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Explicit and implicit attachment representations in cognitively able school-age children with autism spectrum disorder: A window to their inner world

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Abstract

The few studies available on quality of attachment in school-age children with autism spectrum disorder (ASD) exclusively used questionnaires assessing explicit attachment representations. Thus, in the current study we assessed both explicit and implicit attachment representations in 23 children with ASD (without intellectual disability), 22 with learning disabilities and 27 with typical development aged from 7 to 13 years. A self-reported measure on the quality of attachment to parents and a semi-structured interview were administered to the children. In addition, a developmental assessment of the child including measures of intelligence and social-communication impairment was conducted. Despite the lack of group differences on explicit attachment representations, we found that children with ASD showed higher rates of at-risk self-protective strategies and psychological trauma compared to the TD group. Children with SLD also showed a high level of at-risk implicit attachment representations than TD, albeit to a lesser extent compared to children with ASD. These results may be related to several factors associated with ASD impairment and developmental pathways, such as the atypical learning process which occur at interpersonal level, the difficulties in social information processing and reflective functioning. Our findings suggested that children with ASD may experience difficulties in the construction of balanced implicit attachment representations. Thus, a more comprehensive assessment of attachment including both implicit and explicit representations is recommended.

Keywords

Autism spectrum disorder, attachment, representations, trauma, middle childhood, arousal

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Introduction

According to the original tenets of attachment theory, the relationship with the primary caregiver constitutes not only the core of early social development but also the foundation of future interpersonal experiences (Bowlby, 1969/1982). Although empirical evidence widely supported the basic assumptions posited by attachment theory, several outstanding questions are still enriching the scientific debate on the role of attachment in child development, particularly for specific clinical populations. In this regard, autism spectrum disorders (ASD) constitute one of the most intriguing scenarios in view of the complex interplay between social-communication difficulties and attachment processes (McKenzie and Dallos, 2017).

A recent review by Teague et al., 2017, confirmed that children with ASD (aged 12 or less) showed similar levels of attachment security than their comparison group when they did not present intellectual disabilities. Nevertheless, further examinations are needed to understand how the diagnosis of ASD itself constitutes an independent risk factor for the development of attachment security, regardless of child cognitive abilities. Importantly, previous studies focused almost exclusively on the assessment of attachment relationship during preschool-age. However, as cognitive abilities become more elaborated across development, children internalize their attachment experiences into representational models of self and other (Bowlby, 1969/1982; Bretherton & Munholland, 2008). Following a dual-process theoretical framework (Gawronski & Creighton, 2013), explicit representations are based on strategic processes related to individual perception, whereas implicit representations of self and others are mainly automated and unconscious and guide individuals' behavior in the context of interpersonal relationships and threatening circumstances (Bowlby, 1969/1982, Crittenden, 2015a). The assessment of implicit representations during middle childhood focuses on child ability to recount coherent and balanced memories of their attachment experiences and it is primarily based on observer-rated narratives such as story stems and semi-structured autobiographical interview, as opposed to self-reported measures (Jewell et al., 2019).

In this regard, the developmental perspective of the Dynamic-Maturational Model of attachment and adaptation (DMM; Crittenden, 2006; 2015a) offers the opportunity to tap into school-age children implicit attachment representations underlying attachment pattern considering their cognitive and affective maturing abilities (Farnfield et al., 2010). Building on Ainsworth's ABC classification (A: avoidant; B: secure; C: ambivalent), DMM proposes a dimensional model of information processing underlying a wide array of theoretically grounded self-protective strategies (attachment pattern). It is based on two dimensions: (a) cognition (temporal order information) and (b) affect (intensity of stimulation) which in turn motivate and organize respectively Type A and Type C strategy. The DMM emphasizes the role of danger in organizing individual self-protective attachment strategies and identifies other factors that could interfere with attachment organization, such as psychological trauma or losses and altered arousal (modifiers). According to the DMM, psychological trauma refers to the lack of resolution with respect to specific previous danger associated with current threat, whereas modifiers (e.g.depression) are considered more pervasive conditions that make attachment behaviors ineffective and non-strategic.

Attachment and ASD during school-age: The significance of internal representations

To date, only a very limited number of studies on attachment in school-age children with ASD without intellectual disability have been published in the last decade (Bauminger et al., 2010; Chandler & Dissanayake, 2014; Keenan et al., 2016; Sivaratnam et al., 2018) confirming the lack of group differences in attachment security between children with ASD (without intellectual disability) and matched

typically developing children (TD). However, in one case (Bauminger et al., 2010) quality of mother-child relationship was found to be higher in TD children compared to those with ASD. Therefore, further studies are needed to analyze attachment security in school-age children with ASD also considering the evidence of lower security of attachment in children with other neurodevelopmental disorders, as is the case of children with Specific Learning Disabilities (SLD) (Bauminger and Kimhi-kind, 2008).

