

## Jealousy and emotional responsiveness in young children with ASD

Nirit Bauminger, Liza Chomsky-Smolkin, and Efrat  
Orbach-Caspi

*Bar-Ilan University, Ramat-Gan, Israel*

Ditza Zachor

*Tel-Aviv University, Tel-Aviv, Israel*

Rachel Levy-Shiff

*Bar-Ilan University, Ramat-Gan, Israel*

We investigated manifestations of jealousy in preschoolers ( $n = 32$ ) with autism spectrum disorder (ASD) and in a group of typically developing children ( $n = 18$ ) matched on mental age, verbal mental age, nonverbal mental age, and mother's education. Main results revealed explicit indices of jealousy in two thirds of the children with ASD compared with 94.5% in the typical group. In addition, different manifestations of this emotion emerged in the ASD group compared with the matched control group. Regarding mental and affective correlates of jealousy, expressions of jealousy correlated with IQ only for the children in the ASD group, and the ASD group revealed deficient emotional responsiveness (ER) capabilities. Significant correlations emerged between jealousy and ER in both the ASD and control groups. Discussion focuses on implications of these findings for understanding the core emotional deficit in autism.

Jealousy is considered to be an unpleasant social emotion. By definition, people experience social-relation jealousy in a triadic context, where a potential threat exists that a valued relationship will be lost to a rival. This context arouses the child's fear of losing love and/or "formative or exclusive attention" (Hansen, 1991; Izard, 1991; Miller, Volling, & McElwain, 2000;

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Correspondence should be addressed to: Nirit Bauminger, School of Education, Bar-Ilan University, Ramat-Gan, 52900, Israel. E-mail: bauminn@mail.biu.ac.il

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Parrott, 1991). The interpersonal nature of the experience of jealousy requires children to intersubjectively relate to others.

Trevarthen and Aitken (2001) described infants as congenitally interpersonally aware, that is, as possessing primary “intersubjectivity” or “person awareness”. This person awareness, where the infant is specifically receptive to others’ subjective states in person–person immediacy, enables the infant to share attention and to link the subjective experience of one person to the subjective experience of another. Primary intersubjectivity assumes that the infant possesses conscious appreciation of adults’ communicative intentions very early in life (Trevarthen, 1979). Secondary intersubjectivity, which develops around 9 months of age, comprises a cooperative intersubjectivity (person–person–object awareness), where infants’ interactions with another person begin to make reference to surrounding objects (Hobson, 2002). Hobson emphasised the emotional nature of this person–person intersubjectivity: By co-ordinating patterns of behaviour with other people, infants become emotionally connected with them. Trevarthen and Aitken underscored that emotions between people (such as jealousy) have their foundation in the dynamic reactions of even young infants, who have limited brain and cognitive development yet do experience “being present” with another, meaning that they experience someone else as a “person”.

A lack of intersubjective sharing, which seriously disrupts children’s ability to experience, be sensitive to, or react emotionally within social contexts, is considered a core deficit in autism (Hobson, 2005; Rogers & Bennetto, 2001; Rogers & Pennington, 1991). Whereas typical infants can recognise and share affective experiences with others very early in life (Dissanayake & Sigman, 2001), young children with autism have been described as having difficulties in turning to others to express their feelings or in responding to others when feelings are expressed (Hobson, 2005). Kanner (1943), who perceived autism disorder as an “innate inability to form the usual biologically provided affective contact with people” (p. 250), set the stage for extensive research and theorising to explain the affective deficit in autism. Although many researchers agree that emotional engagement develops atypically in autism, a gap exists in the literature regarding the unique characteristics and range of these children’s emotional expressions in interpersonal contexts (Hobson, 2005). Thus, questions remain concerning the nature of the emotional deficit in autism, the role of individual differences, and the effect of mental capabilities on emotional functioning.

To begin to more comprehensively tease apart some of the emotional deficits in autism spectrum disorder (ASD), our primary goal was to document jealousy in preschoolers with ASD in comparison to children with typical development. Our secondary goal was to examine the role of mental

and affective capabilities (IQ and emotional responsiveness towards others' distress) in explaining individual differences in ASD for the expression of jealousy.

### Jealousy in typical development and in autism

Notwithstanding its importance to the understanding of typical emotional development, childhood jealousy is an overlooked area of study. Several studies have experimentally provoked jealousy in children via interpersonal triadic situations (mother-child-peer rival or parent-two sibling scenarios), with a focus on detecting behaviours and action components that indicated jealousy in those situations (e.g., Masciuch & Kienapple, 1993; Miller et al., 2000; Volling, McElwain, & Miller, 2002). These studies provided rich description of behaviours, actions, and verbalisations signifying jealousy in infancy through early childhood. For example, children evidenced behaviours such as discontinuing work and focusing attention on the triad, frowning or gazing at the mother-rival interaction, and making attempts to maintain close proximity or to interfere with or enter into the parent-sibling interaction using attention-provoking verbalisations and behaviours (e.g., Masciuch & Kienapple, 1993; Miller et al., 2000; Volling, McElwain, & Miller, 2002).

In a different line of studies, Hart and her colleagues have documented jealousy in very young children (6 and 12 months) in response to a situation in which the mother is cuddling a lifelike doll. Jealousy was defined as infant disturbance, such as negative affect (sadness or anger), negative vocalisation, increased proximal contact with the mother, protest, and play inhibition (e.g., Hart & Carrington, 2002; Hart, Carrington, Tronick, & Carroll, 2004; Hart, Field, del Valle, & Letourneau, 1998a; Hart, Field, Letourneau, & del Valle, 1998b; Hart, Jones, & Field, 2003). In addition, Hart drew attention to a possible link between jealousy expressions and the quality of mother-infant interaction. Jealousy protest was greater in a mother condition versus a stranger condition (cuddling the lifelike doll; Hart et al., 1998b), and in infants of nondepressed mothers compared to infants of depressed mothers (e.g., Hart et al., 1998a). Moreover, 6-month-old infants expressed anger and sadness both in a jealousy and in a still-face situation, but the still-face situation provoked avoidant responses (heightened distancing and diminished interest), whereas the jealousy situation provoked approach responses (heightened interest and gaze, diminished distancing; Hart et al., 2004).

The results of Hart and her colleagues regarding jealousy in such young infants raise theoretical questions about the cognitive-representational and affective prerequisites for jealousy (see Draghi-Lorenz, Reddy, & Costall, 2001; Salovey, 1991, for reviews). If Hart's results are interpreted as jealousy, then, to experience jealousy at even the lowest developmental level, infants

should possess some degree of intersubjectivity or interpersonal awareness, because jealousy results from the loss of exclusive attention from a significant other. On a higher developmental level and in line with the majority of jealousy researchers, jealousy may indeed involve complex affective and representational capabilities that occur within a network of valued close relationships, triggered by a perceived loss of this relationship to a rival (e.g., Volling et al., 2002).

