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**Attachment in school-age children
with Autism Spectrum Disorder:
moving to the level of representations
to meet their needs**

Supervisor: Professor Simona de Falco

PhD Candidate: Michele Giannotti

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GENERAL INTRODUCTION

During the last decades, a substantial body of research has documented the prominent role of attachment organization for children adaptation and their later social relationships. Despite empirical evidences have widely supported the basic assumptions posited by attachment theory, several outstanding questions are still enriching the scientific debate on the contribution of quality of attachment to child development, particularly in specific clinical populations. One of the most intriguing scenarios concerns the study of attachment in individuals with Autism Spectrum Disorder. In this regard, the original tenets of attachment theory have been questioned in view of the impact of the ASD socio-communicational impairments and child interpersonal relatedness on attachment processes. In fact, the understanding of the complex interplay between ASD symptoms and quality of attachment constitute a remarkable challenge for developmental research. Starting from this impasse, the study of attachment and ASD has yielded to several unsolved issues. The first wave of studies on this topic has demonstrated the ability of children with ASD to form an enduring, selective and affectional bond with their attachment figure. These findings confirmed the preserved ability of children with ASD to develop a secure attachment relationship with their primary caregiver and thus the adaptive nature of human social attachment. Following this direction, Rutgers and colleagues (2004) published the only metanalysis available on autism and attachment reporting that approximately one children with ASD of two showed secure attachment. Importantly, they observed no significant differences in terms of attachment security between children with High-Functioning ASD and matched typical control groups (TD), albeit other studies documented atypical responses of children with ASD in the context of attachment relationship. Nevertheless, the mechanisms through which ASD impairment and security of attachment can coexist remain partially unknown. Similar findings have been put forward again by the most recent systematic review on this topic (Teague et al., 2017). However, the majority of these studies only used attachment observational procedures focusing almost exclusively on the assessment of attachment relationship during preschool-age instead of the investigation of attachment representations in older children. Indeed, although the

prevalence rates of ASD diagnosis in the last decades is tremendously increased, only few studies examine quality of attachment in children with ASD, particularly in middle childhood. Moreover, the difficulties to find an age-appropriate instrument for children with ASD may have hindered empirical research on attachment representations.

On this matter, a specific hypothesis envisages that children with ASD may find it hard to develop secure attachment internal representations. Despite they showed elevated rates of attachment security with respect to attachment relationship during early childhood, the construction of balanced representations of the self, the others and the relational experiences might constitute a conspicuous challenge. These mental schemas may guide individual behaviors in interpersonal and threatening circumstances and can be re-enacted and communicated through the language. Thus, from school-age the assessment of attachment internal representation is largely based on the use of narrative and semi-structured interview. However, only four investigations on school-age children with ASD have been carried out, replicating the finding of no group difference in security of attachment compared to typically developing controls. Nonetheless, these studies only used self-reported questionnaire, providing data on child perception of attachment to the caregiver (explicit conscious representations). Therefore, the investigation of internal models (implicit representations) has been completely overlooked, even though they constitute a salient developmental predictor since attachment is internalized. Furthermore, an additional aspect that increases the complexity of the study of attachment in ASD, is the difficulty to disentangle the ASD symptoms from markers of disorganization, which in fact result overrated in this clinical sample. In general, the lack of studies on this topic keeps open essential questions regarding the role of attachment in ASD, limiting the potential contribution of this construct, especially in terms of clinical application. Particularly, several unaddressed issues should be covered: 1) no studies assessed attachment internal representations in children with ASD; 2) there are only limited information about how caregiving environment and children abilities shapes quality of attachment; 3) few studies investigated the outcomes of having

secure/insecure attachment in ASD and 4) little is known about the influence of traumatic experiences on attachment state of minds in ASD.

For this purposes, the main aim of this dissertation is to address some of these issues looking at attachment representations (both implicit and explicit) in school-age children with ASD without intellectual disability. The general purpose is to explore the inner worlds of children with ASD during middle childhood to shed light on the information processing underlying self-protective organization and attachment strategies. Thus, we used the Dynamic-Maturational Model of attachment and adaptation (DMM; Crittenden, 2015) with the aim: a) to overcome the limited explanatory value of disorganization and b) to consider strategic organization (attachment pattern) as the result of child adaptive efforts to cope with threatening conditions in a specific developmental context. The DMM offers a good differentiation between mild and severe dysfunction and it provide an accurate assessment of attachment risk in clinical samples. According to the DMM perspective, we emphasized the role of adaptation rather than security in order to understand whether insecure attachment could also play a functional role for children adaptation, given the ASD clinical characteristics.

Specifically, this doctoral thesis included four empirical studies on school-age children with High-Functioning ASD, in which attachment representations are considered the central aspect.

In the first study “*Exploring the inner world of children with Autism Spectrum Disorder: an investigation of attachment organization and mental representations during school-age*”, we assessed attachment representations in children with ASD, Learning Disabilities (LD) and Typical development (TD). In particular, we investigated possible group differences on perceived attachment to parents, and for the first time, self-protective strategies and quality of attachment implicit representations. As secondary purpose, we determined whether children with ASD showed higher rates of psychological unresolved trauma compared to clinical and normative control group. Finally, we explored if markers of altered arousal or failed attempts to inhibit negative affect undermined self-protective strategies in children with ASD. After checking group differences on different attachment

outcomes, the Study 2 “*Parenting dimensions and quality of attachment representations in children with ASD*” focused on the caregiving environment and its influence on child attachment implicit representations. To this aim, we assessed parenting stress and parental style in mothers and fathers of children with ASD and TD, examining whether parents of children with ASD differ from those of matched TD group. Potential gender differences were also considered. Secondly, we examined which caregiving environment dimensions contribute significantly in predicting at-risk attachment representations, assessing separately the contribution of maternal and paternal parenting stress and parental interactive social style. To extend this analysis, we also explored whether child age moderates the association between parenting stress and child attachment representations.

Following this direction, in the third study “*Intergenerational transmission of attachment in Autism Spectrum Disorder*” maternal and paternal attachment style were assessed to test the hypothesis of attachment continuity across generations. Firstly, we investigated whether parents of children of ASD reported higher level of attachment-related avoidance/anxiety compared to their TD counterpart. In the second place, the associations between attachment style of both mothers and fathers and quality of child attachment representations was tested, by examining the moderation effect of child ASD diagnosis.

Given the non-significant impact of child diagnosis on child perceived attachment to parents, the Study 4 “*Alexithymia, but not Autism Spectrum Disorder, predicts perceived attachment to parents during school-age*” investigated the role of other potential child attachment predictors. Due higher co-occurrence of ASD and difficulties in identifying, describing and distinguishing one’s own feelings, the predictive effect of alexithymia on child explicit attachment representations was tested. Moreover, we also examined whether children with ASD reported higher level of alexithymia compared to controls.

In sum, this series of studies targets some of the outstanding questions in the field of attachment and ASD, moving from the analysis of attachment relationship to the level of representations according to a developmental perspective. In terms of parenting, the presence of both mothers and fathers in

these studies allows a more detailed description of parental experiences and behaviors as well as of the influence of caregiving environment on child attachment.

Taken together, this work offers an initial overview concerning child attachment representations in school-age children with ASD and their potential predictors and correlates. Interestingly, the distinction between attachment explicit and implicit representations make it possible to capture the complexity of attachment representational processes in a more subtle way. Clinical implications of our findings and directions for future research are discussed. Despite several limitations of these studies need to be considered, this doctoral thesis constitute the first attempt to tap into internal worlds of children with ASD by assessing implicit representations.

Study 1. Exploring the inner world of children with Autism Spectrum Disorder: an investigation of child attachment organization and mental representations during school-age.

1.1. INTRODUCTION

1.1.1. Background

Despite theoretical and empirical work on attachment has been mainly focused on infancy and subsequently on adulthood, several studies highlighted the significance of attachment in middle childhood and its prominent link with child adjustment and adaptation (Granot & Mayseless, 2001). Two decades of research has documented extensive findings on the contribution of attachment to child typical development and psychopathology across the life span (Kerns, 2008; Fearon et al., 2010). However, as opposed to other developmental stages, there is still no agreement among researchers regarding a gold-standard method for the assessment of attachment during middle childhood (Jewell et al., 2019). Despite observational methods are often used (Brumariu et al., 2018), in some cases by adapting standardized procedures designed for infancy or preschool-age, the majority of attachment measures in middle childhood concern the assessment of implicit and explicit representations (Bosmans & Kerns, 2015). In this scenario, we can consider three different types of assessment methods: a) self-reported measures (e.g. Armsden & Greenberg, 1987; Kerns, Keplac & Cole, 1996; b) story stem procedure (e.g. Cassidy, 1990; Green et al., 2000) and c) and semi-projective (Crittenden, 1997/2005) or autobiographical interview (Steele and Steele, 2000; Target, Fonagy & Samuel-Goetzi, 2008). Nevertheless, the first systematic review examining the validity and reliability of these measures has revealed non-optimal adequacy in terms of psychometric properties (Jewell et al., 2019) for the vast majority of the instrument reviewed. Importantly, the differences in assessment approaches also reflect discrepant theoretical underpinnings and latent constructs through which attachment during middle childhood is conceptualized. For instance, some measures refer to attachment as the quality of relationship whereas others define it as a specific characteristic of the child. In this regard, some authors emphasized the need to use both implicit (automatic) and explicit

(strategic) measures of attachment representations in future research to provide a better understanding of this phenomenon (Boisman & Kerns, 2015). In this regard, the lack of a common framework may be connected to the key features of this specific developmental transition. In fact, school-age is characterized by unique critical changes, including attachment internalization (Thompson & Raikes, 2003), which may render more difficult to comprehensively capture the complexity of attachment construct. These problems are reflected also in the assessment of attachment in school-age children with Autism Spectrum Disorder, in which the impact of socio-communicational impairment on attachment dynamics make it even more challenging. In fact, despite some hypothesis have been put forward, the analysis of attachment role in ASD has generated several contradictions limiting its understanding and clinical utility.

1.1.1.1 Attachment security in children with ASD

The study of attachment in individuals with ASD is considered particularly puzzling given the tangled interplay between socio-communicational impairment, attachment needs. In fact, that primary relationship with the caregiver constitute not only the core of early social environment but also the foundation of future interpersonal experiences (Bowlby, 1969/1982). However, to date, the fascinating debate focused on whether or not ASD condition challenge the validity of attachment theory (van IJzendoorn et al., 2007) has not received sufficient attention. In fact, the study of individual differences in attachment organization of children with ASD seems to revealed more impasses compared to what is already be documented for other clinical populations.

At the beginning, the vast majority of earlier studies investigated the ability of children with ASD to form an enduring affectional bond with a specific caregiver by observing the quality of attachment behaviors during separation episodes. These studies stem from the outdated theory (Rutter, 1978) according to which ASD children may not be able to develop a discriminated attachment relationship with specific adult figures. To disconfirm this, the first wave of research on attachment and ASD showed that these children are capable to form a significant attachment relationship, displaying

increased protest and distress to the separation (Sigman & Mundy, 1989; Capps, Sigman & Mundy, 1994; Dissanayake & Crossley, 1996) as well as more proximity and maintenance to the reunion (Buitelaar, 1995; Dissanayake & Crossley, 1997). In addition, the ability to form a selective affectional relationship was confirmed by several studies in which children with ASD has demonstrated a clear preference for their caregiver over a stranger during stressful conditions (Sigman, Mundy, Sherman & Ungerer, 1984). Indeed, a substantial body of research supported these earlier findings concerning ASD interpersonal selectivity, considered as an essential characteristic of attachment bond. In particular, normative emotional, behavioral and brain responses to familiar vs unfamiliar faces (Nuske, Vivanti & Dissanayake, 2014; Pierce & Redcay, 2008) were found across development, including school-age (Pierce, Haist, Sedaghat, Courchesne, 2004). Therefore, the socio-communicational impairment of ASD does not preclude the possibility to form an attachment relationship with a specific selective figure with the aim to receive protection, comfort and a secure from which explore the environment.

Nevertheless, other studies highlighted the presence of unusual responses in the context of assessment of attachment such as less prosocial and proximity seeking behaviors, and more resistance (Rogers et al., 1993; Grzadzinski et al., 2014). This complementary area of research reported that children with ASD showed atypical behavioral repertoires in terms of mutual relational exchanges (eye contact, smile etc...) (Dissanayake & Crossley, 1997), psychophysiological responses (Naber, 2006) and pattern of vocalization in the context of the Strange Situation (Esposito et al., 2013).

Nowadays, one metanalysis (Rutgers al., 2004) has been published that investigate whether or not the rates of attachment security in children with ASD are similar to those of matched control groups. This meta-analytic review includes 16 articles (N= 287) with study designs, control groups, type of ASD diagnosis and attachment classification which change across studies. The results underlined that children with ASD were less likely to show secure attachment to their caregiver compared to the control groups with a moderate combined effect size ($r = .24$). Despite this significant difference, the percentage of children with ASD classified as securely attached according to SSP categorization ($n =$

72), amount to 53%. Recently, Teague and colleagues (2017) extended the results of the previous meta-analysis with an update systematic review of ASD and attachment literature. By adding three studies, they found that 47% of children with ASD (n = 186) were classified as secure (Type B) using the Strange Situation Procedure. In light of these data and previous research (Rutgers et al., 2007) there is a substantial evidence of the significant differences in rates of attachment security between children with ASD and normative, or non-ASD developmental disabilities population. However, two crucial factors seems to moderate this group differences: severity of ASD symptoms and the intellectual disability (Rutgers et al., 2004). Importantly, according to earlier meta-analysis the most recent review (Teague, 2017) showed that children with ASD without intellectual disabilities as well as with lower socio-communication symptoms did not differ from controls group. However, further examinations are needed to understand how this two moderators affect attachment processes in ASD and the extent to which the presence of ASD diagnosis constitute an independent risk factor for the development of attachment security, regardless of the severity of symptoms. In addition, it is still unclear the way in which this two child characteristics may influence the construction of secure attachment mental representations from early school-age.