Notably, the assessment of attachment in these studies was exclusively based on self-reported questionnaires, which rely on child conscious knowledge and awareness reflecting their explicit representations. Thus, the study of implicit attachment representations in school-age children with ASD has been overlooked (Authors, 2021). In general, it has been suggested integrating multiple sources of information (e.g., both implicit and explicit representations) to comprehensively capture the different core mechanisms that characterize attachment during middle childhood (Bosmans & Kerns, 2015). Consistently, previous studies on attachment and ASD encouraged the use of multimodal research designs also including age-appropriate interviews to overcome the limitations of self-reported measurement (Keenan et al., 2016). Although the biobehavioral system that serves psychobiological attachment functions seems preserved, several mechanisms that characterize ASD condition, may hinder information processing and the development of coherent attachment representations, leading to developmental discontinuity. Starting from infancy, the more frequent non-sequential child-caregiver interactive episodes along with the limited child sensitivity to social cues may result in an atypical learning process (Vivanti & Nuske, 2017). In addition, ASD atypical neurobiological processes and the difficulties in reflective functioning (Sivaratnam et al., 2015, Katznelson et al., 2014) may constitute further risks. Moreover, the frequent exposure to adverse experiences in childhood (Berg et al., 2016) and the higher emotion dysregulation in response to stress (Sivaratnam et al., 2015) may pose further challenges for the development of coherent attachment representations increasing respectively the risk for psychological trauma and arousal alterations. Specifically, it has been suggested that children with ASD showed greater sensitivity to stressful stimuli (Corbett et al., 2006) and higher difficulties in emotion regulation, defined as the ability to modulate one's physiological arousal (related to internal affective changes) to promote an optimal engagement in one's environment (Shields & Cicchetti, 1997). Higher arousal dysregulation in children with ASD may be also influenced by behavioral inhibition, different susceptibility to the positive effect of optimal parenting and the adverse effect of detrimental early environmental circumstances (Sivaratnam et al., 2015). In this regard, also atypical sensory processing has been found to be a characteristic of the ASD diagnosis, impacting different dimensions of child functioning (Dellapiazza et al., 2018). Hence, it could hinder efficient information processing and adaptive learning processes in the context of parent-child relationship. Although there is still a paucity of data, some studies have also highlighted that children with SLD experience more difficulties in regulating their emotions compared to children with TD (Bauminger & Kimhi-Kind, 2008; Kopelman-Rubin, et al., 2021). Notably, the capacity to regulate their own emotional arousal has been linked to effective social information processing, since it can affect the way in which a specific situation is interpreted and evaluated (Lemerise & Arsenio, 2000). For these reasons, the construction of balanced and integrated representations of self and others (cognitive form of attachment) could represent a demanding task for children with ASD and SLD.

Aims and hypotheses

The general purpose of the current study is to investigate attachment organization in a sample of school-age children with ASD without intellectual disability, assessing both explicit and implicit attachment representations. Figure 1

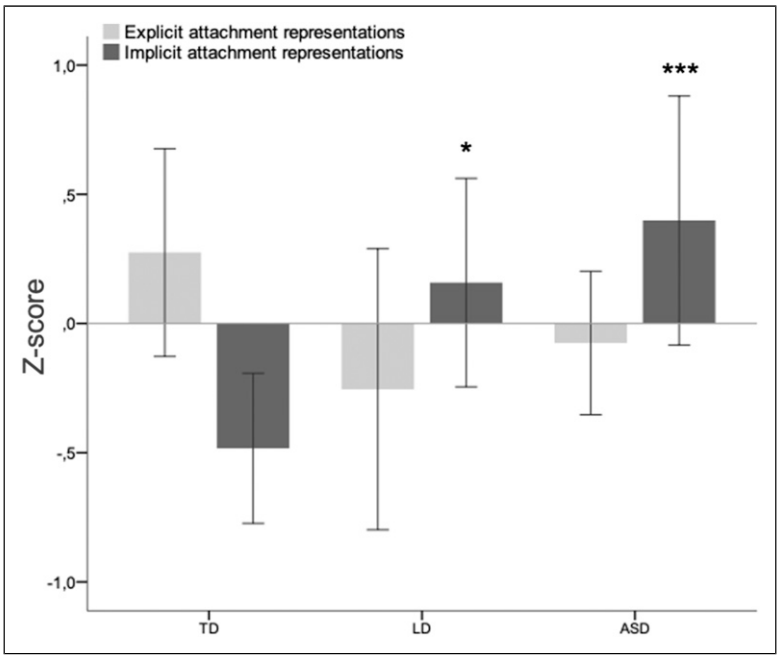

Figure 1. Comparisons of z-converted explicit and implicit attachment representations scores between children with autism spectrum disorder, learning disabilities and typical development.
Confidence Interval 95%; ASD: Autism Spectrum Disorder; LD: Specific Learning Disabilities; TD: Typical Development.