Both intersubjective sharing and representational capabilities are presumed to be core deficits in autism (Hobson, 2002; Tager-Flusberg, 2001), thus leading to speculation that these children will likely demonstrate difficulties in expressing jealousy. So far, one study (Bauminger, 2004) has presented clear indications of jealousy in older high-functioning preadolescents with autism (mean CA = 11.4 years), with no group differences from typical controls, despite differing manifestations of jealousy between the two groups (i.e., typical children gazed more at the parent, whereas children with ASD exhibited more actions). Jealousy was examined in two social situations, one in which the child's parent praised another child's picture and another in which the parent engaged in affectionate play exclusively with the other child. The current study aimed to expand on these preliminary findings to help clarify the manifestations of jealousy in younger children with ASD (preschoolers) as well as its affective (emotional responsiveness; ER) and cognitive (IQ) correlates.

### **Possible affective (ER) and cognitive (IQ) correlates of jealousy in typical development and in autism**

Regarding possible affective correlates of jealousy, ER comprises another emotional capacity that, like jealousy, involves the child's reaction towards the subjective state of another person, thus necessitating "person awareness", but each has a different focus. ER consists of prosocial behaviours such as acts of comforting, which reflect the child's response to recognition of the emotional state of another person regarding an event that happened to that person (e.g., distress from hurting their knee). In contrast, jealousy involves awareness of another's emotional state (i.e., the other person's positive affect/emotional investment directed towards a third person) regarding an event that happened to oneself ("loss of attention"). Although our purpose was not to predict the chronology of these two emotional capabilities, we may speculate that children with high responsiveness towards a person in distress would also demonstrate jealous expressions, due to the fact that in typical development the ability to relate to another's emotional state is related to one's ability to relate an emotional state to oneself (Saarni, 1999). In any case, the examination of both ER and jealousy may provide

important information about the extent to which children with ASD react to the emotional displays of others.

In a series of studies examining ER toward an experimenter or a parent in distressing situations (bumping a knee/hand/elbow, pretending to be ill, pretending to lose a pen), preschoolers with ASD demonstrated impaired ER capabilities (e.g., fewer eye gazes, lower concern response) compared with either children with typical development or children with mental retardation (e.g., Bacon, Fein, Morris, Waterhouse, & Allen, 1998; Charman et al., 1997; Corona, Dissanayake, Arbelle, Wellington, & Sigman, 1998; Dawson et al., 2004; Dissanayake & Sigman, 2001; Dissanayake, Sigman, & Kasari, 1996; Sigman, Kasari, Kwon, & Yirmiya, 1992). However, it seems that higher cognitive capabilities are related to better ER capabilities in children with ASD. For example, in Bacon et al. (1998), IQ correlated with gaze toward the examiner in a hurt-knee procedure, and verbal mental age correlated with prosocial behaviours for a group of low-functioning children with ASD. Also in Dissanayake et al.'s (1996) follow-up study, children's prosocial behaviour and ER correlated with their MA.

Based on former studies that examined ER in autism, and on difficulties in attending to others' emotional states among children with ASD as just discussed, we chose the term ER due to our interest in children's genuine attentiveness to other's emotional expressive behaviour. Those possible reactions can range from no interest or no attention at all, through *empathic response* (i.e., an emotional reaction to another's emotional state or condition that is consistent with the other's state or condition, such as feeling sad when viewing a sad person; Denham, 1998; Harris, 1989; Saarni 1999); to *sympathic response* (i.e., feelings of concern or sorrow for another in reaction to the other's emotional state or condition, or deliberately performing comforting behaviours; Denham, 1998, Eisenberg, 1992).

The current study examined differences between young children with ASD and typical development in their expressions of jealousy within a triadic interpersonal context and in their ER when the parent pretended to hurt his/her knee. In order to attain a more comprehensive inquiry into the extensiveness of the emotional deficit in ASD, we examined the correlations between jealousy and ER in each group and the role of IQ in both jealousy and ER.

Based on the emotional deficit of children with ASD, specifically in social emotions such as jealousy and prosocial behaviours, and the young age and lower level of functioning of the children in the current study compared with the children in the Bauminger (2004) jealousy study, we expected that children with ASD would perform more poorly than typical controls both on the jealousy and ER measures, and that jealousy would be manifested differently in the ASD group compared with the typical controls. However,

we also expected advantages for children with ASD with higher IQs. In addition, we expected a link between jealousy and ER in both groups.

## METHOD

### Participants

A sample of 50 preschoolers participated in the study, including 32 (2 female) children with ASD and 18 (3 female) typically developing children. Children with ASD were recruited from special-education preschools specialising in pervasive developmental disorder, and children with typical development were recruited from local preschools. Exclusionary criteria in the autism group included the presence of other neurological diseases or syndromes, and in the typical group, the presence of known cognitive or behavioural problems according to the preschool teacher's report.

All participants with ASD had received that diagnosis based on the *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV;* American Psychiatric Association, 1994) prior to their participation in the study, as determined by licensed psychologists unassociated with the current study. In addition, all children met the criteria for autism on the Autism Diagnostic Interview – Revised (ADI-R; Lord, Rutter, & LeCouteur, 1994), which was administered to the parents of the children for the purpose of the current study, to verify diagnosis. The three main areas of ADI-R criteria for autism correspond with the DSM-IV criteria for ASD and include: reciprocal social interaction; communication and language; and repetitive, restrictive, and stereotyped behaviours. The child also needs to show evidence of developmental delay or deviance prior to the age of 36 months. All 32 children met criteria for autism on all four ADI-R criteria. To assess children's IQ and MA scores, the Mullen Scales of Early Learning (AGS Edition; Mullen, 1997) were administered to all participants.

Groups were matched on mental age, verbal mental age (including receptive and expressive language), and nonverbal mental age (including visual perception and fine motor) using the Mullen Scales of Early Learning and were also matched on maternal education. As can be seen in Table 1, analysis of variance (ANOVA) tests revealed no significant differences between the two groups on these criteria.