1.1.1.2. Attachment and ASD in school-age children

Although attachment in young children with Autism spectrum disorders has been widely investigated, particularly on preschool-age (ASD) only few studies focused on attachment organization in this clinical population during middle childhood. Four studies (Bauminger, Solomon & Rogers, 2010a; 2010b; Chandler e Dissanayake, 2014; Keenan, Newman, Gray & Rinrhart, 2016; Sivaratnam, Newman & Rinehart, 2018) have explored quality of attachment in children with ASD (without intellectual disability) showing in most cases no significant differences with typically developing children. However, these studies only used self-reported measures overlooking child's implicit internal representations, which constitutes an essential component of assessment of attachment since early school age. Specifically, the cross-cultural study of Bauminger and colleagues (2010a)

examined the quality of mother-child attachment relationship in a sample of 77 children, (45 with ASD, 32 TD) from United States and Israeli (age 8-12). The groups were matched on child age and gender, maternal education and verbal intelligence. Two different self-reported measurements were used to assess child's security of attachment to the mother: the Kerns Security Scale (KSS; Kerns et al., 1996) and the Inventory of Parent and Peer Attachment (IPPA; Armsden & Greenberg, 1987). Significant associations were found between the two questionnaires in both study groups (ASD, TD). By considering also IPPA subscales (Trust, Communication and Alienation), correlations between the two instruments ranged from .42 to .75 ($p < .01$). Whereas, results from this study are mixed regarding group differences on perceived attachment to parent. A significant effect of child diagnosis was found on IPPA subscales, except for Alienation, $F_{(3,75)} = 4.97$, $p < .01$, with ASD children reporting higher scores in comparison with TD. However, the results of the KSS highlighted different results. Using the cut-off score of KSS (Kerns et al., 1996), 54% of the children with ASD were classified as securely attached versus 71% of TD group. Nevertheless, no differences emerged on this measure of attachment in accordance with the chi-squared test. This result was in line with previous findings on young security of attachment in children with ASD (without intellectual disability) (Rutgers et al, 2004). Yet, the significant differences on IPPA represent a contradictory finding, despite the authors refers to this questionnaire as a measure of quality of mother-child relationship instead of attachment security. The same research group (Bauminger, Solomon & Rogers, 2010b) used IPPA-R and KSS scores to test attachment contribution to the understanding of children internalizing and externalizing symptoms (I-E) assessed by the Child Behavior Checklist (CBCL; Achenbach, 1991). However, despite the robust theoretical assumption and the prior empirical evidences (Siller & Sigman; 2002; Fearon et al., 2010) attachment security does not emerged as a significant predictor of internalizing and externalizing behaviors for both KSS and IPPA-R. Only in the case of children with high verbal IQ (considering the median of the sample), a more secure relationship with the mother was associated with fewer I-E. behavioral problems.

In addition, Chandler and Dissanayake (2014) conducted the second investigation on security of attachment in children with ASD (without intellectual disabilities) with a sample of 38 males (21 ASD, 17 TD) aged between 8 and 12 years old. Firstly, the aim of this study was to test differences in security of attachment to the primary caregiver between children with ASD versus TD. The secondary purpose was to investigate the correspondence between parent and child reports on the same attachment questionnaires. Consistently with the previous study, it is based on KSS and IPPA rather than observational procedures or semi-structured interviews. In this case, mothers also completed the same questionnaires from the child perspective. The group matching included child chronological age, parental age, education, employment and household income, whereas analysis were controlled for child mental age. Starting from KSS, no differences between groups emerged for both total score, $F_{(1,35)} = 0.10$, $p = .75$, and subscales (dependency and availability), $F_{(2, 34)} = 0.68$, $p = .51$. The results also showed non-significant differences on KSS parental reports with respect to total attachment ratings, $F_{(1,35)} = 0.47$, $p = .50$, and the two dependent variables, $F_{(2, 34)} = 0.14$, $p = .87$. The same results is also replicated on IPPA-R, given that child ratings did not differ between ASD and TD group, considering both the global score, $F_{(1,35)} = 0.22$, $p = .64$, and the subscales, $F_{(1,33)} = .38$, $p = .77$. Again, there are no significant differences between parental ratings between the clinical and control group, $t(36) = 1.90$, $p = .065$, whilst the result revealed a trend that approached significance. With respect to the parent-child agreement, child and parental ratings moderately correlate on KSS total scores, $r = .39$, $p = .08$, but not on IPPA, $r = .02$, $p = .92$. This inconsistent result regarding parent-child reports accordance raised questions about the impact of social desirability and limited child self-awareness and reflection. Moreover, the way in which children and parent interpret the questions may have affecting the item ratings. In general, this study confirms no differences between groups in the security of attachment to their caregivers; thus, both children with ASD (without intellectual disabilities) and their parents, reported similar scores compared to TD group.

Furthermore, the most recent study on ASD and attachment during school-age (Sivaratnam et al., 2018) aimed at examining the link between attachment security, executive functioning and theory of mind. Children completed both the KSS and the Attachment Style Classification Questionnaire (ASCQ; Finzi, Cohen, Sapir & Weizman, 2000), a 15-item self-reported measures designed to assess perception of security in close relationship, including peers, which yield to two main subscales (attachment avoidance and anxiety). According to the previous studies (Bauminger, 2010a, Chandler & Dissanayake, 2014; Keenan et al., 2016) no significant differences were found in security of attachment between High-Functioning ASD and TD group. Despite both measures (KSS, ASCQ) corroborated these results, the authors suggested to interpret these data with caution due to the limited sample size (26 ASD vs 27 TD) and statistical power. Surprisingly, did not emerge a significant association among security of attachment assessed by KSS and attachment dimensions (avoidance and anxiety) with the performance on theory of mind and emotion recognition. In this regard, given the well-established limitations of self-reported measures in detecting subtle individual differences, the authors encourages the use of more in-depth qualitative methods such as observation or semi-structured interview.

1.1.2. Attachment representations and ASD: in search of the missing piece

1.1.2.1. The development of attachment representations

According to a developmental perspective, the internalization of dyadic experiences into a representational system occurs during childhood, becoming more elaborated as language ability increase (Bowlby, 1969/1982; Marvin & Bitner, 1999; Bretherton and Munholland, 2008). This transition lead to the construction of a cognitive form of attachment (Kraemer, 1992) which includes internal representations originally defined as internal working models (IWM; Bowlby, 1969/1982; Bretherthon, 1985). Indeed, children develop complementary models of the self and the others based on past and current experiences with the attachment figures. These models refers to interpersonal expectations, self-beliefs, perspective-taking and relational schemas that are strictly connected to

information surrounding the self, the others and the environment (Thompson, 2008). In this respect, Crittenden (2015) extended the definition of IWM by proposing the construct of multiple Dispositional Representations (DRs). This concept, borrowed by Damasio (1996), defines the neurological pattern that guide individual to act self-protectively in threatening and interpersonal circumstances. These representations does not necessarily reflect the actual circumstances in an accurate way, resulting in distorted information processing (Crittenden, 2006). Alternatively, when children are able to co-construct a coherent organization through an external correspondence of their own internal attachment emotions and needs, they are more likely to develop a secure state of mind. Importantly, along with attachment internalization, school age introduces several cognitive and social changes, which are developmentally determined. For instance, children develop the ability to discriminate between their own and other's mental states and goals simultaneously, understanding how they may differ. In addition, child self-awareness metacognition and flexibility improve child's understanding of emotional cues and relational context (Kerns, 2008). According to Bowlby definition of "goal-corrected partnership" (1969), child capability to negotiate with the adult given his/her confidence in reciprocal understanding, constitutes a crucial developmental change in the relationship with the attachment figure. In this way, physical separation should be more tolerable by the child who is more focused on caregiver's psychological availability. Thus, parental hierarchical control gives way to more symmetrical mutual co-regulation. Furthermore, this age-related step also enables the child to extend their social context, through the prominent contribution of peer relationship on child adjustment and adaptation as well as the impact of extra-familial adult figures (Goodvin, Meyer, Thompson & Hayes, 2008).

1.1.2.2. Attachment representations and ASD: what we know and what we still need to learn

As previously mentioned, the majority of the research on this topic is focused on younger children with ASD, leading to a tremendous gap in the literature on attachment and ASD during school-age, adolescence and adulthood. The few studies available on middle childhood confirms metanalytic

findings showing no differences between groups in attachment security when children have higher mental development and/or less severity of socio-communication symptoms. However, the literature on ASD and attachment in school age has completely leave out the investigation attachment representations and states of mind. To date, only one exploratory study on adults with ASD (Taylor, Target & Charman, 2018) has investigated group differences in attachment status assessing implicit internal representations. To this purpose, the authors used the *Adult Attachment Interview* (AAI; George, Kaplan & Main, 1984/1996), the golden standard method for the assessment of attachment in adulthood. The sample consisted of twenty adults with High Functioning ASD aged from 19 to 60 and 20 matched controls. In the first place, results showed that individual with ASD are able to engage with AAI producing classifiable transcripts. Surprisingly, only three of the 20 participants with ASD (15%) were classified as secure, which is inconsistent with attachment rates documented by ASD literature on toddlerhood, preschool-age and middle childhood. On the other hand, this data confirmed the possibility for ASD population to develop secure attachment status also at implicit representational level, albeit with a lesser extent compared to the control group. The level of reflective functioning in adults with ASD was significantly lower compared to the control group. Additionally, the rate of attachment security in this study is similar to those of other clinical samples as highlighted by previous metanalytic findings (van IJzendoorn & Bakermans-Kranenburg, 1996).

In light of these assumptions, there are several reasons to investigate the role of attachment representations in children with ASD (without intellectual disability). Firstly, attachment status based on internal representations is strongly associated with individual ability of mentalizing which is defined as “the capacity to understand ourselves and others in terms of intentional mental states, such as feelings, desires, wishes, attitudes, and goals” (Luyten & Fonagy, 2015, pp. 366). Given the complexity of interpersonal dynamics, mentalizing play a fundamental role in social interactions, with particular reference to attachment relationship (Frith and Frith, 2006; Fonagy & Bateman, 2016). Attachment research operationalized the construct of mentalizing as Reflective functioning (RF) which leads the way to an extensive body of research in the last few decades. Similarly, in the context

of ASD and developmental theory, a similar set of abilities is more commonly known as “theory of mind” (ToM). Despite there is a substantial overlap between the two definitions, some authors highlighted how specific tasks used to measure ToM in ASD did not reflect the flexible and active nature of mentalization as is the case of RF (Taylor et al., 2008). In this regard, it is widely documented that children and adult with ASD have more difficulties in developing the ability to understand other people as individual with different feelings, reasoning, intentions and perceptions. Some authors proposed that impaired mentalizing might represents one of the core cognitive shortcomings related to the ASD socio-communicational difficulties (Baron-Cohen, Leslie & Frith, 1985). As is the case of attachment, children with ASD (without intellectual disability) tend to adopt more often cognitive strategies in order to compensate their difficulties in the understanding of self and other mental states (Baron-Choen, 2000; Frith & Happè, 1994). Due to the considerable link between mentalizing and attachment representations, some authors suggested that ASD inability to infer and interpret their own and other’s people intentions, emotional signals and thoughts might affect the construction of internal working models (Rogers, Ozonoff, Maslin-Cole, 1993). The socio-communicational impairment related to the lack of interpersonal relatedness (Cortina & Liotti, 2010) does not inhibit the formation of attachment relationship with a selective caregiver (Rutgers et al., 2004). Nevertheless, it is conceivable that the impaired intersubjectivity may jeopardize the development of balanced and coherent attachment representations. As reported by Chandler and Dissanayake (2014) the psychobiological form of attachment, related to the drive of safety and physical proximity is preserved. Whereas the formation of a cognitive form of attachment (Kraemer, 1992) which include internal representation may be more challenging for children with ASD. Therefore, despite the biobehavioral system that serve psychobiological attachment functions is maintained, the transition to middle childhood within which attachment internalization is completed may lead to developmental discontinuities (Ammaniti, Van IJzendoorn, Speranza & Tambelli, 2000). Additionally, starting from infancy the more frequent non-sequential child-caregiver interactive episodes along with the limited child sensitivity to social cues and rewards (Vivanti & Nuske, 2017)

could make more difficult for the dyad to interpret and understand each other intentions, goals, feelings, and needs. Another aspect to take into consideration is the tendency of children with ASD to adopt a behavioral rather than an intersubjective perspective to give meaning to caregiver's actions (Baron Cohen, 1989; Stern, 2004). Moreover, the atypical learning process related to less sustained positive dyadic interactive exchanges (Guo et al., 2017) could negatively contribute to the construction of coherent (secure) internal representations. Hence, the development of balanced and integrated models of the self and others may represent a demanding task for these children increasing the risk of maladjustment.