Consistently with previous studies using similar research design (Bauminger-Zviely et al., 2019), we used a multiple group comparison, including children with SLD as clinical control group and TD children as non-clinical control group. In the current study, we tested the following hypothesis:

(H1a) children with ASD without intellectual disability would show no differences in explicit attachment representations (self-reported security of attachment to their parents) compared to children with TD (Chandler & Dissanayake, 2014) and possibly a higher self-reported security compared to children with SLD (Bauminger & Kimhi-Kind, 2008); (H1b) children with ASD would show high risk self-protective strategies and at-risk attachment representations compared to TD children, but not to SLD group. We expect to replicate this result both for categorical self-protective strategies and continuous attachment representations risk in light of the ASD atypical learning process in the context of parent-child relation (Vivanti & Nuske, 2017), the potential neurocognitive difficulties (Sivaratnam et al., 2015) and the previous results in adults (Taylor, Target and Charman, et al., 2018);

(H2a) psychological trauma would be significantly higher in children with ASD compared to the clinical and normative control group considering the high exposure to ACEs among children with ASD (Berg et al., 2016). (H2b): Children with ASD and SLD would show more often markers of altered arousal (modifiers) during the attachment interview compared to the normative control group due to their higher difficulties in regulating emotional arousal in response to stress (Sivaratnam et al., 2015; Kopelman-Rubin et al., 2021).

Table 1. Descriptive statistics of the study variables and group comparisons.

	ASD (n = 23)		SLD (n = 22)		TD (n = 27)		Group comparison		
	M	*SD*	M	*SD*	M	*SD*	F	*Eta*	*p*
Control variables									
Age (months)	124.46	17.38	124.50	16.23	118.44	24.06	1.22	.03	.29
SES	42.02	14.54	38.52	14.42	44.66	14.80	1.11	.03	.33
Nonverbal IQ	.41	.86	.20	.77	.59	.88	.88	.02	.41
Verbal IQ	22.45	4.00	21.73	4.94	22.48	4.67	.17	.01	.94
SRS	76.52	17.14	50.82	9.21	47.30	7.93	42.28	.55	<.001
Explicit representations									
IPPA total	60.58	8.99	58.14	16.77	65.37	13.89	1.95	.05	.15
Trust	41.50	4.79	41.00	6.67	43.67	5.24	1.69	.04	.19
Communication	35.71	5.93	35.91	7.83	37.33	5.,78	.43	.01	.65
Alienation	16.63	3.72	18.77	5.21	15.63	5.36	2.68	.07	.07
Implicit representations									
SAA risk	5.22	2.41	4.45	2.06	3.00	1.66	7.03***	.17	<.01

ASD: Autism Spectrum Disorder; SLD: Specific Learning Disabilities; TD: Typical Development; SES: Socioeconomic Status; IQ: Intelligence Quotient; IPPA: Inventory of Parent and Peer Attachment; SAA: School-age Assessment of Attachment. *p < .05, ** p < .01, ***p < .001.

Method

Participants

We initially contacted 86 families of school-age children aged 7–13 years. 10 families refused to participate in the study (8 of SLD, 2 of ASD, 2 of TD group) and two children with ASD were excluded from the study given their reluctance to complete the semi-structured interview. Thus, the final sample of the current study (N = 72) is composed of 23 children with ASD (without intellectual disabilities), 22 with SLD, 27 with TD. Descriptive statistics are displayed in Table 1. Family Socioeconomic status (SES) has been reported using Hollingshead (1975) index

We only included children who were Italian native speakers and whose mothers were the primary caregiver. Children with intellectual disabilities were excluded from the study. For the TD group, we did not include children with a history of psychiatric disorder and deficits in expressive and receptive language. Also, we excluded from the control groups (TD and SLD) children with significant socio-communicational symptoms using the optimal cut-off of the parent-reported Social Responsiveness Scale 2 (SRS-2; Constantino & Gruber, 2012). Focusing on the target group, all the children received a certified diagnosis of ASD without intellectual disabilities (IQ > 70 based on the Wechsler Intelligence Scale for Children-IV (WISC-IV, Wechsler, 2004), according to the Diagnostic Statistical Manual of Mental Disorder 5th Edition (DSM V; APA, 2013). The ASD diagnosis has been also confirmed using the Autism Diagnostic Observation Schedule (ADOS, Module 3; Lord et al., 2012). With respect to the SLD group, half of the children (50%), have a combination of Specific Learning Disabilities (50%), 45% a diagnosis of Dyslexia and only 5% of Dysgraphia.