### Measures

On all measures, unless otherwise noted, two trained coders separately assigned the scores to each child, and then inter-coder discrepancies were discussed and clarified until reaching 100% agreement. The parent received

TABLE 1  
Sample characteristics

	Mean (standard deviation)		Group differences $F(1, 48)$
	ASD ( $n=32$ )	Typical ( $n=18$ )	
CA (months)	45.91 (12.75)	31.94 (9.93)	16.04***
MA (months) <sup>a</sup>	33.02 (9.94)	34.71 (10.19)	0.33
Visual perception <sup>a</sup>	38.34 (12.33)	35.94 (10.58)	0.48
Fine motor <sup>a</sup>	36.06 (11.01)	30.83 (9.05)	2.93
Verbal receptive <sup>a</sup>	33.69 (12.26)	35.61 (10.27)	0.32
Verbal expressive <sup>a</sup>	31.63 (13.43)	34.44 (12.43)	0.53
Verbal overall <sup>a</sup>	32.94 (12.39)	35.67 (11.07)	0.60
Full-scale IQ <sup>a</sup>	74.38 (21.35)	109.50 (14.09)	38.95***
Mother education <sup>b</sup>	2.53 (0.62)	2.72 (0.46)	1.29
Birth order <sup>c</sup>	4.26 (1.69)	3.82 (1.47)	0.79

Notes: <sup>a</sup>Based on the Mullen Scales. <sup>b</sup>High school or less, without matriculation (1); special professional training after high school or high school matriculation (2); academic education (3). <sup>c</sup>1-only child, 2-eldest, 3-second, 4-third, 5-fourth, 6-fifth. \*\*\* $p < .001$ .

detailed verbal and written instructions on how to perform each of the scenarios, while ensuring that the child could not overhear instructions.

## Expressions of jealousy

### *Experimental scenario and nonsocial condition*

*Jealousy-provoking experimental scenario: Storybook reading to rival.* Based on Masciuch and Kienapple (1993), the story-reading scenario to provoke jealousy in the children included a triad consisting of the child (with ASD or typical development), his or her main caregiver (mostly mothers except for 4 fathers in the ASD group, and 2 fathers in the typical group), and another child (the "rival") who was a familiar peer attending the child's preschool. The session began with the child, main caregiver, 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 parent to ignore the children while completing the demographic form for 2 minutes. Upon the experimenter's signal, the parent placed the rival child on his/her lap and embraced the rival while reading a story aloud to that child, for another 2 minutes. At the end of the 2 minutes, or if the parent's own child showed substantial distress before that time, the parent was signalled to take his/her own child, hug the child, and read another story to him/her. Videotaping began when the parent placed the rival on the lap, lasting for 2 minutes.

*Jealousy nonsocial condition: Book interest.* To control for the possibility that the child's attention toward the parent–rival dyad related to mere interest in the book stimulus, we also implemented a nonsocial scenario where the parent read the story aloud to himself/herself. During this scenario, only the parent and child were present in the room; the child was encouraged to play with the available toys; and the parent read aloud from a children's book (the same book that was used later in the jealousy-provoking situation) for 30 seconds, ignoring the child. Videotaping began when the parent started reading the book and lasted for 30 seconds.

### *Coding of jealousy expressions from experimental scenario*

Children's videotaped jealousy-provoked behaviours, verbalisations, and affects were assessed using three coding scales: explicitness, quantity, and response time.

*Explicitness: Hierarchical jealousy scale.* This scale (Bauminger, 2004) derived from the behaviours, verbalisations, and affects identified as jealousy indices by previous research (e.g., Bers & Rodin, 1984; Hupka, 1984; Masciuch & Kienapple, 1993; Miller et al., 2000). The 7-point scale ranked the explicitness of actions, verbalisations, and affective expressions of jealousy in hierarchical order, as follows: no attention paid to any of the ongoing scenario (1); one brief eye gaze at the parent, peer, or dyadic interaction (2); one long gaze or a number of several short eye gazes directed at the parent, peer, or dyadic interaction, with or without stopping own activity (3); actions or verbal comments that indirectly intervened in the interaction between the parent and peer, e.g., rising from chair and starting to jump and scream at mother, making repeated loud comments about own game such as, "Who knows . . . ?", or directing gaze at mother and saying, "My tooth is loose" (4); direct actions or verbalisations that focused parent's attention, e.g., moving closer to mother while hugging her, trying actively to show toys to the parents and peer and making comments such as, "Here is a cute lion! Look!", or gazing at the book and loudly naming words related to the story, "Sun . . . Dog" (5); direct verbal or nonverbal indications of comparison without negative affect, e.g., making comments like, "Dad, I'd like you to read me a story" or gazing towards the interaction and saying, "Mom, do it with me . . .", or physically entering into the mother–rival interaction, e.g., climbing onto the mother's lap, turning the book pages, pointing at its contents, with or without making comments such as "Want look . . ." (6); and direct verbal or nonverbal indications of comparison, accompanied by negative affect (e.g., frustration, anger, crying, sadness, depressed facial expression or tone of voice), as a reaction to parent's behaviour, e.g., moving closer to mother, trying to get on her lap while



crying, “Mom, give me . . .”, or getting up from the chair, pushing the peer and saying, “No . . . no, no”, while crying) (7). Examples are all taken from the ASD sample. On this scale, coders assigned the child the highest score evidenced over the 2-minute scenario. A score of 4 and above indicated explicit actions, verbalisations, and affects that reflected jealousy, whereas a score below 4 indicated only eye gaze in different degrees.

*Quantity of different jealousy manifestations: Behavioural coding category scale.* This scale (Bauminger, 2004) included 8 indices of jealousy comprising three main categories: the child’s gaze direction, verbalisations, and actions. The presence of each jealousy index in each of the three categories was assessed every 5 seconds during the 2 minutes of observation, for a total of 24 intervals (or fewer if the scenario was shortened due to the child’s distress). The number of observations in which a jealousy index was detected was summed separately for the gaze direction, verbalisations, and actions categories and then divided by the total number of actual intervals for each child. Thus, a higher score in a particular category indicated a higher quantity of that category of jealousy manifestations.

The child’s gaze direction category included four specific gaze behaviours: gaze directed at (a) the parent, (b) the peer (c), the book, and (d) the interaction. The latter coding was given in cases when it was not possible to determine the exact point of reference of the child’s gaze. The child’s verbalisations category included two specific components: (1) *attention-seeking comments*—verbal attempts to draw the parent’s attention to oneself or one’s own playing, without direct reference to the interaction between the parent and peer, such as talking about own game and (2) *interactive comments*—comments that interfere with the ongoing interaction between parent and peer, such as repeating words from the story being read or answering questions aimed at the peer. The category for the child’s actions also included two specific components: (1) *attention-seeking actions*—attempts to draw the parent’s attention to oneself, such as trying to show parent the game one is playing, or rising from chair, moving closer to parent, and standing beside parent; and (b) *involvement actions*—attempts to physically interfere with the interaction between parent and peer, such as pushing the rival and trying to climb onto parent’s lap.

