated for each category and were divided by scenario duration, with higher scores indicating a higher quantity of jealousy manifestations.

All videotapes underwent coding by two coders who separately assigned scores to each child. The interclass correlation coefficients for the mother scenario were 0.99 for all three jealousy categories (gaze, verbalization, action), and for the stranger scenario they were 0.99 for gaze and verbalization categories and 1.00 for the action category. In the few cases of disagreement between the coders, the value used for data processing was the mean of the two coders' scores for that child.

3. *Affect scale.* We developed this 4-point scale (based on Masciuch and Kienapple 1993) to assess a possible change in children's affect before versus during the jealousy-provoking social scenario. Coding, ranging from 1 (*very negative affect*) to 4 (*very positive affect*), was executed twice: Time 1 - when the peer-rival entered the room and each child played alone with his/her toys; Time 2 - when the mother/stranger took the peer onto her lap and read him/her a story. Each of the coders coded the whole

sample; Cohen's κ for agreement between coders was 1.00 at Time 1 and 0.96 at Time 2 for the mother scenario and was 1.00 at both times for the stranger scenario.

4. *Responsiveness scale.* This scale measured target children's responsiveness to mother's/stranger's invitation to come hear the story, immediately after the peer-reading scenario ended. Children agreed (scored 1) or disagreed (scored 0).

Coding of Expressions from the Nonsocial Control Scenario The nonsocial condition (mother/stranger reading book to themselves) was coded using two scales. First, the same hierarchical scale described above for the social scenario was used, to enable comparisons between the social and nonsocial scenario data. Each of the two coders scored the whole sample, obtaining Cohen's κ of 0.95 for the mother scenario and 1.00 for the stranger scenario. Disagreements were resolved through discussion. Second, the book-interest scale was used, a 3-point scale assessing the child's level of interest in the book: *no interest* (1); *little interest* (2); or *high interest* (3). For the book-interest scale, the two coders assigned scores for the whole sample, reaching Cohen's κ of 1.00 for the mother scenario and 0.95 for the stranger scenario.

Assessment of Children's Spontaneous Jealousy Expressions Reported by Mothers This 4-item questionnaire about children's jealousy expressions within the natural home environment, developed for the current study based on Hobson et al. (2006), asked mothers: (1) Has your child ever expressed jealousy? (*yes*=1; *no*=0); (2) If yes, at what frequency? (from *never*=1 to *very often*=5); (3) If yes, toward whom? and (4) If yes, in what situations? Mothers' responses to Item 3 yielded the following jealousy agents: siblings, parents, friends, and other peers. Mothers' responses to Item 4 yielded the following jealousy situations along two types: (a) emotional jealousy—for example, when mother's attention was directed toward sibling(s) through behaviors like complimenting, kissing, hugging, or caressing the sibling; and (b) social-comparative jealousy—when the rival had something the target child wanted like a present or candy. Each target child received a score of 1 for each reported jealousy agent and likewise for each reported jealousy situation.

Assessment of Mother-Child Attachment To assess attachment security, Water's Attachment Behavior Q-Sort (AQS; Waters and Deane 1985) was utilized. This 90-item measure comprehensively depicted the child's use of the primary caregiver as a secure base (i.e., the balance between proximity-seeking and exploration behaviors) during a child-parent interaction at home. Sample items included: “actively solicits comforting from an adult when distressed,” “cries to prevent separation,” and “is willing to

talk to new people, show them toys, or show them what he/she can do, if mother asks him/her to.” The AQS was proven psychometrically sound for measuring attachment behavior in children beyond infancy. Especially, the observer AQS has shown convergent validity with the Strange Situation Procedure and predictive validity with sensitivity measures (see review in van IJzendoorn et al. 2004), and it was also approved for children with ASD (Rutgers et al. 2007).

Two new well-trained observers (not those who coded the jealousy scales) completed the AQS after conducting a 3-hour home visit. Observations occurred in natural family contexts, such that other household residents (e.g., siblings) were typically present.

Observers’ training included four stages. First, prior to home visits, observers became familiar with attachment behavior and classifications according to Ainsworth et al. (1978) and Waters and Deane (1985), and with the AQS items. Second, the two observers conducted home visits together to five pilot mothers of TYP children of similar age to the current participants. Third, after each pilot visit, both observers independently completed the AQS sorting procedure for each case. Fourth, together with the first author, they discussed and clarified points of agreement and disagreement. At the end of this pilot coding stage, the two observers reached inter-observer agreement of 85 % on the AQS.