Measures

Control variables

ASD severity. We used the parent-reported Social Responsiveness Scale-2 (Constantino & Gruber, 2012), a widely used questionnaire developed to assess child mutual social behavior and restricted and repetitive behaviors, which characterize ASD in children from 4 to 18 years-old. It consists of 65 items on a 4-point Likert-type scale (1 ("never true"); 2 ("sometimes true); 3 (often true); and 4 ("almost always true"). Higher scores on this scale reflect greater child social and communicative difficulties. The SRS-2 generates raw scores which have been converted into T-scores. We used the optimal cut-off point of 84.0 suggested by Aldridge et al., (2012) to identify ASD, using the parent-form of the scale. In the current study, the Italian version of the questionnaire (Zuddas et al., 2010) has been completed by the mother, showing a Cronbach alpha of .88.

Verbal intelligence. For the assessment of children's verbal intelligence we used the Wechsler Intelligence Scale for Children-IV (Wechsler, 2004). Two WISC subtests were used (Similarities and Vocabulary) and summed up to generate a Verbal intelligence Index. For both subtests raw scores were transformed into weighted scores (range 1–19) by using normative values based on age (years and months). The WISC-IV validation has shown an adequate stability of the instrument as well as a satisfactory validity. In the current study, we used the Italian version of the instrument (Orsini et al., 2012), with Cronbach alpha values of .79 (Similarities) and .80 (Vocabulary).

Nonverbal intelligence. We used the Raven Coloured Progressive Matrices (CPM) test (Raven et al., 1962). It is based on figural materials consisting of three series of 12 items which have been found to be appropriate for children with ASD in different age groups (Baron Cohen, 1991). Higher scores reflect greater abilities in perceptual reasoning. Raw scores have been standardized using z scores based on normative values of the Italian validation sample. In our study, we used the Italian version of the instrument for the normative values which has shown adequate psychometric properties (Belacchi et al., 2008)

Attachment variables

Explicit attachment representations. The Inventory of Parent and Peer Attachment (IPPA; Armsden & Greenberg, 1987) is a self-reported questionnaire aimed to assess cognitive and affective dimensions of attachment relationship with parents (IPPA-Par) and close friends (IPPA-Peer). In the current study we only used the section on attachment to parents (IPPA-Par) which included 28 items rated on a 5 points Likert-type scale from 1 = "almost never or never true" to "almost always or always true". The IPPA generates three subscales: a) Trust (10 items, range 10–50), Communication (10 items, range 10–50) and Alienation (8 items, range 8–44). Trust subscale measures the extent to which children are confident that parents understand and respect their desire and emotional needs. IPPA total score is obtained by subtracting Alienation score to the sum of Trust and Communication subscales. The IPPA has been also used to investigate explicit attachment representations in children with ASD (without intellectual disabilities) during middle childhood (Chandler & Dissanayake, 2014). In this study, we used the Italian version (Baiocco et al., 2009) of the questionnaire which have shown acceptable Cronbach alpha values for Total score ($\alpha = .61$), Trust subscale ($\alpha = .74$) and Communication subscale ($\alpha = .67$), while the Alienation subscale revealed low internal consistency ($\alpha = .56$)

Implicit attachment representations. The School-age Assessment of Attachment (SAA; Crittenden, 1997/2005), is a semi-structured clinical interview developed to assess self-protective strategies (patterns of attachment) in children from 6 to 13 years using the DMM (Crittenden, 2015a). The SAA consists of a set of seven cards, which reflects a gradient of increasing age-salient threatening situations that school-age children may frequently face with the aim to elicit children's self-protective strategy through fantasy stories and autobiographical episodes. The SAA is audio recorded and transcribed verbatim including paraverbal communication and relevant non-verbal behaviors. The coding is based on the DMM method of discourse analysis, derived from the Adult Attachment Interview (DMM-AAI; Crittenden & Landini, 2011).Three outcomes were generated: (a) a categorical attachment classification (self-protective strategy); (b) a continuous variable which defines e the degree of risk of attachment representations underlying self-protective organization (SAA risk); (c) dichotomous variable regarding the presence of psychological trauma and unresolved loss (Utr/Ul); (4) a binary variable on signs of altered arousal (modifiers) which make the self-protective strategy ineffective. Studies examining the psychometric properties of this procedure, confirming SAA construct validity and reliability both in clinical and normative groups (Crittenden et al., 2010; 2015). SAA demonstrated higher sensitivity in discriminating high-risk populations from control groups across several domains (Crittenden, 2015b) and it has been already used in single case or multiple case studies on children ASD (Brewerton et al., 2017; Kozlowska et al., 2021).