Scores were calculated for the specific behaviours comprising the three categories and also a global score for each category. Two observers underwent training in coding the three categories (children’s eye-gaze behaviours, verbalisations, and actions), until an inter-observer agreement level of 85% or higher was obtained. Then, all the videotapes underwent coding by both observers, obtaining an agreement level of 93%. For each behaviour, the value used for data processing was the mean of the two observers’ scores for that child.

*Response time.* Response time was measured to examine whether children with autism, due to their well-documented emotional difficulties in linking emotions with social situations (Dennis, Lockyer, & Lazenby, 2000), would need a longer duration to respond with expressions of jealousy than would their typical age mates. Children's initial jealousy response on the jealousy behavioural coding scale was coded in seconds.

### *Coding of jealousy expressions from nonsocial condition*

The level of child interest in the book that the parents read to themselves was measured along a 3-point scale. A score of 1 indicated that the child showed *no interest*—did not gaze even once toward the book or the parent; a score of 2 indicated that the child showed *little interest*—gazed briefly toward the book or the parent, without stopping play; and a score of 3 indicated that the child showed *high interest*—stopped whatever he/she was doing and looked at the parent or the book continuously, or got up and moved closer to the reading parent.

## Emotional responsiveness

### *ER-provoking experimental scenario*

Based on Bacon et al. (1998) and Sigman et al. (1992), the hurt-knee experimental scenario was implemented to provoke ER in the children. In this scenario, the child and the parent were seated at the table, at a 90-degree angle from one another. The experimenter encouraged the child to play with the available toys, and, like in the jealousy-provoking scenario, the parents ignored the child while completing the demographic form for 2 minutes. Then, at the experimenter's signal, the parent pretended to bang his/her knee/leg on the table, with appropriate pained facial expression and exclamation ("Ouch!"), followed by rubbing the injured body part for 20 seconds. At the end of the 20 seconds, or if the children showed substantial distress before that time, the parents were instructed to reassure their children that, "It doesn't hurt any more". Videotaping began when parent banged knee/leg and lasted for 20 seconds.

### *Coding of videotaped ER*

Children's videotaped ER-provoked behaviours, verbalisations, and affects were assessed using two coding scales: level of concern and quantity.

*Level of concern: Hierarchical ER scale.* Based on Corona et al. (1998), we measured the child's level of concern during the ER-provoking scenario along a 3-point scale. *No interest* (1) indicated that the child did not even gaze once toward the distressed parent and did not alter his/her own

behaviour or emotional expression during the scenario; *interest, but no concern* (2) indicated that the child gazed briefly at the parent or the “injured” knee/leg, or made a comment like, “Mom, what is it?” without showing distress; and *concern* (3) indicated that the child showed a facial expression revealing concern, worry, or discomfort, sometimes accompanied by a relevant comment like, “Mom, what happened?” and/or comforting behaviours such as hugging the parent or kissing the parent’s knee/leg.

*Quantity of different ER manifestations: Behavioural coding category scale.* Based on Sigman et al. (1992), Corona et al. (1998), and Dawson et al. (2004), this scale measured the quantity of ER manifestations along three categories: gaze direction, verbalisation, and behaviour. The presence of each ER index in each of the three categories was assessed every 2 seconds during the 20 seconds of observation, for a total of 10 intervals (or fewer if the scenario was shortened due to the child’s distress). The number of observations in which an ER index was detected was summed separately for the gaze direction, verbalisations, and behaviours categories and then divided by the total number of actual intervals for each child. Thus, a higher score in a particular category indicated a higher quantity of that category of ER manifestations.

The child’s gaze direction category consisted of gaze directed at (a) the parent and (b) the “injured” knee/leg. The child’s verbalisation category consisted of (a) imitation—repeating parent’s verbalisation, such as, “Ouch!” or, “It hurts” and (b) a verbalisation indicating interest in the situation, such as, “What happened, Dad?” or, “Is it your leg?” The child’s behaviour category consisted of (a) giving a toy to the distressed parent and (b) comforting behaviours, such as patting parent’s knee, hugging the parent, etc.

Two observers underwent training in coding the three categories (children’s eye-gaze behaviours, verbalisations, and behaviours), until an inter-observer agreement level of 85% or higher was obtained. Then, all the tapes underwent coding by both observers, yielding an agreement level of 95%. For each category, the value used for data processing was the mean of the two observers’ scores for that child.

## Procedure

We contacted the parents of the children in both the special and regular education settings 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 the teachers about the nature of the research by telephone, and we arranged three meetings for families in the autism group and two meetings for families in the typical

development group. The first meeting for the autism group comprised the ADI-R interview of at least one parent, conducted in a quiet room at the child's preschool or home without the child present. In the second meeting (first meeting for the typical development group), the Mullen Scales were administered in the preschool for all participants but 3 (administered in the child's home). In most cases, the presence of the parent or a teacher was required. The third meeting (second for the typical development group), in which the scenarios were videotaped, was held in the child's preschool.

Inasmuch as this study comprised part of a larger study, the current participants were administered a fourth scenario on social referencing (SR) during the last meeting, in addition to the two experimental scenarios (jealousy and ER) and the nonsocial-jealousy scenario. This SR scenario, entailing storm sounds played on audiotape for 20 seconds, was out of the scope of the current study. The four scenarios were enacted consecutively. For half of the sample, the sequence was ER hurt knee followed by the nonsocial jealousy, SR, and jealousy story-reading to rival. For the other half, the sequence was SR, nonsocial jealousy, ER, and jealousy story-reading to rival. The experimental jealousy scenario was always last because it alone required the presence of the child's peer in addition to the parent-child dyad (order effect was nonsignificant).

The room contained a low rectangular table, low chairs, and age-appropriate toys of three kinds set on the table—symbolic toys (plastic animals), cause-and-effect toys (pop ups, rain-stick noisemakers), and motoric toys (beads for stringing, towers of Hanoi).

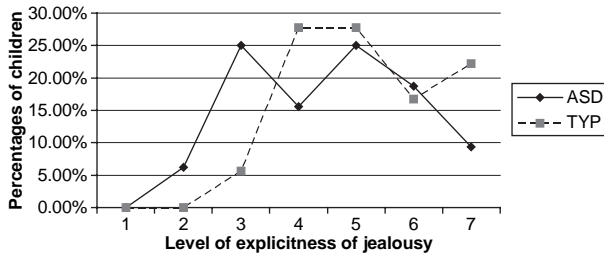
## RESULTS

### Expressions of jealousy from experimental scenario

The first set of analyses examined the differences in the explicitness, quantity, and response time of jealousy expressions (using the hierarchical scale, behavioural coding scale, and response time measure, respectively) between children with ASD and typically developing children as manifested in the book reading to rival scenarios.