The two observers then visited 30 % of the current study participants together to observe the same 18 children (randomly selected from HFASD and TYP groups) and then conducted independent sorts after each of those visits. Interrater reliability (Pearson r) was calculated by correlating the observers’ sorts of the same children. Mean correlation between the two observers was 0.70.

To complete the AQS sorting procedure, observers sorted the 90 Q-sort items into 9 piles with 10 items per pile, from least (1) to most (9) like the child. Attachment security scores derived from Q-sorts via the criterion sort method, in which each sort was correlated with a criterion sort of the hypothetically most securely attached child, yielding a score from 1.0 to 8.8 (Waters 2009). Security scores could theoretically range from a negative correlation of -1.00 (for the most insecure child) to a positive correlation of $+1.00$ (for the most secure child).

Procedure

We contacted the parents of the children through their preschool teachers, after receiving permission from the Israeli Ministry of Education. After obtaining written parental consent for participation, we advised the parents and teachers about the nature of the research by telephone, and we arranged five meetings for HFASD and four meetings for TYP. The first meeting for HFASD comprised the ADI-R

(Lord et al. 1994) interview of at least one parent. In the second meeting (first meeting for TYP), the Mullen Scales (Mullen 1997) were administered for all participants but 5 (who had former IQ scores within a year range). The third and fourth meetings (second and third for TYP), in which the jealousy scenarios with mother/stranger were videotaped, were held in the child’s preschool. The final visit was held in the child’s home, assessing attachment security.

Analytic Plan

In accordance with the study aims, three main lines of analysis were conducted. First, jealousy expressions were explored by assessing group (HFASD and TYP) and adult (mother and stranger) effects for all jealousy scales. In addition, for the jealousy hierarchical scale we also examined the condition effect: social (book reading to a rival vs. nonsocial (book reading to oneself)). The second line of analysis explored group differences in security of attachment. Due to children’s increases in verbal complexity over the years of the preschool period, more verbalizations and fewer actions may be expected as expressions of jealousy (e.g., Masciuch and Kienapple 1993); also, age was found to be linked with attachment security for children with ASD in some studies (e.g., Rogers et al. 1993). Thus, age effects on jealousy and attachment were explored using a median of 55 months. The third line of analysis focused on examining the correlations between jealousy and attachment security, as well as the correlations among jealousy, attachment security, and developmental background variables (CA, MA, VMA, NVMA).

Results

Expressions of Jealousy from Enacted Scenarios

Scenario Duration Duration of the experimental social scenarios did not significantly differ between groups for either the mother scenario (HFASD: 50–120 sec., $M=114.14$; $SD=16.80$; TYP: 75–120 s., $M=113.63$, $SD=12.87$) or the stranger scenario (HFASD: 65–120 s., $M=115.16$; $SD=11.48$; TYP: 100–120 s., $M=115.37$, $SD=6.34$). The majority of children completed the full 2 min in the mother social scenario (73.3 % of each group) and in the stranger social scenario (72.4 % of HFASD group and 60 % of TYP group; difference in percentages was non-significant).

Hierarchical Jealousy Scale To examine differences on the explicitness of jealousy, we executed a 2 (group: HFASD/TYP) X 2 (age: <55mo/>55mo) X 2 (adult: mother/stranger) X 2 (condition: social/nonsocial) ANOVA, with repeated

measures on adult and condition. A significant main effect for adult emerged, $F(1,55)=15.53, p<0.001, \eta^2=0.22$, with higher jealousy explicitness levels expressed toward the mother ($M=3.92, SD=1.12$) than the stranger ($M=3.42, SD=0.96$), across groups. Results also yielded a significant main effect for condition type, $F(1,55)=71.78, p<0.001, \eta^2=0.56$, with higher jealousy explicitness levels in the social scenario ($M=4.34, SD=1.15$) than the nonsocial scenario ($M=3.00, SD=0.93$). Lastly, a significant interaction emerged between adult (mother/stranger) and condition (social/nonsocial), $F(1,55)=23.57, p<0.001, \eta^2=0.30$. Clarifications of this interaction revealed significant differences only in the social situation, $F(1,58)=38.91, p<0.001, \eta^2=0.40$, with more explicit jealousy expressed toward the mother ($M=4.84, SD=1.29$) than the stranger ($M=3.85, SD=0.95$). See Fig. 1 for distributions by adult and condition. Children in both groups explicitly expressed more jealousy toward the mother than the stranger only when the mother read the rival a story. When no rival was involved (reading to self scenario), children’s reaction was equal between the mother ($M=3.00, SD=1.01$) and stranger ($M=2.99, SD=0.91$).