In sum, in the case of ASD developmental pathways, optimal parent-child relationship as well as an efficient information processing may be hindered by: a) child unusual brain structure and functional neurological connectivity (Crittenden, 2017; Cole, Barraclough & Andrews, 2019); b) atypical neuroendocrine processes and dysregulation (Naber, 2006; Sivaratnam, Newman, Tonge & Rinehart, 2015; Saxbe et al., 2017); c) hypo or hyper-sensitivity to sensory stimulation (Marco, Hinkley, Hill & Nagarajan, 2011) and difficulties in multisensory integration (Stevenson et al., 2014), d) abnormal arousal self-regulation (Dawson & Lewy, 1989) and e) impairment of mentalizing/reflective functioning (Baron-Cohen, 1997; Taylor, Target & Charman, 2008) more frequent mismatches and disruptions in the context of parent-child interactions (van Ijzendoorn et al., 2007; Guo et al., 2017). Moreover, an additional source of risk for the development of a secure attachment status for children with ASD is the frequent exposure to potential traumatic experiences. Berg et al., (2016), revealed a significant elevated association between ASD condition and the Adverse Childhood Experiences (ACEs). Specifically, children with ASD showed higher rates of income insufficiency, parental divorce/separation, and exposure to neighborhood violence and household mental illness compared to controls. Research has also highlighted that experience of bullying is 3-4 times more frequent for children with ASD compared to typical development population (Hoover and Kaufman et al., 2018). These factors may hamper the development of a resolved attachment status given that children with ASD are asked to make a greater psychological effort to cope with these dangerous circumstances.

Taken together, these theoretical models and empirical evidences have made clear the importance to investigate attachment representations in children with ASD. However, looking at the previous research on attachment and ASD in school age, none of the studies assessed implicit mental representations, which remain a crucial missing piece in the puzzling scenario of ASD and attachment.

1.1.3. Aims and hypothesis

The primary study aims are: a) to examine the relationship between ASD symptoms severity and quality of explicit and implicit attachment representations; b) to test potential differences among children with ASD, Learning Disabilities and Typical development in child's perception of attachment security to their parents; c) to investigate possible group differences on self-protective strategies and quality of attachment implicit representations using an age-appropriate semi-structured interview based on the *Dynamic-Maturation Model of attachment and adaptation* (DMM; Crittenden, 2015). This study also include children with Learning Disabilities as a comparison group, because recent investigation focused on children social information processing used similar research design (Bauminger-Zviely et al., 2019). Moreover, a series of studies documented that children with LD reported low level of attachment security compared to their typical counterpart (Al Yagon & Mikulincer, 2004; Bauminger & Kimhi-Kind, 2008). Thus, it could be interesting to compare both clinical populations to extend the knowledge on attachment and neurodevelopment.

In addition, the secondary purposes of this study are: d) to determine whether children with ASD showed higher rates of unresolved trauma compared to clinical and normative control group; e) to assess if self-protective strategies in children with ASD are undermined by markers of altered arousal or failed attempts to inhibit negative affect. Thus, in the current study, we tested the following hypothesis:

H1: Socio-communication abilities would show a moderate association with attachment continuous measures both for self-reported security (Inventory of Parents and Peer attachment; IPPA) and for

implicit representation (SAA risk). This association has been documented by attachment research focused on ASD (Teague et al., 2017).

H2a: Based on previous study on early childhood (Rutgers et al., 2004) and school-age (Chandler and Dissanayake, 2014) children with Autism Spectrum Disorder would show no differences in self-reported security of attachment to their parents compared to children with Typical Development using the self-report measure (IPPA). Conversely, we expected that children with school-age children with LD differ from TD group as highlighted by prior research (Al Yagon & Mikulincer, 2004; Bauminger & Kimhi-Kind, 2008).

H2b: According to previous results on adulthood (Taylor et al., 2008) and the documented ASD impairment on theory of mind (Rogers et al., 1993; Baron-Cohen, 1997), attachment representations of children with ASD would be more often classified with at-risk self-protective attachment strategies underlying distortion of information processing compared to typically developing children. We expect to replicate this result both for SAA continuous and categorical variables.

H3a: The presence of psychological unresolved trauma and losses (Utr; UI) would be significantly higher in children with ASD compared to the clinical and normative control group (Learning Disabilities and Typical Development). Due to the ASD higher exposure to challenging experiences (Berg et al., 2016) and sensory processing difficulties (Marco et al., 2011) the ineffective psychological efforts to cope with dangerous events and/or threatening experiences of children with ASD would reveal a lack of resolution with respect to specific event or issues.

H3b: ASD group would show more often markers of Modifiers during the attachment interview compared to clinical and normative control group. Given the difficulties in arousal self-regulation (Dawson & Lewy, 1989) persistent low (depression), high arousal (disorientation) or the alternating failure to inhibit negative affect may render the self-protective organization non-strategic reflecting the inability of ASD children to protect themselves effectively.

1.2. MATERIALS AND METHOD

1.2.1. Participants

We initially contacted 79 families, of which 10 families refused to participate in the study (8 of LD, 2 of ASD, 2 of TD group). In addition, two ASD children were excluded from the study given their reluctance to complete the semi-structured interview. Thus, our final sample (N=65) is composed by 21 children with High-Functioning Autism Spectrum Disorder (HFASD), 20 with Learning Disabilities (LD) and 24 with Typical Development (TD) and their mothers. The majority of the participants involved in this study were males, (n = 44; 67.7% of the total sample), particularly in the ASD group (n = 18; 85.7%). Whereas, both TD and LD group comprised 9 girls and respectively 15 (55%) and 11 (62.5%) boys. We recruited a lower number of girls due to the significantly higher prevalence of Autism Spectrum Disorder among boys compared to girls (Christensen, 2018). All the children of the target group had a certified clinical diagnosis of Autism Spectrum Disorder without intellectual disabilities (IQ greater than 70), based on clinical judgment according to the *Diagnostic Statistical Manual of Mental Disorder 5th Edition* (DSM V; American Psychological Association, 2013). We also administered the Autism Diagnostic Observation Schedule (ADOS, Module 3; Lord et al., 2002) to confirm diagnosis in ASD children. Similarly, LD group includes children who had a certified clinical diagnosis of Learning Disabilities (Dyslexia, Dysgraphia and Dyscalculia) using DSM V (APA, 2013). In addition, children of TD and LD group were screened for socio-communicational symptoms using the Social Responsiveness Scale (SRS; Constantino & Gruber, 2012). Children age in this study ranged from 7 to 13 years (M = 122.9, SD = 20.3). We only included children who were Italian native speakers and whose mothers were the primary caregiver. Children with intellectual disabilities, severe impairment of cognitive functioning and deficits in expressive and receptive language were excluded from the study. For the TD group, we did not include children with a history of psychiatric disorder. In general, we also excluded families in which there was an ongoing separation between parents. Only the target group includes one child with a divorced single

mother. Descriptive statistics, including age, gender, verbal, non-verbal intelligence and family socioeconomic status for each sample subgroup are displayed in Table 1.

1.2.2. Procedure

1.2.2.1. Recruitment

Participants in the clinical groups were recruited through the Observation, Diagnosis and Education Lab, Department of Psychology, University of Trento and the Centro Medico Riabilitativo Pompei (Naples) between May 2017 and January 2019. Participation in the study was proposed by clinical psychologists of the aforementioned Centers to parents of children with certified ASD or LD diagnosis who met the inclusion criteria. Specifically, clinical psychologists briefly clarified the aims and methodology of the study. Parents who were interested to participate authorized the research staff to contact them by phone to provide detailed information and schedule an appointment. Children with typical development were recruited using snowball sampling and specific posting flyers in the University area. For parents of TD children who voluntarily decided to receive more information about the research project an appointment was scheduled.

1.2.2.2. Informed consent and ethical approval

Participants in all groups read a detailed informative form, which explained the specific purposes, methods, and the different phases of the study protocol, including the information about data protection and privacy. After having read this form, parents who accepted to be involved in the study, read and signed the informed consent along with the form for the protection of personal data. A specific part of this form focused on child consent to participate in research activities and required the signatures of both parents. In general, both the child and the parents were informed they could interrupt or drop out at any time and without any obligation to give prior communication.

This procedure has been accomplished according to the EU General Data Protection Regulation (GDPR) n. 2016/679. This study was given ethical approval by the Ethic Committee on Experiments involving human beings of the University of Trento.

1.2.2.3. Data collection

Before starting the data collection, inclusion and exclusion criteria were verified both for clinical and control groups. Then, participant families were contacted by phone to participate to the two study visits. During the first study visit, we administered to the child two core subtests of the *Wechsler Scale of Intelligence for Children* (WISC-IV; Wechsler, 2004) which composed the Verbal Comprehension Index: Similarities (SI) and Vocabulary (VC) and the Raven Colored Progressive Matrix (CPM; Raven, Raven & Court, 1962). During the first study visit, mothers completed a brief questionnaire for the Socioeconomic Status index (SES; Hollingshead, 1975) and the Social Responsiveness Scale (SRS). Fathers also participated to one of the two study visits for a complementary data collection, which will be discussed in the next chapter. The second visit occurred after 2 weeks at latest and was focused on the administration of a semi-structured interview to the child, the *School-age Assessment of Attachment* (SAA; Crittenden 1997/2005). At the end of the interview, the experimenter gave a short break (5 minutes) to the child, before asking him/her to complete a brief self-reported questionnaire, *the Inventory of Parent and Peer Attachment* (IPPA; Arnsden and Greenberg, 1987). In case of young children (from 7 to 8 years) or reading difficulties, particularly for children with dyslexia or LD group, the experimenter read the questions using a neutral approach so as not to influence the child's responses. The visits took place in a quiet room at the abovementioned clinical Centers that was familiar to the participants in the clinical groups. TD children were visited at home in most of the cases in order to assess them in a familiar setting but 16% were tested at the clinical Center based on family preference. For children in the clinical groups ADOS (for children with ASD only) and WISC-IV (for children with ASD or LD) data were gathered

using child clinical records if the assessment was conducted in the previous 10 months, otherwise, children were newly evaluated.

1.2.3. Measures (Control variables)

1.2.3.1. The *Autism Diagnostic Observation Schedule-2* (ADOS-2; Lord et al., 2012). is the gold standard assessment for the diagnosis of Autism Spectrum Disorder. Four different modules based on child's level of receptive language compose the instrument. In our study we used the Module 3, Italian version (Colombi, Tancredi, Persico & Faggioli, 2013), which is more appropriate for more verbally fluent children and young adolescents (up to 16 years). This module consists of 14 activities (e.g. joint interactive play, telling a story from a book etc...) and 29 coded items related to the two ADOS domains: Social affect (SA) and Restricted and Repetitive Behavior (RRB).

The ADOS-2 module 3 tasks consist of specific standardized or unstructured situations aimed to elicit social, interpersonal behaviors, linguistic and non-verbal communication. A trained and certified examiner who is directly involved during the procedure, administers and codes the ADOS protocol. By observing child responses and behavior during the unstructured tasks, the examiner can determine whether the child is able to initiate and continue a social interaction. By contrast, when the situations is structured with specific tasks and requests to the child, the ability of the child to respond to specific social stimuli is assessed. In this way, this standardized tool allows to collect information about child spontaneous and formal non-verbal communication and language. Specific markers were coded during the informed assessment for each module related to a) Language e communication, (b) mutual social interaction, (c) play and imagination; (d) write stereotyped and restricted interests. Altogether, the codes allow generating a diagnostic algorithm. The ADOS-2 improved the accuracy of diagnostic algorithms compared to the previous version. In school-age children with ASD, a negative association was found between social impairment and verbal ability (Klin et al., 2007). With respect to statistical adequacy, ADOS-2 has demonstrated good psychometric properties, both in terms of validity (construct, content and predictive) and reliability. Specifically, internal consistencies (Cronbach α)

for modules 1 to 3 were high for the SA domain (.87-.92) and moderate for the domain RRB (.51-.66) (Lord et al., 2012).

1.2.3.2. The Social Responsiveness Scale-2 (Constantino & Gruber, 2012) is a rating scale developed to quantitatively assess child mutual social behavior and restricted and repetitive behaviors, which characterize Autism Spectrum Disorder 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”)) and it can be completed by caregivers (teacher and/or parents etc...) who are familiar with both child history of development and current functioning. SRS is widely used as a screening tool for socio-communicational impairment and requires approximately 15 minutes to be filled out. It is also used to distinguish between ASD and other neuroatypical conditions and psychiatric disorder. With respect to the interpretation, a total score was generated from the items sum to indicate the degree of social impairment. Using the specific profile sheet, which is different for teacher and parents, the scoring procedure allows to transform raw data into T scores. In addition, SRS scores are obtained for five subscales are: 1) Social Awareness; 2) Social Cognition; 3) Social Communication; 4) Social Motivation and 5) Restricted Interests and Repetitive Behavior.

SRS includes two separate profile sheets based on child/adolescent gender (female, male).

Several studies using large samples have documented the psychometric properties of the SRS showing positive results in terms of validity (Constantino & Todd, 2003) and both short and long-term reliability. In this study, the mother as a primary caregiver completed the Italian version of the questionnaire (Zuddas et al., 2010). The SRS scores were used to screen children with typical development and Learning Disabilities for socio-communicational impairment. To this purpose, in order to minimize the rate of false positive we used the optimal cut-off point of 84.0 (T score) suggested by Aldridge, Gibbs, Schimdhofner and Williams (2012) to identify ASD using the parent-form of the SRS (specificity = .85; sensitivity = .64). Despite the original cut-off is significantly lower (T score of 64), the optimal threshold proposed by Aldridge and colleagues (2012), may decrease the

possibility to overestimate the social impairment in our sample providing a more accurate percentage of children who are correctly identified as not having an ASD condition. In addition, this optimal cut-off is recommended for SRS reported by parents, as is the case of the present study.