#### *Jealousy Hierarchical Scale*

To examine group differences on the explicitness of jealousy, we executed a one-way ANOVA. Although children with ASD revealed a lower level of explicitness of jealousy ( $M = 4.53$ ,  $SD = 1.46$ ) than typical controls ( $M = 5.22$ ,  $SD = 1.26$ ), group differences did not reach significance  $F(1, 48) = 2.83$ ,  $p = .09$ ,  $\eta^2 = .06$  (see Figure 1, which presents the distribution of children's scores on the jealousy hierarchical scale). Further, in order to control for the



**Figure 1.** Explicitness of jealousy scores: Group distribution. *Level 1:* No particular indication of jealousy; *Level 2:* One brief eye gaze; *Level 3:* Long gaze or several short gazes; *Level 4:* Behaviours/verbalisations indirectly intervening in parent-rival interaction; *Level 5:* Direct behaviours/verbalisations aiming to attract parent's attention; *Level 6:* Direct indication of comparison/inequality; *Level 7:* Direct indication of comparison/inequality, with negative affect.

possible effect of CA differences between the groups, we also computed a univariate analysis of covariance (ANCOVA), with CA as the covariate on the jealousy hierarchical scale, which mirrored previous ANOVA results. However, when we examined group differences according to the distribution of the explicitness of jealousy on the hierarchical scale, comparing the percentages of children who demonstrated clear indices of jealousy (i.e., a score of 4 and above), we found significant group differences, with the majority of children in the typical group demonstrating clear indices of jealousy on the hierarchical scale (94.5%), versus (68.75%) in the ASD group (Fisher exact test,  $p < .05$ ).

### *Behavioural Coding Scale*

Next, we conducted a multivariate analysis of variance (MANOVA) followed by univariate ANOVAs to investigate group differences on the quantity of the jealousy indices measured by the jealousy behavioural scale along the three main dimensions (gaze, verbalisation, and action). The MANOVA yielded a significant group effect, Wilks' criterion  $F(8, 41) = 6.72$ ,  $p < .001$ ,  $\eta^2 = .57$ . As can be seen in Table 2, follow-up ANOVAs revealed group differences on two of the four *gaze* behaviours: gaze at the peer and gaze at the interaction. Children with ASD gazed less at the peer, but gazed more often at the interaction compared with typical control. Significant group differences also emerged for one of the two specific *action* behaviours, attention-seeking: Children with ASD displayed fewer actions to attract the parent's attention, compared with their typical counterparts. No indices of jealousy on the verbalisation dimension reached significance. Further, MANCOVA (multivariate analysis of covariance) and follow-up ANCOVAs were also computed to control for possible effects of CA group differences, which yielded the same results as the MANOVA, MANCOVA  $F(8, 40) =$

TABLE 2  
Means (standard deviations), and F-values on the Jealousy Behavioural Coding  
Category Scale and the Nonsocial Book Reading Scenario

	<i>Means (Standard Deviations)</i>		<i>Group ANOVA</i> F(1, 48)	$\eta^2$	<i>Group ANCOVA</i> F(1, 47)
	<i>Autism spectrum disorder</i> (n = 32)	<i>Typical development</i> (n = 18)			
<i>Jealousy Behavioural Coding Scale</i>					
<i>Gaze</i>					
Parent	0.18 (0.20)	0.26 (0.20)	2.18	.04	0.54
Peer	0.07 (0.07)	0.24 (0.17)	24.64 <sup>a</sup>	.34	11.69 <sup>a</sup>
Book	0.36 (0.35)	0.51 (0.29)	2.28	.04	1.93
Interaction	0.19 (0.19)	0.04 (0.07)	9.66 <sup>b</sup>	.17	12.09 <sup>a</sup>
<i>Verbalisation</i>					
Attention	0.10 (0.17)	0.12 (0.20)	0.15	.00	0.07
Interactive	0.09 (0.18)	0.14 (0.20)	0.67	.01	0.76
<i>Action</i>					
Attention	0.13 (0.17)	0.33 (0.25)	11.60 <sup>a</sup>	.19	6.05 <sup>b</sup>
Involvement	0.19 (0.25)	0.20 (0.26)	0.04	.00	1.46
<i>Nonsocial Book Reading Scenario</i>					
Book interest	0.91 (0.81)	1.22 (0.64)	1.98	.04	1.22

Notes: <sup>b</sup> $p < .01$ ; <sup>a</sup> $p < .001$ .

6.02,  $p < .001$ ,  $\eta^2 = .55$ , and follow-up ANOVAs. Means, *SDs*, and *F*-values for the follow-up univariate analyses are provided in Table 2. Also, due to large standard deviations compared with the means on several of the jealousy indices on the jealousy behavioural scale, group differences were also examined through a series of Mann–Whitney nonparametric tests. These tests demonstrated significant differences between children with ASD and children with typical development on the same two gaze dimensions ( $Z = 3.96$ ,  $p = .000$  for gaze at the peer;  $Z = 3.31$ ,  $p = .001$  for gaze at the interaction) and on one of the action dimensions, behaviours to attract parents' attention ( $Z = 3.31$ ,  $p = .001$ ). Thus the nonparametric results mirrored the ANOVA results. Verbal indices of jealousy did not reach significance along the two different analyses (ANOVA and nonparametric tests).

### *Response time*

To examine group differences on response time, we conducted a Mann–Whitney test (due to large standard deviations compared with the means)

that revealed a significant group effect ( $Z = 2.40$ ,  $p = .01$ ). Typically developing children displayed a shorter jealousy response time ( $M = 1.33$ ,  $SD = 0.68$ ) compared to children with ASD ( $M = 9.69$ ,  $SD = 19.33$ ).

#### *Nonsocial condition scenario: Book interest*

No group effect emerged for children's mere interest in the book according to the one-way ANOVA or ANCOVA (controlling for CA differences). Table 2 presents means, *SDs* and *F-values*. The same results also emerged using a non-parametric Mann–Whitney test due to the large standard deviation compared with the mean for the ASD group. We also were interested in examining a possible link between the child's interest in the book and the child's level of explicitness of jealousy as measured by the hierarchical scale, thus we conducted a Pearson correlation. This analysis revealed nonsignificant correlations for the ASD group ( $r = .18$ ,  $p > .05$ ) and a significant negative correlation for the group of children with typical development ( $r = -.49$ ,  $p < .05$ ). Thus, for children with ASD, jealousy expression was not related to their interest in the book, whereas for the typically developing children, children who revealed higher degrees of jealousy were less interested in the book.