No significant group or age differences emerged. Thus, differences in jealousy explicitness between adult and condition go beyond group or CA.

Quantity of Jealousy Behaviors Scale We conducted a 2 (group) X 2 (adult) X 2 (age) MANOVA, with repeated measures on adult, followed by univariate ANOVAs to investigate differences in the quantity of jealousy indices provoked by the social scenarios in the three categories: gaze, verbalization, and action. One TYP child was removed from this analysis because his verbalization score was almost three *SDs* higher than the group mean. The MANOVA yielded a significant adult (mother/stranger) effect, $F(\text{Wilks’ criterion}) (3,53)=5.39, p<0.01, \eta^2=0.23$. Follow-up ANOVAs revealed adult differences on two of the three

jealousy indices: verbalizations and actions (see Table 2). Due to large *SDs* compared with means on several of the jealousy indices, we also conducted non-parametric Wilcoxon analyses, which yielded similar adult differences for both verbalization ($Z=3.23$) and action ($Z=3.24$), $p<0.001$. The Group X Adult interaction was significant, $F(\text{Wilks’ criterion}) (3,53)=2.77, p=0.05, \eta^2=0.14$; follow up ANOVAs yielded significant ($p=0.05$) Adult X Group interaction for the verbalization scale (see Table 2). Simple effect test, computed to examine the interaction’s source, revealed a significant difference between mother and stranger on the verbalization scale only for the children with HFASD (HFASD: $F(1,28)=8.43, p<0.01, \eta^2=0.23$; TYP: $F(1,27)=1.66, p>0.05$). Overall, whereas children in both groups displayed more actions to attract the mother’s attention than the stranger’s, only children with HFASD made also more verbal comments toward the mother than the stranger.

Main effect of age was also significant, $F(\text{Wilks’ criterion}) (3,53)=3.07, p<0.05, \eta^2=0.15$. Younger children ($M=5.01, SD=6.34$) revealed more actions expressing their jealousy than older children ($M=2.18, SD=2.65$), across groups. Non-parametric Mann-Whitney test, conducted due to large *SDs* compared with the mean, mirrored ANOVA results ($U=315.5, p<0.05$). Group differences were not significant on the jealousy behavioral scale.

Affect Scale To examine changes in target children’s affect between Time 1 (peer entering room) and Time 2 (mother holding and reading story to rival) of the social scenario, we performed a 2 (group) X 2 (age) X 2 (adult) X 2 (time) ANOVA, with repeated measures on adult and time. Only a significant time effect emerged, $F(1,54)=8.79, p=0.01, \eta^2=0.14$, with less positive affect expressed during the scenario at Time 2 ($M=3.14, SD=0.61$) than beforehand at Time 1 ($M=3.30, SD=0.46$).

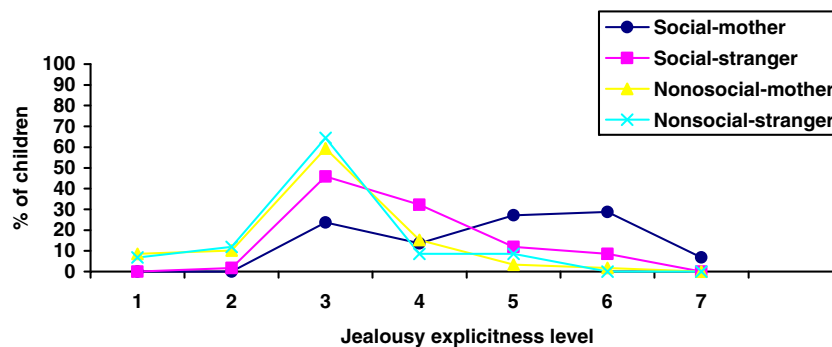


Fig. 1 Distribution of jealousy explicitness scores toward mother vs. stranger in social and nonsocial scenarios. Explicitness levels: 1=No particular indication of jealousy; 2=One brief eye gaze; 3=Long gaze or several short gazes; 4=Behaviors/verbalizations indirectly

intervening in parent-rival interaction; 5=Direct behaviors/verbalizations aiming to attract parent’s attention; 6=Direct indication of comparison/inequality; 7=Direct indication of comparison/inequality, with negative affect