1.2.3.3. The Wechsler Intelligence Scale for Children-IV (Wechsler, 2004), is the most widely used standardized tool in the field of developmental psychological assessment. It is designed to evaluate cognitive abilities in children aged between 6 years and 0 months and 16 years and 11 months. This revision include numerous changes to the structure and content compared to the previous version of the scale (WISC-III), with the aim to increase the validity of the tool. The WISC-IV consist of 10 core subtests, which yield to four subtests index (Verbal Comprehension, Perceptual Reasoning, Working Memory, and Processing Speed) and a Full scale (Child Intelligence Quotient; IQ). Each index include specific subtest as follows: Verbal Comprehension Index (VCI): Similarities, Vocabulary, and Comprehension subtests; Perceptual Reasoning Index (PRI): Block Design, Picture Concepts, and Matrix Reasoning Subtests; Working Memory Index (WMI) comprised Digit Span and Coding subtests; Processing Speed Index (PSI): Letter-Number Sequencing and Symbol Search subtests. As regards to the administration and scoring, the examiners should follow specific instruction and guidelines, which change across subtests considering child age and abilities.

In order to improve the accuracy of the results, this scale include specific tables to raw-weighted scores conversion that are divided into 4 months groups. The WISC-IV has demonstrated high internal consistencies for the full IQ scale, and across subtest or age groups. The WISC-IV validation study have also shown an adequate stability over time of the instrument as well as a satisfactory structure validity.

In the current study, the Italian version was used (Orsini, Pezzuti & Picone, 2012) with an administration time of 65-80 minutes. Moreover, we considered a Full IQ score > 70 as inclusion criteria for ASD, with the aim to include only children without intellectual disabilities. Additionally, according to the methodology and aims of this research, we selected two WISC core subscales of

Verbal Comprehension Index (VCI), (Similarities and Vocabulary) as control variables. Similarities (SIM) provide an estimation of child verbal abstract reasoning and the level of concept formation. This core subtest also involve language development, lexical knowledge, auditory comprehension, memory and the ability to discriminate between essential and non-essential features. Child is asked to explain a crucial similarity of the two words that describes two common concepts or objects. Vocabulary (VOC) offers a measure of child lexical knowledge and the formation of verbal concepts. During this core subtest, child should provide a correct definition of a series of specific words read by the examiner. As well as other core subtest, Similarities and Vocabulary have specific age-appropriate starting point. According to the validity studies with clinical groups, ASD children without intellectual disabilities show no clinically significant delays in language and intelligence within the average range (Kaufman, Flanagan, Alfonso & Moscolo, 2006).

1.2.3.4. The Raven Coloured Progressive Matrices (CPM) test (Raven, Raven and Court, 1962) is a widely recognized individual non-verbal assessment of children intelligence based on figural materials. Specifically CPM Raven evaluates non-verbal perceptual and inductive reasoning in children from 3 to 11 years-old independently from the culture or cognitive impairment. They consist of three series, of 12 items developed to measure the main characteristic processes of this age group. Each item requires completing a partial figure choosing the missing piece among 6 figures. According to a criterion of increasing difficulty, the model figures include graphic themes that change from left to right and from top to bottom; hence the subject should understand the underlying logic to complete the figures. A general score was calculated by adding the correct answers to provide an overall performance level. We converted raw data into z scores to prevent the risk of biased comparisons among children of different age group.

Literature has confirmed that Raven CPM are an appropriate method to be used with ASD children in different age groups (Baron Cohen, 1991). In our study, we used the Italian version of the

instrument for the normative values (Belacchi et al., 2008). The administration time required approximately 40 minutes.

1.2.3.5. The Four Factor Index of Socioeconomic Status (SES, Hollingshead, 1975), is a widely used index of individual or family socioeconomic status in psychological science. It is based on two scores: 1) the educational score which is measured through a 7 point scale, from 7 = graduate/professional training (the highest grade) to 1= primary school; 2), the occupation score that evaluates the type of job (prestige and income) using a 9 points scale, from 9 = higher executive, proprietor of large businesses, major professional to 1= arm laborers, menial service workers, students, housewives, (dependent on welfare, no regular occupation). For the calculation of the SES Hollingshead index we transform raw data into weighted scores using a specific algorithm then we added maternal and paternal scores. In cases where both parents are employed an average of the sum of the two scores was considered. Whereas if one parent is unemployed only the partner score was take into account to generate the SES index. The possible SES index range is 8-66. An extensive body of literature has documented the association between Socioeconomic status, parenting (Roubinov, 2017) and child typical and atypical development (Borstein & Bradley, 2003), including Autism Spectrum Disorder (Larsson et al., 2005).

1.2.4. Measures (Dependent variables)

1.2.4.1. The Inventory of Parent and Peer Attachment (IPPA; Armsden & Greenberg, 1987) is a self-reported questionnaire aimed to assess cognitive and affective (positive and negative) dimensions of child/adolescent attachment relationship with parents (IPPA-Par) and close friends (IPPA-Peer). In particular, this scale provides information about how these crucial figures are perceived by the child as a source of psychological security. IPPA-Par and IPPA-Peer include respectively 28 and 25 item rated on a 5 point Likert-type scale from 1= “almost never or never true” to “almost always or always true”. Previous analysis focused on IPPA construct validity confirmed a three-factor model

supporting the presence of three broad dimension for both forms of the questionnaire: a) Trust, b) Communication and c) Alienation.

a) *Trust* subscale measures the extent to which children are confident that parents or peer understand and respect their desire and emotional needs. Positive scores on this scale might reflect a conditions in which child perceive the attachment relationship as characterized by a mutual understanding. An example item is “When we discuss things, my parents cares about my point of view”.

b) *Communication* indicates the extent and quality of verbal communication with the attachment figures. An example item is “My parents helps me to talk about my difficulties”.

c) *Alienation* refers to the feelings of alienation, isolation and the extent of anger associated albeit the need to be closer to others could be recognized. An example item is “Talking over my problems with my parents makes me feel ashamed or foolish”. In addition, Total scores was generated for both forms of the questionnaire by subtracting Alienation score to the sum of Trust and Communication subscales. IPPA is scored by summing the response values for each subscale and reverse item with a negative direction, according to the Manual instructions (Armsden and Greenberg, 1987).

Several studies have supported the psychometric properties of the IPPA for both parents and peer form, highlighting a satisfactory reliability and validity. In particular overall internal consistencies in children sample (aged 9-11 years) range from .78 to .82 for IPPA-parents and from .69 to .87 for IPPA-peer (Gullone & Robinson, 2005). Armsden and Greenberg (1987) reported a three-week test-reliability with a correlation of .86 for attachment to peer and .93 for attachment to parents. Similarly, regarding convergent validity, positive correlations were found between IPPA scores and other questionnaire focused on similar or related construct as is the case of the Self-Esteem Inventory ($r = .51, p < .001$) and the subscales Parental Bonding Instrument (Care, $r = .73, p < .001$; Overprotection, $r = .51, p < .01$) (McCarthy, Moller & Fouladi, 2001; Gullone et al., 2005). The original psychometric investigation (Armsden and Greenberg, 1987) also provided adequate item-total correlations for each IPPA subscales. In general, the psychometric soundness of this instrument is widely confirmed across

studies with different age groups, also in the Italian context (Baiocco, Laghi & Paola et al., 2009; San Martini, Zavattini & Ronconi, 2009).

Moreover, a substantial body of literature has documented the significant link between IPPA and wide range of child/adolescent outcomes such as quality of family environment (Armsden & Greenberg, 1987, Sternberg et al., 2005), parenting style (van Ingen et al., 2015) psychological symptoms (Costa & Weems 2005), internalizing and externalizing problems (de Vries et al., 2016; Gorrese, 2016), life satisfaction and psychological well-being (Laghi et al., 2016), cell phone use (Lepp, Li, Berkley et al., 2016) and bullying involvement (Murphy, Laible, Augustine, 2017).

IPPA was also used to investigate perception of the security of attachment in children with Autism Spectrum Disorder (without intellectual disabilities) during middle childhood (Bauminger et al., 2010; Chandler and Dissanayake, 2014). Bauminger et al., (2010) reported IPPA internal consistencies with Cronbach alpha value ranging from $\alpha = .65$ for Alienation to $\alpha = .87$ for the overall score. In addition, these studies involved 8 years-old children confirmed the possibility to successfully administer and use this questionnaire with younger children, even in the case of High-Functioning Autism Spectrum Disorder.

Some authors (Baiocco, Laghi & Paola, 2009) pointed out the lack of clarity concerning the convergence of the IPPA scale, and more generally for the self-report questionnaires, with traditional attachment measures focused on attachment behaviors or states of mind. This open debate still raises questions about IPPA content validity given yielding to critical conceptual issues. For instance, attachment construct is sometimes considered as an equivalent of other related concepts (e.g. quality of relationship) and hence was misused. On the other hand, IPPA is a simple and reliable instrument (Jewell et al., 2019), easy to administer and score, which require around 10-15 minutes to be completed. After two years from its first publication, IPPA authors developed a revised version of the questionnaire (Gullone & Robison, 2005) including three distinct forms (Maternal, Paternal, Peer) with the aim to separately assess child's attachment to mother and father.

Due to research design and aims, for the current study we used the original version of the IPPA to have a unique measure of attachment security to the parental figures. Additionally, we choose the 5-point Likert type scale rather than the 3-point scale (as suggested for the revised version). In this regard, according to the previous study that used IPPA with ASD children (Chandler and Dissanayake, 2014), the 5-point Likert type scale was preferred to avoid lack of variability in the study. In the current research, we used the Italian version IPPA that have demonstrated adequate internal consistencies for both subscales (from .83 to .84) and total score (.93). However, the authors suggest considering the total score of the questionnaire as a more reliable dimension compared to the three subscales in accordance with the factorial structure (Baiocco et al., 2009).

1.2.4.2. The School-age Assessment of Attachment (SAA; Crittenden, 1997/2005) is a semi-structured clinical interview developed to assess patterns of attachment in children from six to thirteen years using the Dynamic Maturational Model of Attachment and Adaptation (Crittenden, 2015). According to the DMM, patterns of attachment are also defined as self-protective strategies which underlying information processing concerning danger and interpersonal relationships. A crucial assumption is that unprotected exposure to dangerous or threatening circumstances increases the risk of maladaptive information processing leading to the organization of extreme self-protective strategies (Crittenden, 2006). SAA consists of a set of seven picture cards, which represent potential threatening situations that school-age children may frequently face. These figures serve as stimuli to activate different types of dispositional representations (DRs, Damasio, 1994), described as the neurological patterns, which predispose children to behave adopting particular responses. The event related to the seven cards are: 1) the child going out alone; 2) being left when a best friend play with other children; 3) moving house; 4) being bullied; 5) the child's father leaving the home; 6) the child running away and 7) the child's mother is going to the hospital with the ambulance. Two distinct versions of the cards are used for females and males. The pictures on the card are very simple (black and white) in a way that limits the possibility of distractibility and overstimulation. The order of the seven cards reflects a gradient

of increasing age-salient threat with the aim to elicit specific self-protective strategy through fantasy stories and recall episodes. According to the memory system theory (Tulving, 1985), child mental representations related to of experiences of protection and comfort with the attachment figures in case of danger and threat can be: a) implicit/non-verbal (procedural, somatic, sensory); b) explicit/verbal (semantic, evocative/denotative, verbalized bodily states); c) integrative, which includes particular recalled episodes and reflections.

Firstly, the interviewer asks the child to invent a story based on the picture card and then to tell a recalled episode on the same topic related to his/her own personal experience. Moreover, the interviewer makes also use of additional questions to investigate the type of representations the child tend to systematically avoid or prefer. On one hand, some additional questions examine how the child use information related to temporal order, causality and contingencies (cognitive information). Whereas, on the other side the main interest is to explore feelings and emotions related to the self and the others. In addition, the interviewer may pose reflective questions that require the integration and balance of both affective and cognitive information. However, these types of questions are used only few times during the interview given that they require a greater effort and can be perceived as too demanding by the child. At the end of the procedure, the child is asked to rank the cards giving a score from one to ten based on how dangerous he/she perceived that figure/event. Before the conclusion, in order to re-establish a condition of baseline after the stressful task the interviewer asks the child to tell a happy moment with the family to close the procedure in a positive way.

A certified trained professional who is familiar with the basic assumption of the DMM should administer this interview. SAA is audio recorded and transcribed verbatim including paraverbal communication and relevant non-verbal behaviors, which are annotated by the interviewer during the procedure. The coding is perform by reliable coders (who have no additional information about the child) and it is based on the DMM method of discourse analysis. This method, derived from the Adult Attachment Interview (AAI; Crittenden & Landini, 2011), has been modified to consider the current and emergent abilities that characterized school-age, in order to be consistent with individual

maturational level. The transcript was analyzed to yield one of the 13 classifications available according the DMM during school-age along with possible unresolved trauma or losses and modifiers such as depression or reorganization.