Due to the small sample size, the wide array of DMM attachment classification was grouped into a two-way (low risk vs. high risk) and a three-way categorization (low risk vs. moderate risk vs. high risk). "Low risk" category included normative pattern (A1-2; B1-5; C1-2) whereas "High Risk" included A3-4 and C3-4 (moderate risk), A5-6 and C5-6 and mixed pattern (A/C) (high risk).

The SAArisk continuous variable was obtained considering: (1) a corresponding score for pattern of attachment following the DMM quasi-linear risk hypothesis (es. B3 = 1; B4-5 = 2; A1-2 = 3 etc...), (2) the presence of Utr/Ul and/or modifier (altered arousal) as additional risk factors. Each unresolved trauma, based on its severity, corresponds to a respective score (low = +1; moderate = +2; severe/intense = +3). Similarly, modifiers were considered by adding/subtracting corresponding scores (e.g. Depression = +2; Reorganization = −3). Two trained clinical psychologists administered the SAA to the participants. All the information about child clinical status that emerged during the interview were removed from the transcript to ensure blind coding. The primary coder examined all the transcripts whereas the secondary coder assigned a classification to 18 interviews (25% of the total sample). The interrater agreement between the two coders was examined by Cohen's k coefficient.

Procedure

Participants in the clinical groups were recruited through two Italian clinical centers for developmental disorders between May 2017 and February 2020. Participation in the study was proposed by clinical psychologists to parents of children with certified ASD or SLD diagnosis who met the inclusion criteria. Children with typical development were recruited using snowball sampling and specific posting flyers in the University area. Parents who accepted to be involved in the study, read, and signed the informed consent, including detailed information on data protection and privacy as well as on the study protocol and purposes. The study was approved by the Ethical Committee of the (masked for review) (IRB: Prot 2017–016).

Data analysis

Firstly, we examined potential differences between groups performing MANOVA with clinical status (ASD, SLD, TD) as a between-group factor and the continuous control variables (child age verbal and nonverbal intelligence, family SES) as within-subjects factors. Potential gender differences between groups were analyzed using the chi-squared test. Variables were considered outside of normal distribution if skewness and kurtosis were between −2 and 2. Correlations among the study variables were examined. For the H1, we performed the ANCOVA and MANCOVA using respectively the IPPA total scores and the IPPA subscales as dependent variables and child clinical status (ASD, SLD, TD) as a factor between groups.

Next, for the H1b, ANCOVA was used to determine potential differences in implicit attachment representations using the SAArisk as dependent variables, using Tukey correction for the post-hoc analysis. To the same purpose, we performed a series of chi-squared test and Fisher exact test to investigate differences between groups on attachment classification, Utr/Ul or modifiers. To perform the chi-squared pairwise multiple comparisons, the adjusted residuals method with z score values were examined (Sharpe, 2015). A more conservative alpha value of 0.01 (z value +/− 2.58) has been adopted, since adjusted standardized residuals were used as a guide to determine what cells might be of interest. Statistical analyses were conducted using IBM SPSS Statistics for Windows, Version 25.0.

Results

Preliminary results

Study samples have been determined considering intellectual abilities (IQ > 70) and severity of social communication symptoms. Skewness or kurtosis of the control variables ranged between 1 and –1 and Box's M test showed that the homogeneity of the assumption of covariance was established (Box's M = 19.8, F = .89, p = .59). No significant group differences emerged on child age, verbal and nonverbal intelligence and family SES (F (4, 138) = .89, p = .53); Wilk's Λ = .87, partial η2 = 0.05) (see Table 1). By contrast, the chi-squared test revealed a marginal statistical significance, χ^2 (2) = 6.12, p = .047, thus, child gender has been considered as a covariate in subsequent analysis. Social-communication difficulties positively correlate with SAArisk (r = 274, p = .021) but not with IPPA (Table 2). With respect to the SAA, the inter-rater agreement between coders was calculated based on attachment classification, showing Cohen's values ranging from .626 (p < .01) to .746 (p < .001). No correlations were found between SAArisk and IPPA (Table 2). One child was excluded from the ANCOVA on implicit attachment representations, since some technical problems occurred while the interview was recorded.