### Emotional responsiveness

The second set of analyses examined group differences in the manifestations of ER with respect to the child's level of concern (concern scale) and to the child's expression of gazes, verbalisation, and behaviours (ER behavioural scale) towards the distressed parent.

#### *Level of Concern Scale*

A one-way ANOVA to examine group differences on the concern scale revealed a nonsignificant group effect,  $F(1, 48) = 0.76$ ,  $p > .05$ ,  $\eta^2 = .02$ . Children with ASD revealed a level of concern toward the distressed parents ( $M = 2.34$ ,  $SD = 0.65$ ) similar to that exhibited by their typical peers ( $M = 2.50$ ,  $SD = 0.51$ ). Further, ANCOVA with CA as a covariate executed to control for possible effects of CA on group differences revealed the same results.

#### *ER Behavioural Scale*

Next, we conducted a MANOVA to investigate group differences on the manifestation of ER gazes, verbalisations, and behaviours observed towards the distressed parent. Results of the MANOVA yielded a significant group effect,  $F(3, 46) = 7.04$ ,  $p = .001$ ,  $\eta^2 = .31$ . Follow-up ANOVAS to examine the source of the differences revealed a significant group effect for ER gaze

only,  $F(1, 48) = 15.94, p = .000, \eta^2 = .25$ . The ASD group expressed fewer gazes towards the distressed parents compared with typically developing children. Further MANCOVA analysis and follow up ANCOVA with CA as covariate yielded similar results to the previous MANOVA and follow-up ANOVAs—MANCOVA,  $F(3, 45) = 3.08, p < .01$ ; ANCOVA for gazes  $F(1, 47) = 9.96, p = .003$ . Due to large standard deviations compared with the means, we also calculated three Mann–Whitney tests, for ER gazes, verbalisations, and behaviours, which mirrored our ANOVA results ( $Z$  for gazing at the parents = 3.90,  $p = .000$ ;  $Z$  for verbalisation = 0.53,  $p > .05$ ;  $Z$  for actions towards the distressed parents = 1.43,  $p > .05$ ). Table 3 presents the means, *SDs*, and mean ranks for the ER behavioural scale.

### Within-group examination of correlations between jealousy and ER

The next analysis investigated links between expressions of jealousy (hierarchical and behavioural coding scales for the overall dimensions of gaze, verbalisation, and action) and ER indices (level of concern and behavioural scales for gaze, verbalisation, and behaviour) in each group (ASD and typical). As can be seen in Table 4, two correlations reached significance for the ASD group: Children who expressed more behavioural indices of ER showed more gazes and more actions to express their jealousy. In addition, children with ASD who expressed more behavioural indices of ER revealed a near-significant tendency to demonstrate more explicit manifestations of jealousy. The  $Z$  Fisher test to examine group differences (ASD versus typical controls) was nonsignificant for all these correlations.

Similarly to the ASD group, few significant correlations emerged for the typically developing group. Children with typical development also revealed a near-significant correlation between more expression of ER behavioural indices and more explicit jealousy manifestations. Yet, differently from the

TABLE 3  
Means (standard deviations), and mean ranks on the Emotional Responsiveness Behavioural Scale: Quantity of emotional responsiveness manifestations for the two groups in hurt knee scenario

	<i>Autism spectrum disorder (n = 32)</i>		<i>Typical development (n = 18)</i>	
	<i>M (SD)</i>	<i>M-rank</i>	<i>M (SD)</i>	<i>M-rank</i>
Gaze*	1.29 (0.27)	19.50	1.64 (0.35)	36.17
Verbalisation	0.10 (0.16)	24.78	0.11 (0.16)	26.78
Action	0.06 (0.13)	23.75	0.15 (0.25)	28.61

Note: \* $p < .001$ .



TABLE 4

Within-group examinations: Pearson correlations between jealousy and ER for autism spectrum disorder and typical development

<i>Jealousy indices</i>	<i>Emotional responsiveness (ER) indices</i>			
	<i>ER concern level</i>	<i>ER Behavioural dimensions</i>		
		<i>Gaze</i>	<i>Verbalisation</i>	<i>Behaviour</i>
<i>Autism spectrum disorder (n=32)</i>				
Jealousy explicitness level	.07	.14	.08	.28 <sup>†</sup>
Jealousy behavioural dimensions				
Gaze	.22	.11	-.07	.30*
Verbalisation	.19	.12	.05	-.17
Action	.22	.04	-.09	.51***
<i>Typical development (n=18)</i>				
Jealousy explicitness level	.09	-.27	.07	.37 <sup>†</sup>
Jealousy behavioural dimensions				
Gaze	.15	.02	.44*	-.00
Verbalisation	.42	-.12	.60**	.55**
Action	-.10	-.07	-.21	.17

Notes: \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ ; <sup>†</sup> $p = .06$ .

ASD group, typically developing children showed a close link between the behavioural jealousy scale and the ER behavioural scale. As seen in Table 4, jealousy gazes positively correlated with ER verbalisations; and jealousy verbalisations correlated with ER verbalisations and behaviours. These two last correlations differed significantly between the groups ( $r = .05$ ,  $p > .05$  for ASD; and  $r = .60$ ,  $p < .01$  for typical,  $Z$  Fisher = 2.01,  $p < .05$ ; and  $r = -.17$ ,  $p > .05$  for ASD; and  $r = .55$ ,  $p < .01$  for typical,  $Z$  Fisher = 2.48,  $p < .01$ , respectively). Lastly, again only for typically developing children, the ER concern scale positively correlated with jealousy verbalisations.

### Within-group examination of correlations between expressions of jealousy and IQ

We computed correlation analyses between children's IQ, expressions of jealousy (hierarchical and behavioural coding scales of overall dimensions: gaze, verbalisation, and action), and ER indices (level of concern and behavioural scales: gaze, verbalisation, and behaviour) in each group (ASD and typical). Only for the ASD group did results reach significance for several of the jealousy variables. Positive correlations with IQ emerged for jealousy's level of explicitness ( $r = .44$ ,  $p < .01$ ) and verbalisations of jealousy ( $r = .28$ ,  $p < .05$ ); and a tendency toward significance emerged between IQ and the jealousy action scale ( $r = .26$ ,  $p = .07$ ). None of the correlations

with IQ reached significance for any of the ER variables for either group. *Z* Fisher test revealed significant group differences for the correlation between jealousy's level of explicitness and IQ ( $r = .44, p < .01$  for ASD; and  $r = -.23, p > .05$  for typical, *Z* Fisher = 2.20,  $p < .05$ ). Partial correlation was also calculated to control for possible CA effects, mirroring our previous findings.