Specifically, the SAA coding lead to the following different measures: a) a categorical measure based on the assigned developmentally attachment classification (self-protective strategy) which underlies specific information processing ; 2) a continuous attachment risk measure (with or without trauma and modifiers) which define the degree of the risk of the attachment classification; 3) a dichotomous variable regarding the presence of unresolved trauma with respect to dangerous experiences or events; 4) a binary variable which describe the presence of a modifier (altered arousal) which make the self-protective strategy ineffective. The wide array of DMM attachment (13 for school-age) classification can be grouped into several categorical variables. In this study, due to the small sample size we used a two (low risk high risk) and three-way risk categorization (low risk, moderate risk, high risk). “Low risk” category include secure and low-index pattern (A1-2; B1-5; C1-2) whereas “High Risk” include A3-4 and C3-4 (moderate), pre A5-6 and C5-6 and mixed pattern (A/C) (high).

Despite the SAA is newly developed clinical tool, recent studies have examined the validity and reliability of this procedure, finding encouraging results. In particular, a research by Crittenden, Kozlowska & Landini (2010) confirm SAA construct validity showing positive correlation between “Total Exposure to danger” and attachment strategy ($r = .62, p < .01$), psychological trauma ($r = .55, p < .01$) and modifiers ($r = .40, p < .001$) in a sample of clinical and normative population (mean age 9.5 years). ANOVA confirms the association between exposure to danger, attachment ($F_{1,87} = 8.37, p < .005$) and unresolved trauma $F_{1,87} = 7.63, p < .007$). These associations have been also supported cross-culturally by other studies assessing attachment using SAA and exposure to danger in Australia, Europe and US (Kozlowksa et al., 2009; Kwako, Noll, Putnam, & Trickett, 2010; Crittenden, Robson & Tooby, 2015). SAA also discriminate among referral and psychiatric children, clinical and normative sample (accounting for 31% of the variance) and children at risk within the normative group. Inter-rater agreement among three blind coders was calculated on the whole DMM set of

attachment strategies (13 classifications) ranging from $k = .57$ to $.58$, $p < .001$. Moreover, all the types of attachment classification, psychological unresolved trauma and modifiers were assigned at least once, except for disorientation in the first validation study (Crittenden et al., 2010). Validity of SAA is also supported by a recent short-term longitudinal investigation (Crittenden, Robson and Tooby, 2015) which examined the matching between Preschool-Assessment of Attachment (PAA; Crittenden; 2007) and SAA classifications. This study revealed additional evidences that A1-2 and C1-2 were similar to B pattern, which in turn can be considered within a normative cluster. Although the small sample size, SAA correspondence with PAA and was replicated in long-term longitudinal study (8 years later) in moderate-risk adolescent. According with prior research, this study confirm Associations between SAA classification and parenting and family variables (Kidwell et al., 2015). Conversely, the convergence with a validated attachment self-report measurement was poor especially in children with high-risk status. This discrepancy confirms the limitations of attachment questionnaires in distinguishing children at higher risk from typical developing groups. On the other hand, SAA has demonstrate higher sensitivity in discriminating high-risk populations from control groups across several domains (e.g. psychiatric condition, sexual abuse, psychosomatic disorders) (Kozłowska & Williams, 2011; Kozłowska, & Elliott, 2017; Kozłowska et al., 2015; Kwako et al., 2010).

The SAA clinical utility is bases on its focus on child strategy (rather than disorder) which may shed light on the function of child attachment behaviors, family processes and interpersonal meaning of specific dysfunction as highlighted in clinical case studies (Crittenden & Kulbotten, 2007; Kozłowska et al., 2011; Crittenden, Landini, Kozłowska, 2015; Brewerton, Robson & Crittenden, 2017)

In the current study, two trained psychologists individually administered the SAA in a private quiet room. Next, the transcripts were sent to two reliable blind coders without any additional information about child history of development (past and current diagnosis). All the information about child clinical status that emerged during the interview were removed from the transcript to ensure blind coding. According the SAA instructions, we de-identifying child name and all the personal relevant

information to safeguard participants' privacy. The primary coder examined all the transcripts whereas the secondary coder assigned a classification to 18 interviews (27% of the total sample). Before testing the study hypothesis, the SAA classification was grouped into categorical variables using respectively a two-way (low risk vs high risk), three way (low risk vs moderate risk vs high risk-mixed pattern) and a four-way categorization (Type A, Type B, Type C, mixed A/C). In addition, we also computed two continuous variables from the SAA classification. Each pattern of attachment correspond to a specific score according to the DMM quasi-linear risk hypothesis (es. B3=1; B4-5=2; A1-2=3 etc...). The first SAA risk -continuous variable (SAA ABCrisk) only includes the risk associated with the attachment classification whereas the second (SAA ABCrisk +trauma risk) was obtained by adding also the presence of unresolved psychological trauma/loss and/or modifier (altered arousal) as additional risk factors. Each unresolved trauma, based on the specific severity of the type, correspond to a respective score (low= +1; moderate = +2; severe/intense = +3). Similarly, the presence of specific modifier was considered to compute SAA ABCrisk +trauma risk variable by adding/subtracting corresponding scores (e.g. Depression = + 2; Reorganization = - 3). The interrater agreement between the two coders was examined by Cohen's *k* coefficient.

1.2.5. Data analysis

Before testing the study hypotheses, we conducted preliminary analyses of the data to analyze sample characteristics and group matching. Specifically, we considered SRS, ADOS and WISC-IV scores to ensure correct group assignment of the participants based on our inclusion criteria. Next, with respect to the group matching, we tested potential differences between groups performing a Multivariate Analysis of Variance (MANOVA) with group (Autism Spectrum Disorder, Learning Disabilities and Typical Development) as between-group factor and the continuous control variables (chronological age, Socioeconomic Status, WISC Similarities and Vocabulary and Raven CPM scores) as within subjects factors. Possible gender differences between the three groups were analyzed using the *chi-squared* test. Moreover, to screen for possible covariates we analyzed associations between the

control and the dependent variables. Given that the SRS continuous variable and IPPA total scores are not normally distributed, we used Spearman correlation coefficients. In addition, given the wide age range in the study sample we used a two-level age categorization (lower or greater than 125 months) to analyze potential differences on the dependent variables (IPPA, SAA) based on child chronological age.

We, reported descriptive statistics of the data including the classifications of attachment representations derived by the SAA. After checking normality of the distribution, we standardized the variables with elevated skewness and kurtosis and outliers were removed from further analysis.

Firstly, we tested the first hypothesis of an association between socio-communicational responsiveness and quality of attachment explicit and implicit representations. To this aim, a correlational analysis was performed (Spearman coefficient) including SRS and both attachment outcomes (IPPA total Score and SAA continuous variable).

In order to examine our second hypothesis concerning differences between groups on the perception of child attachment security with parents, we conducted a Multivariate Analysis of Covariance (MANCOVA). We standardized all the dependent variables prior to test the following study hypothesis. We performed a Multivariate Analysis of the Covariance (MANCOVA) using the IPPA total scores and the three subscales (Trust, Communication and Alienation) as dependent variables maintaining child diagnostic status (ASD, LD, TD) as factor between groups.

Next, to test the third hypothesis, a similar analysis (ANCOVA) was used to determine potential differences in attachment representations using the SAA risk continuous scores as dependent variables. We used Tukey correction as post-hoc multiple comparisons between groups.

To the same purpose, we performed a series of chi-squared test or Fisher exact test to investigate differences between groups in terms of attachment organization using both two-way and three-way classification, the presence of psychological unresolved trauma and or a modifier of the attachment prominent strategy. To perform chi-squared pairwise multiple comparisons, z scores (adjusted residuals) with values equal or greater than 1.96, associated with $\alpha < .05$, were considered significant.

Due to the small sample size, we used the magnitude of the residuals to observe which cases might of interests without performing a more conservative Bonferroni adjustment (Sharp, 2015). Analysis were conducted using IBM SPSS Statistics for Windows, Version 22.0.

Table A. Descriptive and inferential statistics of dependent variables for the two age groups (lower or greater than 125 months)

Variable	Age Group (N= 65)					
	< 125 months (n = 33)		> 125 months (n = 32)		Test	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>
IPPA Total Score	60.21	12.83	62.50	14.99	-.66	.51
IPPA Trust	41.55	5.89	42.34	5.71	-.55	.58
IPPA Communication	36.45	5.84	36.56	7.27	-.06	.94
IPPA Alienation	17.79	5.12	16.41	4.91	1.10	.27
SAA risk + Utr	4.39	2.52	3.84	2.05	.963	.33

1.3. RESULTS

1.3.1. Preliminary results

The group matching including child control variables and family SES revealed no significant differences between groups (see Table 1). In addition, chi-squared test using for the gender group matching highlighted only a marginal trend toward significance $\chi^2_{(2)} = 5.09, p = .082$. For this reason, child gender has been considered as covariates in the statistical analysis. With respect to the SAA, we tested the inter-rater agreement between the primary (AL) and secondary (VP) blind coder. The coder agreement was calculated for all the SAA variables (two-way, three-way) showing Cohen's values ranging from .626 ($p < .01$) to .746 ($p < .001$). Moreover, no significant differences emerged on the IPPA total score/subscales and SAA risk continuous variables between the two child-age categories (lower or greater than 125 months; see Table A).

Table 1 Descriptive statistics of the control variables for the three study groups

Variable	Group (N = 65)						<i>F</i>	<i>Eta</i>	<i>p</i>
	ASD (n = 21)		LD (n = 20)		TD (n = 24)				
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Age (months)	126.43	16.45	126.75	15.12	116.21	24.60	2.05	.059	.183
SES ^b	43.52	13.79	38.52	14.42	45.68	14.97	1.41	.050	.238
Perceptual Reasoning ^a	.52	.80	.19	.81	.67	.76	1.46	.055	.207
Verbal IQ ^b	22.45	4.58	21.73	4.94	22.79	4.87	4.12	.012	.722

Note: ^a z scores; ^b weighted scores.

SES: Socioeconomic Status; ASD: Autism Spectrum Disorder; LD: Learning Disabilities; TD: Typical Development

Correlations among dependent and control variables are displayed in Table 2. Spearman correlations among attachment variables (both for self-reported measurement and semi-structured interview) and child intelligence (perceptual reasoning, vocabulary, verbal abstract reasoning,) were not significant (see Table 2), whereas IPPA Alienation and family SES were negatively associated ($r = -.332$, $p = .007$) though at a marginal significance level.

1.3.2. Descriptive statistics

Descriptive statistics, including age, verbal, non-verbal intelligence and family socioeconomic status for each sample subgroup are displayed in Table 1.

None of the participants of the control groups exceeded the SRS optimal cut-off (> 84) used in the current study to screen LD and TD children for socio-communicational symptoms. ASD diagnosis was confirmed by trained clinicians and ADOS total score ($M = 9.65$; $SD = 3.8$) as well as an IQ > 70 in this clinical population. With respect to the clinical control group, the majority of LD children (50%) have a combination of Specific Learning Disabilities (50%), 45% received a diagnosis of Dyslexia and only 5% of Dysgraphia. The mean of the SES index in our total sample was 42.56 ($SD = 14.51$) which correspond to the middle-higher class of the Italian validation of Hollingshead scale. Notably, only three children (15.8%) of children with ASD were classified as securely attached

compared to 25% of LD group and 41.7% of TD group. An overview of SAA classification distribution is presented in Table 5.

Table 2 Spearman correlations among dependent variables and control variables considering the total sample (N= 65)

Dependent Variables	Control variables				
	Age	Family SES ^b	Perceptual Reasoning	Verbal IQ	SRS ^b
IPPA Total Score	.148	.229	.081	.115	-.217
IPPA Trust	.104	.161	.088	.189	-.299*
IPPA Communication	.20	.032	-.007	.008	.006
IPPA Alienation	-.206	-.332**	-.140	-.088	.119
SAA risk + Utr	-.133	.39	-.167	.105	.277*

Note: ^a z scores; ^b weighted scores. * $p < .05$; ** $p < .01$;

SES: Socioeconomic Status; CPM Raven: perceptual reasoning; WISC VC: Vocabulary; WISC SIM: Verbal abstract reasoning; SRS: Social Responsiveness Scale; IPPA: Inventory of Parent and Peer Attachment; SAA: School-age Assessment of Attachment

Table 3 Cross-tabulations of SAA self-protective strategies distribution across the three groups
SAA Classification (%)

Group	A+	A1-2	B	C1-2	C+	A/C
TD (n = 24)	8.3	8.3	41.7	16.7	25.0	-
LD (n = 20)	20.0	10.0	25.0	5.00	35.0	5.0
ASD (n= 21)	30.0	0.00	15.0	5.00	20.0	30.0
Total (N= 65)	18.8	6.3	28.1	9.4	26.6	10.9

Note: SAA: School-age Assessment of Attachment; TD: Typical Development; LD: Learning Disabilities; ASD: Autism Spectrum Disorder.

1.3.3. Main Results

1.3.3.1. Associations between child socio-communicational difficulties and attachment explicit and implicit representations

For the correlational analysis, including the association between SRS score and attachment variables on the total sample see Table 2. After removing three outliers, child socio-communicational difficulties correlates positively with SAA + Utr risk ($r = .269$, $p = .036$) and negatively with IPPA trust ($r = -.324$, $p = .011$). Conversely, the correlation between IPPA total scores and child social responsiveness reported by the primary caregiver only showed a marginal significant tendency ($r = -.250$, $p = .052$).