Table 2 Means, standard deviations, and *F* values on the jealousy behavioral coding category scale

Category	Mother		Stranger		<i>F</i> (1,55) Adult (η^2)	<i>F</i> (1,55) Adult X Group (η^2)
	HFASD <i>n</i> =30	TYP <i>n</i> =29	HFASD <i>n</i> =30	TYP <i>n</i> =29		
Gaze						
<i>M</i>	17.59	14.26	12.76	14.26	2.64	2.59
<i>SD</i>	9.76	7.79	8.15	8.80	0.05	0.04
Verbalization						
<i>M</i>	4.94	2.68	1.67	1.93	9.84**	3.91*
<i>SD</i>	5.75	2.95	3.41	2.57	0.15	0.06
Action						
<i>M</i>	4.85	5.60	2.53	1.61	11.01**	0.54
<i>SD</i>	6.74	7.09	3.67	2.83	0.17	0.01

**p*<0.05; ** *p*<0.01

Responsiveness Scale We examined group and adult differences in children's responsiveness to mother's or stranger's invitation at the end of the social scenario using χ^2 analysis. Group differences were nonsignificant in the mother situation and neared significance in the stranger situation. Most children in both groups responded positively to the mother's invitation (84 % in TYP; 73 % in HFASD), whereas only half of the TYP group (50 %) and one fourth of the HFASD group (26 %) responded positively to the stranger's invitation. Binomial tests conducted to examine differences between the mother's versus stranger's invitation were significant for the whole sample ($p<0.001$) and for each group separately (TYP: $p=0.016$; HFASD: $p<0.001$). In all cases, responsiveness to mother's invitation was higher than to stranger's. The examination of age and situation differences in responsiveness using χ^2 yielded no significant age differences for the mother or the stranger.

We also examined group and age differences for each adult (mother/stranger). Group differences emerged only for the older group; older children in the TYP group showed higher percentages of responsiveness than older children with HFASD, both in the mother situation ($\chi^2=3.56$, $p<0.05$; 91.7 % versus 58.3 %, respectively) and the stranger situation ($\chi^2=5.06$, $p<0.05$; 54.40 % versus 13.30 %, respectively).

Book-Interest Scale For the nonsocial scenario only, we conducted 2 (group) X 2 (age) X 2 (adult) ANOVA, with repeated measures on adult, for children's mere interest in the book read aloud by mother/stranger to herself. No significant effects emerged. Pearson correlations conducted between children's book interest and hierarchical jealousy explicitness revealed nonsignificant correlations for the social-mother situation ($r=0.04$, $p>0.05$) and social-stranger situation ($r=-0.15$, $p>0.05$). Thus, for children in both groups, jealousy expression was unrelated to interest in the book for both the mother and stranger situations.

Expressions of Jealousy from Mothers' Reports

Mothers of 28 children (93 %) in each group reported that their child (HFASD or TYP) expressed jealousy at home. To examine group differences in jealousy-provoking situations and agents according to maternal reports, we conducted χ^2 analyses. Two mothers (one from each group) were removed from analysis because they reported jealousy in the child but did not specify agents or situations. As seen in Table 3, no significant group differences in frequency emerged for any of the questions about jealousy manifestations. Most mothers in both groups reported that their child expressed emotional jealousy and more specifically toward siblings. Lower but nonetheless high percentages of mothers said their child expressed social jealousy, and more specifically toward other peers at preschool. Jealousy toward parents (e.g., when father hugs mother) was reported in very low percentages in both groups.