## DISCUSSION

### Jealousy in children with ASD

Our primary aim in the current study was to examine the expression of jealousy in preschoolers with ASD in comparison to typically developing preschoolers during a triadic interpersonal context where the child's main caregiver held the target child's peer (rival) and read a story aloud to that rival. Our hypothesis that jealousy would be exhibited less in the ASD group was partially supported by the study findings. Despite the fact that a significant proportion of the children within the ASD group (68.75%) demonstrated direct actions, verbalisations, and affects that reflected explicit jealousy (rather than mere gazes or no response), as reflected by a score of 4 and above on the jealousy hierarchical scale, this percentage was lower compared with the proportion of children who expressed explicit manifestations of jealousy in the typical control group (94.5%). Thus, albeit the lack of group differences on the mean score of the hierarchical scale, a higher proportion of children in the typical group expressed explicit manifestations of jealousy compared with children with ASD.

In line with our prediction, the jealousy manifestations of the ASD group differed significantly from those of the typical group: Preschoolers with ASD gazed less at the peer and more diffusely at the interaction in general (i.e., a less focused gaze whose exact point of reference could not be determined) than did the typical group. The preschoolers in the ASD group also expressed fewer actions that aimed to attract parental attention, and required a longer response time before exhibiting jealousy behaviours compared with their typically developing peers. These outcomes correspond with Bauminger's (2004) results for preadolescents with high-functioning autism. In her study, typically developing preadolescents gazed more toward the parent and/or rival child in each of the jealousy-provoking situations (drawing and playing), compared with the autism group. Although the precise direction of the ASD group's gazes in the current study was not clear-cut, the present findings suggest that preschoolers' responses to the jealousy scenario were indeed triggered by the parent-rival interaction itself rather than by interest in the book, because children's reactions to the nonsocial stimuli (where parents read the storybook aloud to themselves) did not

correlate with their jealousy responses. We will now discuss the possible implications of these findings for understanding the emotional deficit in autism, in light of group differences in jealousy.

### **Possible implications of the study of jealousy for understanding the emotional deficit in autism**

All jealousy theorists, regardless of theoretical orientation, underscore one common distinguishing characteristic of jealousy: It occurs in the context of a social triangle (Hansen, 1991; Masciuch & Kienapple, 1993; Miller et al., 2000; Parrott, 1991; Salovey, 1991; Volling et al., 2002). The conventional conceptual perception of jealousy accepted by most researchers describes this emotion as a secondary, socially mediated emotion that is highly dependent on individual awareness and responding within a system of relationships between three participants: the jealous individual, a significant other, and a rival (White & Mullen, 1989). According to White and Mullen, the experience of jealousy reflects an interplay between the intrapersonal (the jealous individual) and an interpersonal network of three dyadic relationships within this triangle: (1) the primary jealous relationship, a valued close relationship between the jealous individual and the beloved; (2) the secondary or rival relationship between the beloved and the rival; and (3) the adverse relationship between the individual and the rival. To feel jealousy, triggered by the real or perceived loss to a rival of the valued close primary relationship, the child must be able to make multiple inferences regarding these interpersonal relationships involving the self and others, including representations of another person's mental state (the mother's preference for a rival).

Is it plausible to assume that two-thirds of the preschoolers with ASD possess these complex interpersonal as well as representational capabilities underlying jealousy? Both the affective and cognitive theories concerning the emotional deficit in autism would suggest that it is implausible. The affective view highlights children's disturbance in intersubjective personal engagement with others, which causes a serious disruption in children's ability to experience interpersonal relationships as such (e.g., Hobson, 2002, 2005; Rogers & Pennington, 1991). The cognitive view underscores children's deficits in taking another person's view into account, which leads to difficulties in attributing mental states to others and to oneself with regard to others (e.g., Tager-Flusberg, 2001).

Studies that have examined the expression of secondary emotions such as jealousy, pride, embarrassment, or loneliness in young children with autism are rare. In one study, Kasari, Sigman, Baumgartner, and Stipek (1993) investigated pride in young children with LFA (mean MA = 22.90 months, mean CA = 42.40 months) compared to children with mental retardation

and to children with typical development. Pride, like jealousy, is considered a secondary, self-reflective emotion in which children express awareness about others' evaluations of them and derive their own mental states vis-à-vis those of others. Study results demonstrated that young children with autism expressed pleasure from their success in completing a puzzle as often as typically developing children, but they showed a different pattern of response when given praise by their mothers. These children with ASD failed to look for praise from their mothers, showed fewer attention-seeking behaviours, and even looked away (demonstrating avoidance) when they were given praise. Inasmuch as Stipek, Recchia, and McClintic (1992) suggested that attention seeking in toddlers is evidence of self-reflective processes associated with pride, Kasari et al. (1993) concluded that the children with autism in their study, who failed to provide evidence for pride in the form of attention-seeking behaviours, thus probably did not experience pride as a self-reflective emotion.

Our results on jealousy differed somewhat. Two thirds of the ASD group demonstrated an explicit indication of jealousy, as demonstrated by at least one attention-seeking action, at different levels of directiveness (a score of 4 or above on the hierarchical scale). In addition, although the ASD group demonstrated less attention-seeking behaviour in the form of actions generated by the jealousy-provoking scenario such as moving closer to the parent, they did not score lower than their typical counterparts on involvement actions, which in fact comprise more direct attention-seeking behaviours like physically intervening in the parent-rival interaction, pushing the peer, or trying to climb onto the parent's lap (action category on the behavioural scale). Moreover, the ASD group was indeed less focused in their target of eye gaze toward either the peer or the parent, but looked more at the mother-rival interaction than did the typical control group.

These outcomes imply that preschoolers with ASD were not uninterested in the mother-rival interaction, and also, like the young infants in Hart et al.'s (2004) study, they used an approach response and not avoidance. For example, one child with ASD rocked and hummed when his mother read the story aloud to herself or bumped her knee, but when she put his peer on her lap and held him there while she read him the story, her son stopped rocking and humming, moved very close to the mother-peer interaction, pushed the other child off, turned mother's face towards him, and started to scream. Taking into consideration that both pride and jealousy may require the projection of one's own mental state vis-à-vis those of others, what accounts for children's avoidant responses in the praise situation versus their approach responses toward the loss of exclusive attention in the jealousy situation? Perhaps social praise is less meaningful for children with autism, whereas the parent's attention comprises a more intrinsic need.