1.3.3.2. Group differences in perceived attachment to parents

We examined the potential difference between groups in attachment security via self-reported questionnaire using both standardized IPPA Total score and IPPA subscales. Multivariate Analysis of Covariance (ANCOVA), with group as factor between subjects and IPPA Total score and subscales as dependent variables, revealed no significant group differences. Results showed that children with ASD do not differ from LD and TD group on reported Trust, Communication and Alienation to their parents (see Figure 1).

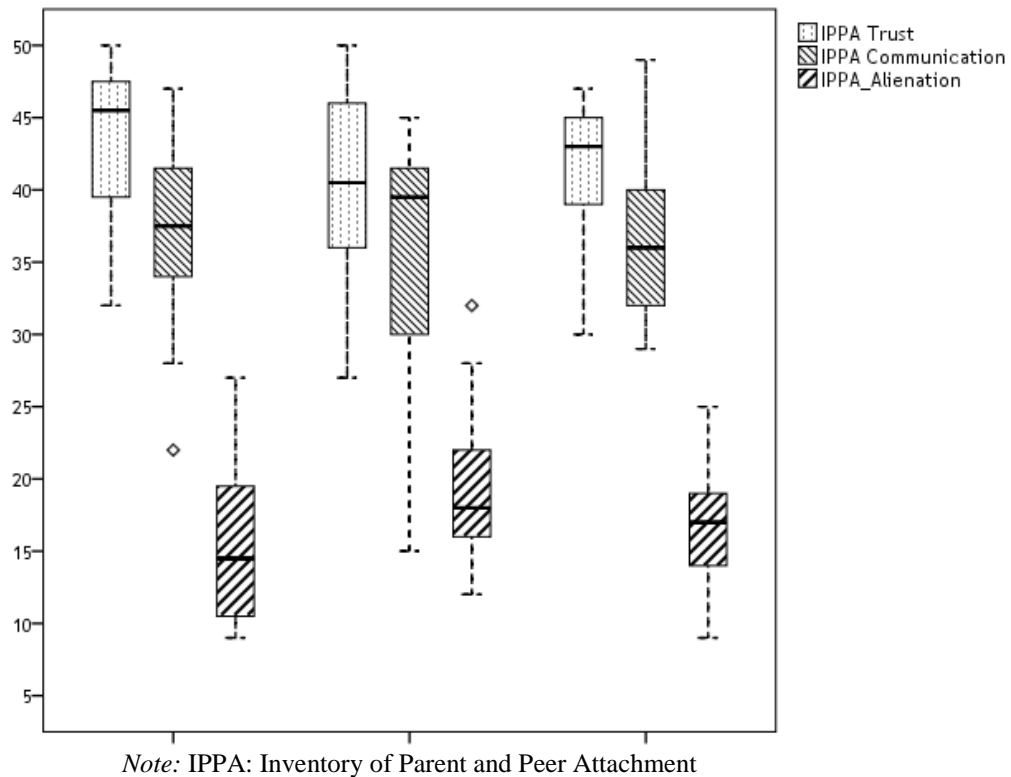
Table 4. Group comparison (means and standard deviations) of attachment variables assessed using different methods: Inventory of Parent and Peer Attachment (self-reported questionnaire) and School-age Assessment of Attachment (semi-structured interview).

Attachment variable	Group						p	F	η^2
	ASD (n = 21)		LD (n = 20)		TD (n = 24)				
	M	SD	M	SD	M	SD			
<i>Self-reported questionnaire</i>									
IPPA Total Score	61.19	8.44	56.55	16.77	65.46	14.27	.103	2.36	.103
Trust Score	41.52	4.89	40.40	6.70	43.58	5.44	.187	1.72	.056
Communication score	36.38	5.48	35.55	8.14	37.42	6.02	.654	.428	.015
Alienation score	16.71 ^a	3.74	19.40 ^{ab}	5.05	15.54 ^b	5.46	.056	3.02ⁱ	.094
<i>Semi-structured interview</i>									
SAA risk + Trauma	4.90 ^a	2.68	4.50 ^b	2.16	3.12 ^b	1.70	.030	3.73*	.114

Note: Adjusted for child gender; ⁱp < .06; * p < .05; a,b,ab

Letters indicate significant differences between groups according to Bonferroni post-hoc test IPPA: Inventory of Parent and Peer Attachment, SAA: School-age Assessment of Attachment

Figure 1. Boxplots of IPPA subscales score (Trust, Communication, and Alienation) for the three study groups (CI 95%).



Whereas, a trend toward significance emerged for Alienation, given that children with Learning Disabilities reported higher levels compared to Typical development group ($F_{(2,60)} = 3.02, p = .056$) but not to ASD ($p > .05$). The results of these statistical analyses are displayed on Table 4.

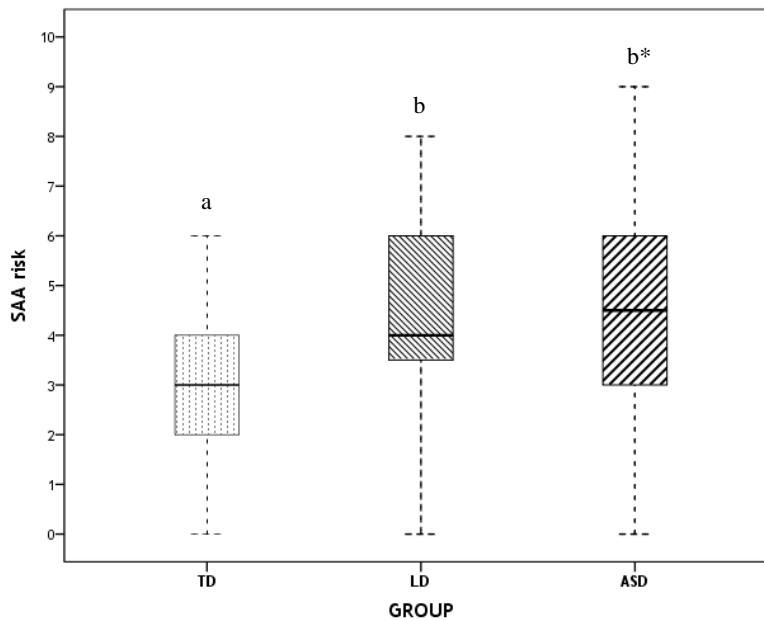
1.3.3.3. Group differences in attachment representations

We examined the potential difference between groups on attachment security using SAA risk + trauma continuous variable, SAA two-way and three way categorizations.

Considering SAA risk + trauma as dependent variable, Univariate Analysis of covariance controlled for child gender revealed a significant difference between groups ($F_{(4,62)} = 3.73, p = .30$). According to Tukey correction for multiple comparisons, ASD and LD group scores higher than TD on SAA

risk variable (see Table 4 and Figure 2), despite these results only showed a considerable trend toward significance.

Figure 2. Boxplots of SAA risk continuous variable for the three groups (95% CI).



Note: * $p < .06$; ^{a,b,ab} Letters indicate significant differences between groups according to Tukey post-hoc correction

Moreover, to test the differences between groups using SAA categorical variables a series of chi-squared test were performed. Due to the small sample size, we only considered the two-way (low-risk vs high risk) and three-way (low risk-moderate risk and high-risk) categorization. Specifically, considering the two-way categorization, chi squared test was statistically significant ($\chi^2_{(2)} = 8.67$, $p = .013$) (see Figure 3). 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 ($z = -2.29$) and TD group ($z = 2.77$), despite their significance is above the corrected alpha value of .01. Distributions of low risk and high-risk attachment pattern are presented in Figure 3. In addition, 78.9% of ASD children show high-risk attachment pattern compared to 63.2% of LD group and 34.8% of typically developing children.

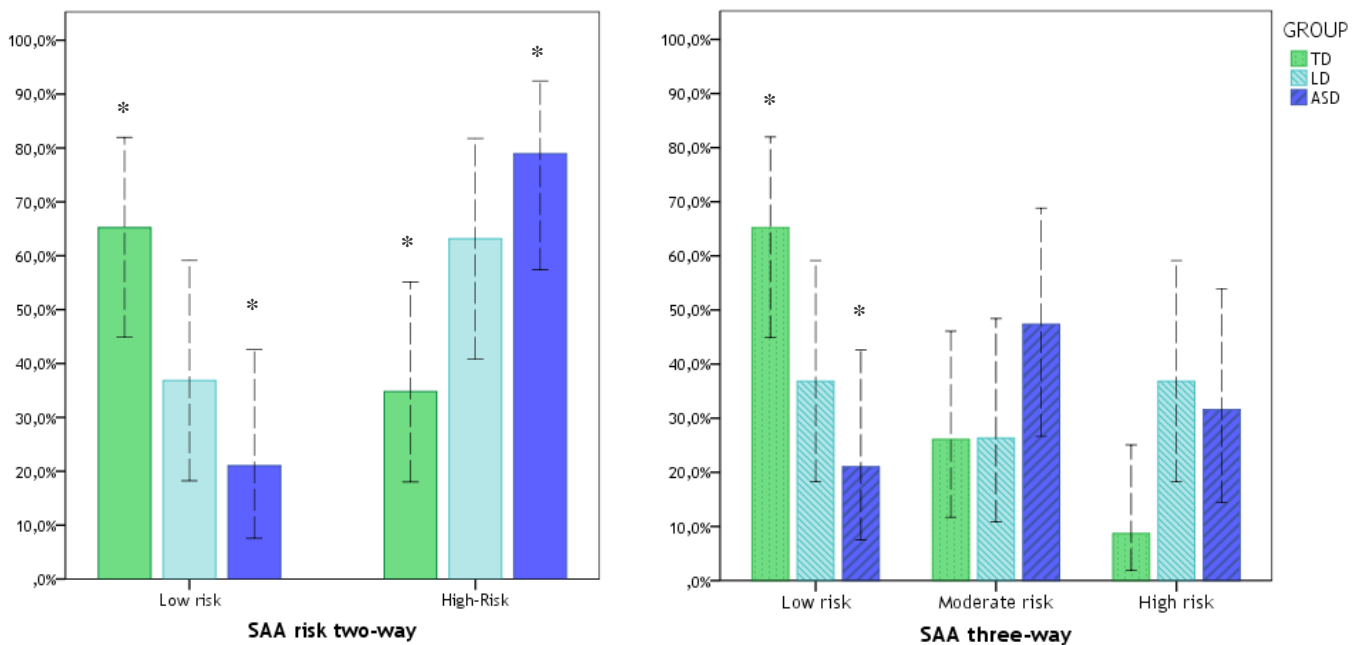
On the other hand, by considering the three-way SAA categorization, chi-squared analysis also showed significant results ($\chi^2_{(4)} = 10.66$, $p = .031$). Similarly to the previous analysis, the cells of

interests according to adjusted residuals are those related to low-risk classification of ASD group ($z = -2.29$) and TD group ($z = 2.67$) and high-risk of TD (-2.24). Compared to 65.2% of TD children, only 21.1% of ASD receive a low-risk attachment classification (see Figure 3). Only 8.7% of children with typical development used a high-risk strategies compared to 36.8% of LD and 31.6% of ASD group. Moreover, the majority of children with ASD received a moderate risk attachment classification (47.4%).

1.3.3.4. Group differences in unresolved trauma and modifiers

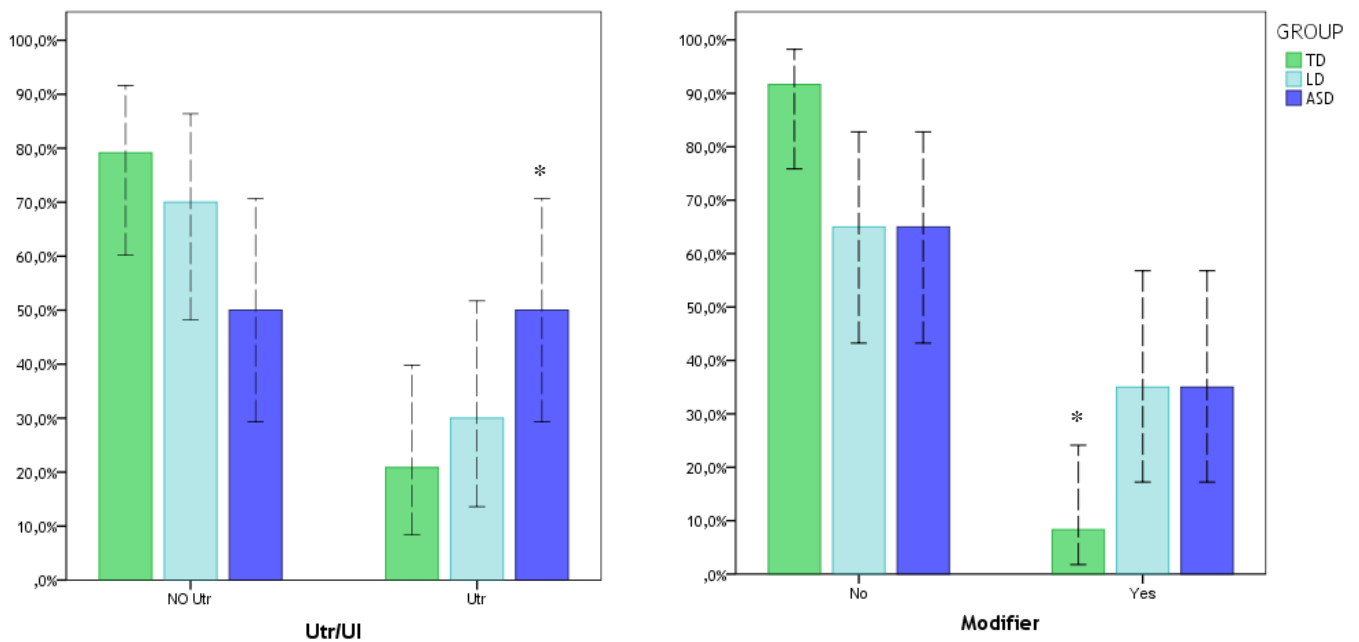
We examined group differences in unresolved trauma and modifier among group using binary outcomes (see Figure 4). Focusing on the presence of psychological unresolved trauma, the chi-squared test does not result significant, $\chi^2_{(2)} = 4.31, p = .116$ despite 50% of ASD group ($z = 1.97$) compared to 28.1 of TD and 30% of LD are classified as unresolved with respect to a specific traumatic experience (see Table 5).