Group comparisons on explicit and implicit attachment representations

Univariate ANCOVA on IPPA Total score as dependent variable revealed no significant group differences (p > .05) adjusted for child gender. Similarly, MANCOVA showed that children with ASD, SLD and TD did not differ on IPPA subscales (Table 1). Focusing on child implicit attachment representations, ANCOVA on SAArisk adjusted for child gender highlighted a significant difference between groups (F (3,71) = 7.03, p <.01) see Table 1). Post-hoc analysis revealed that children with ASD showed higher SAArisk compared to children with TD (p = .001). No significant

Table 2. Correlations among the study variable (total sample, $N = 72$).

	Age	SES	Nonverbal IQ	Verbal IQ	SRS	IPPATot	Trust	Communication	Alienation	SAArisk
Age		−.02	.15	−.24*	.01	−.14	.06	.01	−.18	.10
SES		—	.09	.28*	−.08	−.07	.18	.07	−.25*	.20
Nonverbal IQ			—	.02	−.02	−.11	−.01	.01	−.01	.01
Verbal IQ				—	−.07	.11	.20	.02	−.05	.11
SRS					—	.27*	−.21	−.04	.01	−.11
IPPAtot						—	.84**	.83	−.71**	−.19
Trust							—	.57**	−.46**	−.27*
Communication								—	−.34	−.16
Alienation									—	.01
SAArisk										—

SES: Socioeconomic Status; IQ: Intelligence Quotient; IPPA: Inventory of Parent and Peer Attachment; subscale; SAA: School-age Assessment of Attachment.
*$p < .05$, ** $p < .01$, ***$p < .001$.

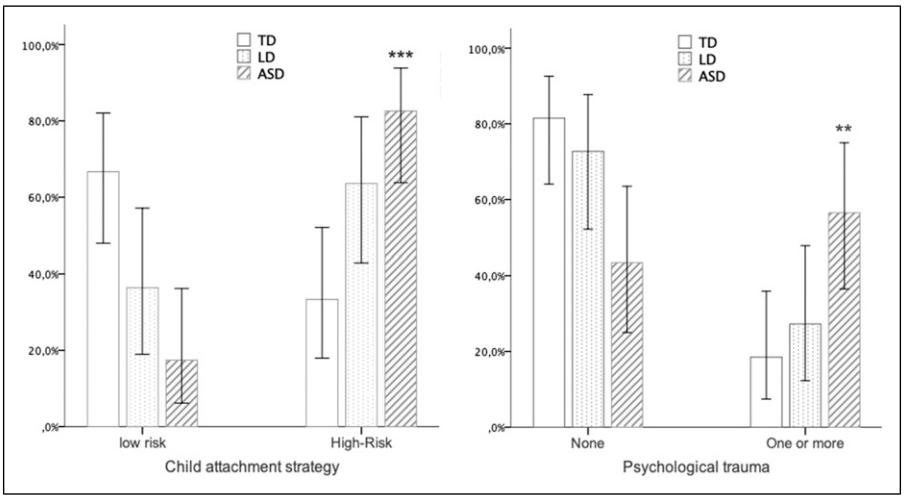

Figure 2. Distribution of attachment strategies (left) and psychological trauma (right) by study subgroups. ASD: Autism Spectrum Disorder; LD: Specific Learning Disabilities; TD: Typical Development;

differences emerged between children of the two clinical groups. Children with SLD also scored significantly higher on SAArisk than typically developing children (p = .04)

With respect to SAA attachment classification, considering the two-way categorization, chi squared test was statistically significant (χ^2 (2) = 12.77, p = .001, Cramer's V= .421) (see Figure 2). Post-hoc analysis using adjusted standardized residuals (z scores) highlighted a noteworthy difference between observed and expected cell counts under the null hypothesis for both ASD group (z = −2.86) and TD group (z = 3.33). Specifically, 82.6% of ASD children show a high-risk attachment pattern (only 13% using secure Type B) compared to 63.6% of the SLD group and 33.3% of typically developing children. On the other hand, by considering the three-way SAA categorization, chi-squared also showed significant results (χ^2 (4) = 13.28, p = .009, Cramer's V= .304). The cells of interest according to adjusted residuals are those related to low-risk classification of ASD group (z = −2.86) and TD group (z = 3.33). Compared to 66.7% of TD children and 36.4% of children with SLD, only 17.4% of children with ASD received a low-risk attachment classification. Distributions of attachment patterns (two-way and three-way categorization) are presented in Figure 2. Focusing on ABC self-protective strategies in the ASD group, we found higher rates (30.4%) of both Type A+ strategies (A3, compulsive caregiving; A4, compliance) and A/C pattern, which consist of a combination of more distorted information and higher dismissing (A+) and coercive (C+) strategies. Moreover, 23.6% of children with ASD has been classified as using a Type C+ attachment strategies (C3, aggressive-feigned helpless; C5-6, punitively obsessed with revenge and/or seductively obsessed with rescue).