On the other hand, if we adopt the more recent view of jealousy presented by Draghi-Lorenz et al. (2001) and supported by Hart's findings (Hart & Carrington, 2002; Hart et al., 2004) about jealousy in very young infants (aged 6 months), jealousy does not necessarily require such complex inferences about the self through another, but does indeed require a certain level of interpersonal awareness. The minimum level would be of primary intersubjectivity, whereby the infant possesses conscious appreciation of the adult's communicative intention and regards that adult as a person (Trevvarthen, 1979), as well as some basic level of social relationship. Infants in Hart's studies reacted with negative affect toward the loss of the mother's attention only in the social situation where the mother cuddled a lifelike doll, and not in the nonsocial scenario where the mother read a book. Moreover, they exhibited an approach response to the mother in the doll condition, in contrast to their avoidance of the mother in the still-face situation. These findings demonstrate a possible link between jealousy and the quality of mother–infant interpersonal interaction and may hint that the infants were attempting to use the mother as a secure base and to regain her attention. This explanation may cautiously imply that even infants with ASD may possess “person awareness” or primary (person–person) intersubjectivity and possibly secondary (person–person–environment) intersubjectivity (Trevvarthen & Aitken, 2001), as may be implied based on their attention-seeking behaviours within the interpersonal context. Perhaps it is possible that jealousy could constitute a signifier for those children with autism who possess higher interpersonal resources.

### **Affective (ER) and cognitive correlates of jealousy**

Our secondary goal was to identify possible affective (ER) and cognitive (IQ) contributors to the explanation of individual differences in the expression of jealousy as well as to examine the extent of the emotional deficit in children with ASD by correlating ER and jealousy. We will first discuss group differences in ER, followed by a discussion on the correlation between ER and jealousy. We will conclude our discussion with the cognitive correlates of jealousy. We assumed that children with ASD would be less responsive to the distressed parent than would typically developing children. We also speculated that IQ would correlate with ER in the ASD group. As for jealousy, our ER hypotheses were only partially supported by study findings. Indeed, in line with former studies (e.g., Bacon et al., 1998; Charman et al., 1997; Corona et al., 1998; Dawson et al., 2004; Dissanayake & Sigman, 2001; Dissnayake et al., 1996; Sigman et al., 1992), the ASD group gazed less at the distressed parent than did the typical controls, however the two groups did not differ on the concern scale. Also, IQ did not significantly correlate with ER measures. Moreover, a quite surprising

finding comprised the relatively high proportion of children with ASD ( $n = 14$ ; 43.75%, versus  $n = 9$ ; 50% in the control group) who demonstrated clear signs of concern or prosocial behaviour (i.e., a score of 3 on the concern scale). This discrepancy with former studies may stem from a methodological difference: Our scenario used parents, whereas in the other studies the experimenter (a stranger) hurt her knee. Children with autism may be more responsive to their parents' distress than to a stranger's. It may also be due to the careful group-matching criteria performed in the current study, matching the groups on both verbal and nonverbal capabilities. On the whole, this discrepancy between the current study's and former studies' outcomes requires further inquiry.

The correlation between ER and jealousy within the ASD group suggested coherence in children's responsiveness capabilities between their ability to express emotion with regard to an event that happened to the self (jealousy) and their ability to do so with regard to an event that happened to a significant other (ER). For the ASD group, ER behaviours toward the distressed parent correlated with several of the jealousy measures, namely, with children's gazes and actions on the jealousy behavioural scale, and also tended to correlate with the explicitness of jealousy. Children who demonstrated ER behaviours, such as giving a toy to the distressed parent or comforting the parent by patting the hurt knee or hugging the parent, also tended to reveal more explicit indices of jealousy, gazed more, and demonstrated more actions in the jealousy situation. Thus, within this group of preschoolers with ASD, jealousy and ER corresponded well: Children who exhibited more ER behaviours also demonstrated clearer indices of jealousy. This may suggest that children with ASD who are better able to express their own emotions are also better at expressing concern toward others. This link should be further examined in future studies.

Interestingly, for both ER and jealousy, ASD children's gaze behaviours were deficient. In the jealousy situation, they gazed more diffusely at the interaction rather than focusing on the parent or the peer, and in the ER situation, they gazed less at the distressed parent compared with typical controls. This provides important information inasmuch as many studies on these children's responsiveness and emotional functioning focus on the coding of their gaze behaviour as a signifier of their responsiveness. We believe that the present findings, in line with these children's documented deficient eye gaze behaviour (DSM-TR-IV; American Psychiatric Association, 2000), call for an expansion of empirical coding scales to tap other more complex behaviours as indices of emotional response when investigating ASD.

Our second possible contributor to the explanation of individual differences in jealousy was children's cognitive capabilities (IQ). The current outcomes highlighted the importance of cognitive capabilities in emotional functioning, especially, for the experience of jealousy. IQ correlated

positively with jealousy explicitness only for the ASD group, indicating that children with ASD who had a higher IQ revealed more explicit expressions of jealousy. This correlation may imply a possible cognitive compensatory mechanism in this clinical group (Hermelin & O'Connor, 1985; Kasari, Chamberlain, & Bauminger, 2001). Alternatively, jealousy may necessitate certain cognitive underpinnings, at least at the average-normative range, corresponding with the typical group's IQ level, thus providing some support for the perception of jealousy as a secondary rather than basic emotion (Salovey, 1991).

### Conclusions and future directions

Two main limitations of our study should be noted. First, this study contained a small number of children in the typical control group, which resulted from difficulties in recruiting typical families to participate in the jealousy situation and then from our implementation of very careful matching criteria that eliminated potential participants. This small sample size may have influenced some study results, mainly the correlation findings. Second, this study lacked another jealousy-provoking situation enacted by a stranger. Inclusion of such a scenario could have clarified the parent's unique importance for the child in the triadic context, to further verify that the child perceived the interpersonal relationship.

Solving the theoretical puzzle concerning the prerequisites of jealousy and its clear implications for the emotional deficit in children with ASD indeed poses a demanding challenge requiring further empirical study. Carefully designed future research is needed to sound out the proposition raised here that jealousy may constitute a very early signifier of children within the autism spectrum who possess greater interpersonal potential. In that regard, the associations found between the expressions of jealousy and of ER in the ASD group again lend support for the identification of children within the ASD spectrum who possess higher and more integral emotional capabilities. The ability for early identification has crucial ramifications for intervention efficacy, to help young children with ASD develop more effective social relationships. Future studies would do well to expand research on expressions of other secondary emotions such as embarrassment as well as to explore the correlations between jealousy and interpersonal relationships (e.g., attachment patterns, friendship) and between jealousy and representational capabilities (e.g., joint attention, theory of mind), to discern more clearly the core of the emotional deficit in autism spectrum disorders.

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