Figure 3. Two-way (left) and three-way (right) rates of SAA self-protective strategies classification for the three study groups (95% CI).



Note: SAA Two-way: Low risk pattern: B, A1-2, C1-2; High-risk pattern: A3-4, pre A6, C3-4, C5-6, A/C mixed
 SAA Three way: Low risk: B, A1-2, C1-2; Moderate risk: A3-4, C3-4; High-risk: pre A5-6, C5-6
 * $p < .05$;

Figure 3. Distribution of Unresolved trauma (left side) and modifiers (right side) across the three groups (95% CI)



Note: Utr: Unresolved trauma; Mod: SAA Modifier; $p < .05$

Furthermore, we observed that the chi-squared test on the presence of modifier showed a distinct trend toward significance, $\chi^2_{(2)} = 5.68$, $p = .058$). Specifically, 35% of ASD and LD children have shown markers of altered arousal compared to 8.3 of the TD group ($z = 2.38$).

Table 5. Cross-tabulations of psychological unresolved trauma (Utr) and Modifier (Mod) distributions for the three groups (N=65)

Group	Utr			Mod		
	N	%	z score	N	%	z score
TD (n = 24)	5	(20.8)	-1.58	2	(8.3)	-2.38*
LD (n = 20)	6	(30.0)	-.32	7	(35.0)	1.24
ASD (n = 21)	10	(50.0)	1.97*	7	(35.0)	1.24

Note: $p < .05$; Utr: Unresolved trauma; AR: chi-square test adjusted residuals; Mod: SAA Modifier

1.4. DISCUSSION

This study was an exploratory investigation of whether school-age children with ASD differ from their typical counterpart in quality of attachment assessed using different methods, including a self-reported questionnaire and a semi-structured interview. To the best of our knowledge, this research represent the first study to examine the internal implicit attachment representations in school-age children with ASD, considering also the lack of resolution with respect to specific traumatic event. Firstly, the results confirmed previous findings of no differences on perceived attachment to parents assessed by self-report questionnaires. On the other hand, the assessment of attachment representations highlighted significant group differences with ASD group showing higher rates of at-risk attachment strategies. Similarly, the presence of unresolved trauma is higher in the target group compared to the clinical and normative controls. Whereas, modifiers of the attachment strategies results were found to be lower in children with typical development compared to clinical population (ASD and LD).

1.4.1. ASD symptoms and quality of attachment

Starting from the first study hypothesis, significant correlations confirms the moderate association between child socio-communicational difficulties and quality of attachment. The observed association among these variables was confirmed both for perceived attachment to parents and child implicit representations assessed by blind coders. Although we only found moderate associations, these data are consistent with previous research that has largely documented the negative predictive effect of the severity of ASD symptomatology on the security of attachment (Rutgers et al., 2007; van IJzendoorn et al., 1997).

Thus, ASD symptoms seem play a negative role on quality of attachment, albeit their impact is only moderate. Interestingly, a study on toddler with ASD (Naber et al., 2006) has also shown that children with higher ASD symptoms exhibit different physiological reaction (lower cortisol) in response to social stressors in the context of assessment of attachment. However, there is an open debate on whether attachment insecurity is more related to developmental delay or severity of ASD symptoms,

which have both been recognized as significant predictors of attachment quality considering the autism spectrum (Teague, 2017). In our study, no associations were found among attachment outcomes and child verbal and non-verbal intelligence. Nevertheless, it is essential to consider that only children with High-Functioning ASD compose our sample – hence, there is not much data variability in terms of severity of ASD symptoms and child intelligence.

1.4.2. Self-reported quality of attachment to the parents

Focusing on child self-reported quality of attachment to parents, our findings revealed that children with ASD perceived their relations with their mothers and fathers in a similar way to the typical development group. 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 perception of attachment security (Chandler and Dissanayake, 2014). A possible explanation of this result is that children with High Functioning ASD may compensate, at least to some extent, their difficulties in theory of mind and interpersonal relatedness by using specific cognitive strategies (Dissanayake & Sigman, 2000). Nevertheless, given its limited content validity (Baiocco et al., 2009), IPPA only partially reflect the construct attachment masking potential differences between groups. In fact, some authors have considered this questionnaire as a scale to evaluate perceived quality of parent-child relationship instead of a direct measure of attachment (Bauminger et al., 2010a).

On the other hand, the significant trend we found in children with LD compared to other groups with respect to feelings of alienation toward their parents is consistent with previous results on reported security of attachment to their mothers (Al-Yagon & Mikulincer, 2004, Bauminger & Kimhi-Kind, 2008) and fathers (Al-Yagon, 2014). Moreover, it is plausible that increasing the number of participants with LD significant higher level of insecurity would be found also on IPPA total score, as is the case of prior research with large sample size. Moreover, this trend toward significance may also be linked to a greater ability of children with LD to understand the impact of their difficulties on

quality of attachment relationships with their caregivers. Whereas, self-reflection processes and psychological insight may be more compromised in children of the ASD group, undermining the accuracy of self.-reported evaluation. In this regard, the use of this scale on ASD population has revealed some limitations, as the lack of significant correlations among child and maternal reports. In general, self-reported measurement seems to be more adequate in LD research, which have documented the crucial contribution of attachment to social and emotional adjustment also during school-age.

1.4.3. Quality of attachment implicit representations and self-protective strategies

We assessed potential differences on quality of child attachment implicit representations and self-protective strategies. Statistical analysis confirmed the differences between ASD and TD group regardless of the type of data (categorical or continuous). By contrast, children with LD did not differ neither from ASD nor from TD on attachment strategies, whereas show similar results of ASD group on quality of attachment representations. According to our hypothesis, we found higher rates of at-risk attachment pattern in children with a clinical diagnosis (both ASD and LD) compared to normative controls.

Starting from the target group, children with ASD showed insecure and extreme type of attachment self-protective organization. Nevertheless, 15% of children ASD were classified as securely attached confirming this finding confirmed the ability of these children to organize a balanced self-protective strategies underlying balanced information processing. Specifically, we found higher rates (30%) of both Type A+ strategies (A3, compulsive caregiving; A4, compliance) or of A/C pattern (30%) which consist of a combination of more distorted information and higher dismissing (A+) and coercive (C+) strategies. Moreover, one in five of children with ASD (20%) has been classified as using a Type C+ attachment pattern (C3, aggressive-feigned helpless; C5-6, punitively obsessed with revenge and/or seductively obsessed with rescue). Our findings is consistent with the only study available on attachment representations in ASD (Taylor et al., 2008) which found the same rates of securely

attachment (15%) in ASD adult sample. As is the case of adulthood, difficulties in reflective functioning and metacognitions of ASD (Katznelson, 2013) may be related to less secure attachment representations also in school-age children. In this regard, these data seem to support the hypothesis suggesting that the development of cognitive dimension of attachment (representational level) appears to be more challenging for children with ASD (Teague et al., 2017). In addition, the only study available on parental attachment representations in ASD revealed higher rates of insecure attachment (Seskin et al., 2010), suggesting a potential mechanism of intergenerational transmission. Atypical ASD developmental pathways could offer other possible explanations of our finding. The meaning that children with ASD give to their own experiences of protection and comfort may be adversely affect by neurobiological anomalies as well as difficulties in multisensory integration and sensitivity, emotion processing and arousal dysregulation (Sivaratnam et al., 2015; Crittenden, 2017). Furthermore, this results on ASD are in line with previous results pattern of close relationships as perceived by the child (Al Yagon et al., 2004), despite no studies on this clinical population have used a formal assessment of attachment classified by external coders. However, according to prior research on LD, low level of security was associated with difficulties in social information processing (Bauminger & Kimhi-Kind, 2008). Specifically, in our results children with LD differ from TD on attachment representations but not on self-protective strategies. This difference may be explained by the fact that the SAA risk score for attachment representations reflect a global index of attachment state of mind, including unresolved trauma, which is higher in our LD subgroup, as is the case of ASD. Whereas, the SAA categorical variable refers exclusively to information processing underlying attachment strategy.

In general, these results on ASD and LD are in line with previous studies on other clinical samples based on the assessment of attachment strategies during middle childhood using SAA protocol (Kwako, et al., 2010; Kozłowska & Williams, 2011; Kozłowska, & Elliott, 2017). The efficacy of this procedure in discriminating among clinical and normative group seems to be confirmed also in

the case of ASD. However, in our study, the presence of two clinical populations (both as target and as control group) may have hidden significant differences between LD and TD group.

The development of at-risk self-protective strategies could be related to several difficulties that children with ASD and their caregiver may frequently face, such as the recurrent impasses on social relatedness (Davis and Carter, 2008), the non-sequential dyadic interactions (Vivanti & Nuske, 2017) and the parental perception of ineffectiveness (Crowell, 2019).

In general both Type A and Type C high-risk strategies and particularly their unintegrated combination (A/C) are related to emotional dysregulation and maladaptive information processing, which in turn can be associated with parental cognitions and psychological health in ASD. However, literature suggest that children with ASD do not benefit from security of attachment with respect to emotion regulation, as is the case of TD children (Crowell et al., 2019). Despite an area of research on parent-child relationship have documented that parents behaviors of children with ASD appear similar to those of TD children (Karst, Van Hecke, 2012), the ASD child-driven impact on parenting evidently influence the transactional dynamics within the family. Therefore, given these bidirectional effects within caregiver-child relation it is essential to consider also the parent-driven effect in order to better understand child developmental pathways (Crittenden, 2017; Cowan, 2019).

Focusing on the specific type of attachment organization, the use of Type A+ inhibitory/compulsive strategies reflect the child preference to inhibit or falsify negative affect (e.g. fear, desire of comfort or angry) in order to meet adult demands, which does not correspond to an absence of emotional reaction also in ASD (Capps, Kasari, Yirmiya, & Sigman, 1993). Thus, these children mainly rely on predictable cognitive information trying to elicit protective responses in their caregiver by systematically avoiding forbidden behaviors or following adult directions. Moreover, parental psychological vulnerability, withdrawn or punitive attitude may reinforced a Type A strategy. In this, scenario, mothers and fathers of children with ASD show higher risk for developing psychological symptoms (Yirmiya & Shaked, 2005) and parental distress (Estes et al., 2013) which in turn may undermine optimal parental functioning. In addition, unresolved state of mind with respect to child

diagnosis may play a crucial role in determining the quality of caregiving (Oppenheim, Koren-Karie, Dolev, Yirmiya, 2009). For instance, by refusing to accept ASD diagnosis, denying the presence of continuative rupture of social reciprocity, parents may more frequently fail to interpret child needs of protection and comfort. This defensive approach to the diagnosis, aimed at “normalize” child clinical condition, could nourish parental desire to minimize child s behaviors. Thus, Type A strategy may function to “repair” the violated parental expectations contributing to the construction of a more positive image of the child from the parents perspective. Concurrently, children with High Functioning ASD may show more attention to the others dismissing their own needs and inner emotional states in order to obtain protective responses. According to Crittenden (2017), the information processing underlying these behaviors may lead to a greater difficulty to develop representations of the self in children with ASD.

On the other hand, children using Type C coercive strategies tend to exaggerate negative affect to make caregiver responses more predictable. These patterns focus on maintaining an ongoing struggle to increase caregiver compliance and attention. Therefore, children may emphasized challenging behaviors by alternating aggressive or punitive signals with apparent incompetence or submission. Moreover, Type C+ emotional display does not accurately reflect children inner states generating a deceptive effect given that only one intensified feeling at a time is exhibited. In this case, as opposite to Type A, attachment figures may covertly reinforce child forbidden behaviors or extreme display of negative affect providing intermittently responses. Furthermore, the reciprocal child and caregiver efforts to give meaning to each other behaviors may often be ineffective yielding to an arousal escalation and a more reactive confusion, which may negatively affect interpersonal exchanges (Crittenden and Kulbotten, 2007). The alternate display of a vulnerable or aggressive self may jeopardize caregiver understanding of child intentions and needs, provoking parental guilt and/or anger. In the case of ASD, several aspects may be connected to Type C+ strategy and parental functioning. Firstly, research has proven that parenting distress in mother and fathers of children with ASD is a crucial issue regardless of severity of symptoms (Totsika et al., 2011) suggesting that it

could significantly increase the effect of child challenging behaviors (Hayes & Watson, 2013). Type C interpersonal functioning may also escalate parents guilty, which is one of the common feeling that mothers and fathers of children with ASD often experience. In this regard, as pointed out by Kuhn and Carter (2006) higher level of guilty and lower agency are negatively associated with parental self-efficacy contributing to increased child maladaptive behaviors.