Group comparison on psychological trauma and altered arousal

Statistical analyses on the presence of psychological trauma showed significant differences between groups χ^2 (2) = 8.59, p = .014, Cramer's V= .346). Adjusted residuals method highlighted that child with ASD (z = 2.86) showed a higher occurrence of one or more psychological trauma (n = 13, 56.5%) compared to SLD (27.3%) and TD (18.5%) group.

Furthermore, group differences in altered arousal have been found χ^2 (2) = 7.45, p = .024, Cramer's V= .322). Children of the two clinical groups (ASD and SLD) showed higher rates of modifiers (e.g., disorientation or depression) compared to the TD group (z = 2.67). Specifically, we observed the presence of altered arousal in 39.1% of children with ASD and 31.8% of children with SLD compared to 7.4% of typically developing children.

Discussion

To the best of our knowledge, this is the first study to investigate both explicit and implicit attachment representations in school-age children with ASD (without intellectual disability) and to examine self-protective strategies, psychological trauma and altered arousal based on attachment narratives.

Explicit attachment representations

Our findings on child self-reported attachment to parents underlined the lack of group differences, showing that children with ASD perceived their relations with their mothers and fathers in a similar way to the typical development group. The IPPA scores in our three subsamples were comparable with those observed in the Italian validation study of the scale (Baiocco et al., 2009). This result confirms previous metanalytic findings on toddlers and preschoolers with ASD (without developmental delay) based on observational method (Rutgers et al., 2004) as well as the available data on school age children's perception of attachment security to parents (Chandler & Dissanayake, 2014). Nevertheless, some authors have considered IPPA as a scale for the assessment of parent-child quality of relationship instead of a measure of attachment (Bauminger et al., 2010a). Moreover, the use of IPPA in school-age children with ASD has revealed some limitations, since no correlations between child and maternal reports were found (Chandler & Dissanayake, 2014). On the other hand, our hypothesis on children with SLD has not been confirmed. In contrast to previous studies on perceived attachment to parents (Bauminger & Kimhi-Kind, 2008), children with SLD in our sample did not report lower levels of attachment security to their parents compared to TD children. It is plausible that the multiple group comparisons and the small sample size have masked specific group differences in our study.

Implicit attachment representations

Participants with ASD showed more insecure and distorted implicit attachment representations compared to typically developing children. In this regard, our hypothesis has been confirmed, suggesting that the development of balanced implicit representations could be more challenging for children with ASD. Nevertheless, three children with ASD (13%), were classified as securely attached, confirming their ability to develop adaptive self-protective strategies underlying balanced information processing. Interestingly, our findings are consistent with the only study available on attachment representations in ASD (Taylor et al., 2008) which found a similar rate of secure attachment in adulthood (15%). Several mechanisms related to the atypical developmental pathways of children with ASD could offer possible explanations of our findings. In fact, the meaning that children with ASD give to their own attachment experiences may be adversely affected by unusual neural functional connectivity (Crittenden, 2017; Cole et al., 2019) altered neurobiological, neuroendocrine and neurocognitive processes (Sivaratnam et al., 2015) as well as difficulties in sensory processing (Dellapiazza et al., 2018), difficulties in reflective functioning/mentalizing and

metacognitions of ASD (Katznelson et al., 2014) and arousal regulation (Sivaratnam et al., 2015). Moreover, the less sustained positive dyadic exchanges and the frequent mismatches and disruptions in the context of parent-child relationship (Guo et al., 2017), could negatively contribute to the construction of balanced attachment representations. These difficulties could also explain the higher frequency of mixed A/C pattern (30.4%) within the ASD sungroup. This pattern is characterized by sudden (A/C) or subtle (AC) alternation of organized strategic behaviors with the aim to elicit protection and comfort. Since parent-child relationships in ASD can be characterized by a wide array of emotional expressions and alterations along with a lower ability to sustain a continuative pattern of interaction, A/C mixed pattern may reflect the attempt of children with ASD to adapt to ever-changing conditions, recurrent impasses, and the divergent pattern of interactions.

Importantly, the difference we found for explicit and implicit representations, may support the idea that they reflect different processes (Giannotti & de Falco, 2021). Prior research in adults has also highlighted that these distinct processes are associated with different brain activation, although sharing a common network (Yaseen et al., 2016). Furthermore, our findings showed that also children with SLD differ from TD on quality of attachment representations, albeit to a lesser extent compared to children with ASD. This is consistent with previous studies documenting less attachment security and higher difficulties in social information processing in children with SLD compared to TD (Bauminger & Kimhi-Kind, 2008). Despite this difference, our results suggested that the risk of unintegrated and unbalanced implicit attachment representations is higher in children with ASD, decreasing from children with SLD to TD group.