Table 3 Frequency of jealousy situations and agents per mothers' reports

		HFASD <i>n</i> =27		Typical development <i>n</i> =27		χ^2
		<i>n</i>	%	<i>n</i>	%	
Situations:						
Emotional jealousy	YES	23	85.2	19	70.4	1.71
	NO	4	14.8	8	29.6	
Social jealousy	YES	18	66.7	15	55.6	0.70
	NO	9	33.3	12	44.4	
Agents:						
Toward siblings	YES	23	85.2	23	85.2	0.00
	NO	4	14.8	4	14.8	
Toward peers	YES	13	48.1	10	37.0	0.68
	NO	14	51.9	17	63.0	
Toward parents	YES	4	14.8	4	14.8	0.00
	NO	23	85.2	23	85.2	

A 2 (group) X 2 (age) ANOVA on mother-reported jealousy frequency (on a 1-5 scale) indicated nonsignificant group differences, $F(1,52)=0.10, p>0.05, \eta^2=0.00$, and nonsignificant age differences, $F(1,52)=3.50, p>0.05, \eta^2=0.06$, but a significant Group X Age interaction, $F(1,52)=4.96, p<0.05, \eta^2=0.09$. Clarification of this interaction revealed significant age differences only for HFASD group, $F(1,26)=7.16, p<0.05, \eta^2=0.22$. Younger children with HFASD showed jealousy more frequently ($M=3.67, SD=0.72$) than older children with HFASD ($M=2.85, SD=0.90$). Younger and older TYP children expressed similar frequencies of jealousy per mothers' reports ($M=3.28, SD=0.47; M=3.36, SD=0.84$).

Attachment

A 2 (group: ASD/TYP) X 2 (age: <55mo/>55mo) ANOVA examined group and age differences in attachment security (Q-sort). Results yielded significant group differences, $F(1,56)=28.49, p<0.001, \eta^2=0.34$. Children in the TYP group showed significantly higher attachment security scores ($M=0.55, SD=0.08$, range: 0.34 to 0.68) than children in the ASD group ($M=0.37, SD=0.17$, range: -0.06 to 0.64). As seen in Fig. 2, group differences emerged on the distribution of attachment scores: Most of the TYP group (90 %) scored above 0.40, whereas only 43.2 % of the HFASD group did. Age differences were nonsignificant, as was the interaction of Age X Group.

Correlations Between Jealousy and Attachment

Of all the jealousy measures, only the quantitative behavioral coding category scale (i.e., frequency of jealousy manifestations) significantly correlated with attachment (Q-Sort). On this scale, for the total sample, attachment correlated negatively with jealous eye gazing and with jealous verbalizations ($r=-0.34, p<0.01$, for both behaviors), but

not with jealous actions. Separate correlations for the two groups indicated a similar pattern of significant negative correlations for attachment with both jealousy behaviors in the HFASD group (with eye gaze: $r=-0.43, p<0.05$; with verbalization: $r=-0.39, p<0.05$), but only with jealous verbalizations in the TYP group ($r=-0.58, p>0.001$, nonsignificant Fisher Z for differences between group correlations). Altogether, more secure attachment was linked with fewer verbalized jealousy expressions in both groups and with fewer eye gazes in HFASD as well.

Correlations of Jealousy and Attachment with CA, MA, VMA, NVMA: Within-Group Examination

None of the developmental variables (MA, VMA, NVMA, and CA) was significantly correlated with any of the jealousy expression dimensions or with attachment, for either group.

Discussion

The most striking finding of the current study is the tremendous similarity between a clinical group of children with HFASD and their TYP peers regarding jealousy expressions and jealousy's affective link (e.g., attachment). Another noteworthy finding is that in both groups jealousy actions expressed toward the mother greatly surpassed jealousy actions expressed toward a stranger. A differential jealousy expression toward the mother was even more robust for the children with HFASD, who also verbalized more toward the mother versus the stranger. Furthermore, jealousy expressions differed between the mother and the stranger only in the social-triangle scenario (adult-child-rival) but not in the nonsocial scenario (adult-object).

Similarities in jealousy experience between HFASD and TYP preschoolers are interesting, especially in light of HFASD's core deficits in the mechanisms underlying the experience of jealousy, such as affective bonding, social interest, and intersubjective sharing. The current study's findings demonstrated that the context of jealousy provoked clear attention-seeking behaviors and affective reactions in both children with HFASD and TYP, toward the loss of exclusive maternal attention to a peer-rival. Implications of the findings for socioemotional development in HFASD and TYP will now be discussed.