Psychological trauma and altered arousal

Our results indicated a higher rate of psychological trauma in children with ASD compared to TD. In this regard, children showed an excessive preoccupation with a traumatic event (preoccupying) or a denial of feelings dismissing the relevance of the event (dismissing) or both types of lack of resolution concurrently. Notably, one child with ASD of two has been classified as unresolved with respect to specific life events, suggesting that the exposure to potential traumatic circumstances and the subsequent lack of resolution may be frequent in children with ASD. A possible explanation could be ascribable to the higher occurrence of adverse childhood experiences (ACEs) which has been found to be higher in children with ASD (Berg et al., 2016) compared to TD. Consistently, in our sample, we found that psychological traumas were often related to parental issues (e.g., separation and conflict), peer bullying, conflict with peers, illness and hospitalization. It is plausible that the psychological efforts to cope with these negative experiences may be ineffective in these children, not only for the higher exposure to adversity but also for the limited ability to interpret and integrate affective and cognitive representations of dangerous experiences in a meaningful and coherent understanding.

Even though the results were not significant, our data underlined higher rates of altered arousal in both clinical groups. Difficulties in self-regulation and the alternating failure to inhibit negative affect seem to have a detrimental effect on attachment organization, making inefficient attempts to act self-protectively in response to threats and interpersonal demands. The neurobiological and neuroendocrine atypical processes, which may occur in children with ASD and the more frequent arousal dysregulation (Sivaratnam et al., 2015), may partly explain our results for the ASD group. Similarly, sensory hyper- and hypo responsiveness, as a core feature of ASD (Marco et al., 2011), may contribute to the higher rates of altered arousal we found in the context of assessment of attachment. Moreover, following a DMM perspective (Crittenden, 2015a), the poor frustration tolerance in ASD is difficult to reconcile with a compulsive inhibition strategy (Type A) triggering

an intrusion of forbidden negative affect. In addition, the limited ability to recognize the consequences of their own protective behaviors (insensitivity to rewards) could lead to a persistent low arousal marked as "depression" or to a recurrent hyper-activation (disorientation).

With respect to children with SLD, group differences on altered arousal may be explained by previous results highlighting that children with SLD are more likely to show emotion regulation problems than children without SLD (Bauminger & Kimhi-Kind, 2008; Kopelman-Rubin, et al., 2021). This is particularly relevant since the higher risk for experiencing negative affective states (e.g. depression, loneliness) can contribute to inefficient information processing (Bryan et al., 2004).

Limitations and future research

Despite the strengths of the study, several limitations should be acknowledged, thus results should be interpreted with caution. Firstly, the wide age range may constitute a drawback in this research. In addition, the small sample size did not allow to perform more subtle analysis within the ASD group, considering the wide array of DMM self-protective strategies and their association with ASD severity. Despite the sample size was empirically set based on previous studies on this topic, we acknowledged that the low statistical power may have contributed to these results. Group comparison on IPPA Alienation should be also interpreted with caution since a lower internal consistency of the subscale has been found. Our study lacks a measure of child attachment perception rated by parents – hence it has not been possible to test parent-child agreement with respect to the IPPA. Moreover, despite SAA adequate content validity, further investigations with larger samples are needed to widely prove reliability in ASD samples.

Future research should replicate these findings using larger samples and different attachment theoretical approaches and methods. We suggest using longitudinal design to test whether the association between specific child outcomes and quality of attachment. Moreover, longitudinal studies could explore the influence of caregiving environment and child characteristics in predicting attachment organization in middle childhood. In this regard, further studies may examine whether sensory processing difficulties in children with ASD are linked to attachment representations in a significant way. Longitudinal approach may be also useful in testing continuity and stability of attachment across development in children with ASD.

Clinical implications

This study has several clinical implications. Firstly, it emphasizes the need to use a global assessment of attachment in school-age children with ASD, including both implicit and explicit representations. With respect to self-protective organization, both Type A and Type C high-risk strategies and particularly their combination (A/C) are associated with increased risk in terms of psychological distress, emotional regulation, and maladaptive information processing. For these reasons, it is essential to consider their long-term impact on child adaptation and developmental pathways in ASD. Moreover, an additional source of risk for the development of a secure attachment status for children with ASD is the higher occurrence of psychological trauma and altered arousal. Taken together, these factors may interfere with the development of a resolved attachment status of children with ASD, given that past dangerous events may activate traumatic memories affecting individuals' strategic current functioning (Crittenden, 2015a). Thus, a more comprehensive knowledge of attachment organization in school-age children ASD may help professionals in targeting personalized treatment and psychological support for families.

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