These findings contribute substantially to the understanding of HFASD, specifically children's capability to form affective bonding with a significant other. Overall, the experience of jealousy appeared to reflect the existence of a distinctive affective bond with the mother among children with HFASD. The mother condition provoked attention-seeking and interactive behaviors through words and

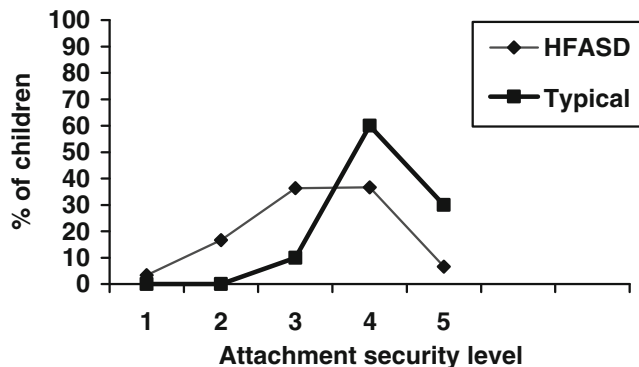


Fig. 2 Frequency distribution for attachment security. Level 1=<1; Level 2=0.00–0.20; Level 3=0.21–0.40; Level 4=0.41–0.60; Level 5=>0.61

actions, as shown on the behavioral scale. These children also more often replied affirmatively to the mother's invitation than to the stranger's.

The fact that children with HFASD differentiated between a mother and a stranger is in line with prior attachment studies on ASD (e.g., Dissanayake and Crossley 1996). In some ways, jealousy and attachment may provoke similar closeness-seeking and attention-seeking behaviors from the child toward the mother when feeling threatened. But, in the attachment context, the child is reacting to the concrete, clear threat of the mother's absence, whereas in the jealousy context the threat comprises the mother's emotional unavailability to her child while present in the room, because she is involved in a warm, affectionate social interaction with another child. Thus, this study showed that the component that evoked children's social attention and jealousy reactions was the child's exposure to the mother-peer interaction, which may have been perceived as potentially harmful to the target child's relationship with the mother. What provoked children's jealous responses was not merely losing exclusive attention; it was losing exclusivity with a significant, close other—someone with whom the target child had developed a close connection or relationship. Inasmuch as jealousy is elicited by situations of personal significance, we may conclude with caution that these children with HFASD have probably developed an affective bond with their main caregiver.

These findings are extremely interesting in light of the significant difference in security of attachment between the groups. Interpretation of the attachment security scores obtained in the current study is difficult because our study is the first to utilize the Q-sort with this clinical group of HFASD preschoolers, and comparative norms are lacking. At first glance, the current HFASD group's mean attachment score ($M=0.37$, $SD=0.17$) appears quite high compared with the mean "secure attachment" score obtained for clinical populations (0.20) in van IJzendoorn et al.'s (2004) meta-analysis of research studies utilizing the AQS. However, a closer look at only those findings of relevance to the current study (which used observers' reports rather than mothers' self-reports and explored mother-child interactions rather than general caregiver-child interactions) indicates that the current HFASD group mean for attachment security is higher than that of children with intellectual disabilities (e.g., 0.18 for Down Syndrome in Atkinson et al. 1999), higher than that of children with mixed genetic disorders including some intellectual disabilities (0.27, in Moran et al. 1992). The current HFASD group mean seems to be closer to that of children with physical handicaps (0.40 in Tessier et al. 2002) or to younger TYP children age 2 years (e.g., 0.38 in Clark and Symons 2000). Taken altogether, unraveling the nature of the attachment security score obtained in the current study indeed requires further

exploration; however, it seems that our high-functioning sample resembles a clinical population unaffected by intellectual disability or else younger TYP children. This coincides with Rutgers et al.'s (2004) meta-analysis of attachment and ASD, which concluded that rates of attachment insecurity were higher only in a sample of children with autism who were also mentally retarded, but not in a sample of HFASD.

Another way to learn about the nature of the security score obtained in the current study is through its link with jealousy. Indeed, those children with HFASD who were more securely attached to the mother did express less jealousy. In both groups, as in Teti and Ablard (1989), children who showed higher attachment security verbalized their jealousy less, and the HFASD group also gazed less to express their jealousy. This may affirm the concept of attachment as a secure base for exploration, where children internalize the mother's availability when facing perceived "danger." Thus, even if the current mean for attachment security was lower for HFASD compared with TYP (but still in the positive range), the concept of mother as a secure base appeared to function similarly in the two groups. Based on jealousy's close link with attachment and on jealousy's affective nature nested within interpersonal exchanges, we propose that future researchers may wish to explore the possible predictive validity of jealousy as an early marker to identify those children with HFASD who may form interpersonal relationships.

Jealousy as a Marker for Social Attention and Sociocognitive Capabilities

Clearly, as described across the study's jealousy measures, the children with HFASD in the current study were very attentive to the interaction between the mother and the peer rival and even made active efforts to interfere or become involved in this interaction, as did the children with TYP. Further support for the uniqueness of this social triangle comprising the child, mother, and peer-rival comes from the mother-rated child jealousy ratings, which identified jealousy reactions toward siblings as most frequent, followed by jealousy toward preschool peers, and only last toward an interaction between the mother and father. This all leads to the fact that the presence of the other peer was associated with heightened jealousy reactions. It is important to note that children with HFASD were much less attentive to the interaction between the rival and a stranger as well as to the mother/stranger-object interaction.

How can we interpret these results suggestive of social interest, or of children's sociocognitive understanding of "thirdness" (of the goals underlying the mother's action)? Social attention was previously examined in a series of studies looking at low-functioning toddlers and preschoolers

with ASD (overall IQ level of 50–60) in comparison to children with developmental delay and to TYP children (e.g., Dawson et al. 2004; Swettenham et al. 1998). Findings were similar across the studies: Children with ASD were found to be severely deficient in orienting to social stimuli (Dawson et al.); they looked less at people and more at objects; and they shifted attention more often between object and object than between object and person or person and person (Swettenham et al.). The conclusion drawn from this prior research is that social stimuli and person-person interaction are not at the focus of attention for these low-functioning children with ASD, thereby depriving them of developing mutual engagement capabilities such as JA.

However, the current results on jealousy differ somewhat. In the jealousy situation, when children may sense that something important was taken away (maternal attention and affection), it may be sufficiently rewarding to warrant paying attention and reacting accordingly. In contrast, loss of the stranger's attention did not seem to elicit sufficient motivation to attend. Future examination of individual differences in attentive skills and their link with stimuli characteristics and agent (caregiver/stranger) can be helpful in guiding intervention to increase such skills in children along the spectrum.

Our results were less informative with regard to the understanding of the sociocognitive markers of jealousy. Based on maternal reports, jealousy is experienced more frequently in a situation that involves another peer than in a situation that involves two familiar adults (mother and father). Peer-rivals resemble the child more than adults do; hence, a peer-rival may be perceived as posing a more concrete danger to the relationship with the mother than an adult rival. To further elucidate the sociocognitive capabilities requested for jealousy, this mother-reported outcome should be examined empirically through different jealousy-evoking laboratory scenarios (e.g., mother/caregiver with an adult rival; two peers interacting while excluding the target child) and through the examination of different representational capabilities (JA, theory of mind) as predictors of jealousy. Interestingly, jealousy did not correlate with the child's cognitive functioning (MA) for the current clinical group of children with relatively homogeneous cognitive functioning (HFASD), whereas it did for the more heterogeneous group of preschoolers with ASD in Bauminger et al.'s (2008) study. This may underscore the importance of normative IQ for the experience of jealousy.

The current study has several limitations that should be noted. First, even if this sample size is considered reasonable compared with other studies that examined HFASD, a larger sample could nevertheless increase statistical power to detect associations between study variables. Therefore, caution must be taken in interpreting the present outcomes,

and replication studies are needed to verify the current findings. Second, due to the fact that the present study included only children on the spectrum without intellectual disability (recently estimated as about half of the spectrum; Centers for Disease Control and Prevention 2009), only future research can clarify whether our findings will generalize to the remainder of children with ASD who are less cognitively able. That said, the homogeneity of the present sample is also a strength of our study, permitting us to obtain purely socioemotional symptoms of autism, without the confound of intellectual disabilities. On the whole, the current study contributed to the literature by highlighting the affective interpersonal nature of jealousy experience in children with HFASD, with possible implications for understanding individual differences in interpersonal capabilities among children with ASD.

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