Interestingly, the co-occurrence of both avoidant and ambivalent pattern (A/C) was found in 30% of the cases in ASD group. In general, Crittenden (2015) describe A/C combination as the more distorted pattern through which anxiously attached children try to cope with caregiver inconsistencies. This pattern is characterized by sudden (A/C) or subtle (AC) alternation of strategical organized behaviors to elicit more responsive parenting. Focusing on ASD, a recent study of Guo and colleagues (2017) on parent-child emotion co-regulation indicates more frequent mismatching and less positive mutual engagement. Thus, child-caregiver relationship in ASD were characterized by a wide array of emotional expressions and alterations along with a lower ability to sustain a continuative pattern. In this regard, following a DMM framework, school-age children with ASD may use A/C combination to act self-protectively and adapt to ever-changing condition at interpersonal level.

1.4.4. Unresolved Trauma and Modifiers

We tested whether the presence of unresolved trauma and modifiers is higher in children with ASD compared to clinical and normative controls. Our results are only partially consistent with our original hypothesis given that no significant group differences emerged on both Utr and modifiers. However, it is essential to note that one children with ASD of two, as well as 30% of children with LD, were classified as unresolved with respect to a traumatic event.,

The elevated rates we found in the target group are consistent with empirical data documenting higher exposure to adverse childhood experiences (ACEs) in this clinical population (Berg et al., 2016). According to this emerging area of research (Hoover & Kaufman, 2017), we found that the lack of resolution in children with ASD were often related to parental issues, including separation and

conflict, bullying, illness and hospitalization. It is plausible that the psychological efforts to cope with these negative experiences of these children may be ineffective, not only for the higher exposure to adversity but also for the limited ability to interpret and integrate affective and cognitive representations of previous experiences in a meaningful coherent understanding. In general, our findings suggested that the exposure to potential traumatic life event and the subsequent lack of resolution are particularly frequent in children with ASD. Therefore, it is essential to consider their long-term impact on child adaptation and developmental trajectory in ASD.

With respect to the presence of modifiers, our data underlined elevated rates in ASD and LD group groups compared to typically developing children. In both cases, difficulties in self-regulation, altered arousal or the alternating failure to inhibit negative affect seem to have a detrimental effect on attachment organization, making inefficient the attempts to act self-protectively in response to threats and interpersonal demands. The neurobiological and neuroendocrine atypical processes, which may occur in children with neurodevelopmental disorders (Sivaratnam et al., 2015) and the more frequent arousal dysregulation (Dawson et al., 1989), may partly explain our results for ASD group. Specifically, the poor frustration tolerance in ASD is difficult to reconcile with a compulsive inhibition strategy (Type A) and may negatively contribute to the activity of the modifier by triggering an intrusion of forbidden negative affect. Moreover, a 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 constant hyper-activation (disorientation) according to DMM perspective. These processes are considered specific breakdown of the attachment strategy, which may increase the difficulties of children with ASD to integrate affective and cognitive representation in a coherent self-protective organization. Unresolved trauma and modifiers often co-occurred in children with ASD represent additional risks for adaptive information processing, emotion regulation, mental health and interpersonal relatedness.

1.5. CONCLUSION

Although the current study extend the knowledge on attachment and ASD, several limitations should be noted. Firstly, the wide age range may constitute a drawback in this research, because it covers the entire school age period, from its early stage up to the adolescence boundary. Despite no differences emerged between age groups in our study, the non-significant results could be related to the small sample size. For the same reason, it was not possible to conduct specific comparisons among different age groups considering child diagnosis. In addition, the small sample size did not allowing to perform more subtle analysis within ASD group, considering the wide array of DMM self-protective strategies and their association with ADOS severity index. 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 attachment questionnaire. Moreover, despite the adequate content validity, the reliability of DMM method still requires further investigations with larger samples in order to be widely proven in ASD samples. In this respect, this represent the first study, expect for prior single-cases (Crittenden, 2017), on ASD and attachment following a dynamic-maturational approach.

In terms, of clinical implications, this study offer several insights for mental health practitioners in the field of ASD. Firstly, understand self-protective organization and quality of attachment representations may constitute a valuable source of information for clinicians to understand: a) child's attachment state of mind with respect past and current caregiving experiences; b) maladaptive information processing; c individual needs of protection and comforts. This type of assessment is particularly useful in the context of ASD, given that socio-communicational symptoms and impaired interpersonal relatedness could make more complex the access to the inner world of these children. Understanding child systematic preference and/or avoidance of specific mental representations (affective, cognitive) as well as the extent to which they are distorted, may provide a useful guideline for clinical interventions. In fact, matching treatment to individual differences in attachment information processing may help professionals in the field of ASD in tailoring personalized interventions by integrating a descriptive diagnosis-based treatment with an attachment-informed approach. In addition, by refusing the concept of Disorganization (Main & Solomon, 1990), DMM

offers accurate explanations concerning the way in which child with ASD protect themselves and strive to adapt to their own developmental context (Crittenden & Claussen, 2003). Disorganization has demonstrated some limitations in providing useful clinical information due to the lack of agreement on its theoretical meaning (Rutter, Kreppner, Sonuga-Barke, 2009). Specifically, a key outstanding challenge is how disorganization markers can be distinguished from unusual qualities of interpersonal behavioral pattern in clinical samples such ASD. Therefore, the focus of DMM on attachment organization (rather than disorganization) put the emphasis on individual strengths instead of child disorder shedding light on potential adaptive mechanisms related to attachment processes, which in turn might expand psychological functioning of children with ASD. Specifically, a functional and systemic understanding of ASD dysfunctions and protective behaviors may be helpful to construct a better therapeutic alliance in the clinical setting. Furthermore, it could be useful to boost quality of dyadic exchanges (reciprocity, attunement, and synchrony) during the interventions, with the aim to enhance child internal security and interpersonal relatedness. Children with ASD may benefit from this work on quality of relationship and attachment representations also at psychophysiological level. In this regard, it is relevant to consider the additional risk posed by the long-term neurobiological sequelae of at-risk attachment pattern and unresolved trauma. Several impaired domains documented with ASD overlap with detrimental effects of complex trauma, such as attachment and relational difficulties, cognitive, behavioral and emotional problems, cognitive and poor self-concept (Cook et al., 2008).

Similarly, the link between attachment insecurity, unresolved trauma and psychopathology (e.g. anxiety, depression, ADHD,) need to be considered given (Kerns et al., 2019) the higher comorbidity of psychiatric disorder in children with ASD (Simonoff et al., 2008). Finally, information on attachment organization and mental representations in children with ASD may suggest new strategies to improve quality of parenting, supporting families in explaining child's thoughts, feelings and signals used to interpret and to cope with danger

Future research should replicate these findings using larger samples and different attachment theoretical approach and methods (e.g. Child attachment Interview; CAI). It could be interesting to conduct longitudinal design to test whether the association between specific child outcomes and attachment security documented in typically developing children is confirmed also in ASD, as suggested by a recent preliminary study (Rozga, et al., 2018). Moreover, it would be interesting to examine whether the discrepancy between implicit and explicit representations is higher in children with ASD compared to matched controls. Longitudinal approach may be also useful in testing continuity and stability of attachment across development in children with ASD.

Study 2. Parenting dimensions and quality of attachment representations in children with Autism Spectrum Disorder

2.1. INTRODUCTION

2.1.1. Background

A vast body of research in developmental and clinical psychology has explored the relation between parenting and attachment during childhood (Fearon & Roisman, 2017). In fact, after decades of empirical research, the hypothesis surrounding the association between quality of caregiving and human healthy development has been widely supported by numerous empirical evidences. However, most of the studies have mainly focused on infancy and early childhood, in view of the prominent interest on sensitivity-security assumption. Thus, only a limited number of studies has investigated in early this field in early and late school-age. In fact, previous studies have focused almost exclusively on the link between parenting and quality of attachment and adaptation in infancy (Belsky & Isabelle, 1988; Susman-Stillman et al., 1996) and early childhood (Teti et al., 1996). Therefore, little is known, on determinants of attachment in middle childhood, particularly with reference to implicit attachment representations, which are considered to play a pivotal role for child socioemotional adjustment and adaptation.

Focusing on neurodevelopmental disorder, there are still numerous outstanding questions about these associations in children, adolescents and adults with ASD. Despite some variables were found to be predictive of quality of attachment in different studies (Rutgers, 2004; Teague; 2017), the contradictory results along with the scarcity of data generated an incomplete and fragmented picture. In fact, the scientific debate concerning the role of predictors and correlates of attachment in security in children with ASD still needs to be enriched, including also school age, adolescent and adulthood. Additionally, among all the methodological approaches proposed for the assessment of attachment, the study of implicit attachment representations has been consistently neglected by prior research,

due to the much easier use of self-reported measurements. Given the lack of studies on this topic, the influence of caregiving environment on attachment representational level has remained unexplored. Similarly, there is a growing interest in the contribution of fathers to child developmental outcomes also in ASD research, to date, none of the previous studies on parenting and attachment in neuroatypical development tested the predictive effect of paternal dimensions.

Therefore, it becomes crucial to extend our knowledge about child internal attachment representations in ASD, examining which child and parental factor may promote the construction of secure self-protective strategies underlying more adaptive information processing. In this scenario, ASD research may benefit from studying both parents to offer a more comprehensive understanding of this phenomenon.

2.1.2. Attachment in school age children: predictors, correlates and outcomes

2.1.2.1. Associations between parenting and attachment in school-age children with typical development

Since its origins, attachment theory has been intrinsically related to parenting, which has been firmly recognized as the foundation of human development (Bowlby 1969/1982). A substantial body of research has proven that a sensitive and responsive caregiving environment constitutes the key foundational component for the development of attachment security during childhood (Ainsworth et al., 1978; de Woolf & van IJzendoorn, 1997). In this regard, developmental changes that occur across middle childhood years involve both child individual characteristics and interpersonal processes, including also parent-child relationship. Despite the role of peers or non-parental figures during school age become increasingly important (Seibert & Kerns, 2009), literature highlighted that children still tend to prefer their parents to fulfill their attachment needs (Kobak, Rosenthal & Serwik, 2005). Kerns Tomich and Kim (2006) found that although children use less frequently their attachment figures when older, they do not showed significant changes in the perception of their caregivers' availability. Specifically, mothers are perceived as more able to comfort their child

representing a safe haven in cases of stressful and threatening conditions whereas fathers as more keen to provide support for the exploration (secure base effect) (Kerns et al., 2006). These findings confirm that caregiving environment as well as family context and child characteristics may have a significant impact on child attachment organization not only in early childhood but also in later stages of development (Collins, Madsen & Susman-Stillman, 2005). Nevertheless, due to the main interest on the sensitivity-security hypothesis, research on infancy and preschool-age have largely dominated the literature on this topic. Therefore, only few studies have linked parenting dimensions and quality of attachment during middle childhood. Specifically, Karavasilis, Doyle and Markiewicz (2003) found several associations between parenting style and child attachment, showing a significant effect of parental involvement, authoritative style and autonomy granting in discriminating between secure and insecure patterns. In addition, parental negligence was found to predict child attachment avoidance. Similarly, other authors revealed associations among maternal reported parenting stress and child ambivalent attachment, as observed also in preschool-age sample (Moss et al., 1998). Research on this topic have pointed out the relationship between parenting distress, and disorganized controlling-punitive children also during school age (Moss et al., 1996; Moss et al. 2004). With respect to maternal behavior, Borelli and colleagues (2016) investigated the association between sensitivity and attachment in middle childhood. Despite no direct significant associations were observed, child attachment security was found to be related with greater affective understanding and synchrony.

An interesting finding from a longitudinal study have also highlighted that both child attachment behaviors (during separation and reunion) and quality of mother-child conversations significantly predict attachment representations in middle childhood (Dubois-Comtois, Cyr & Moss, 2013).

In sum, the few studies available confirmed the relation between positive caregiving and child attachment security; however the study of the associations between parenting and attachment in school age remain limited. Parent's ability to support child autonomy - by offering adequate monitoring and avoiding the exertion of high control - seems to constitute a key factor for the child

adaptive trajectory (Kerns & Briumariu, 2011). Moreover, continuity of attachment security from early to middle childhood has also been identified as a significant predictor of child adaptation in late school-age (Boldt, Kochanska, Grekin & Brock, 2016).

2.1.2.2. Correlates of quality of attachment in children with ASD

As is the case of typical development, the majority of the studies on determinants or correlates of attachment in ASD are focused on infancy and preschool-age. In fact, prior research focused on attachment and ASD in middle childhood based on group difference analysis. In addition, these studies often adopt cross-sectional study design, which prevents to address the issue of causality. Hence, to date, there is still a lack of clarity with respect to the impact of child, parent and environmental features on quality of attachment in ASD compared to typical development. With reference to school-age, the few findings on children with ASD (without intellectual disabilities) only consider security of attachment as a predictor or moderator of specific child outcomes. Bauminger et al., (2010a) underlined the significant effect of attachment in predicting quality of friendship in ASD, particularly on the level of companionship and intimacy. The same research group also reported a significant positive association between child attachment and maternal stress with internalized and externalized behaviors, as in children with TD group (Bauminger et al., 2010b). In addition, a recent finding on children with High-Functioning ASD, revealed no significant correlations between emotion regulation, theory of mind and self-reported attachment in both clinical and control group. In sum, despite these investigations provide some initial data on the role of attachment in school-age children with ASD, the study of the predictors and correlates of attachment in ASD during school age remains almost entirely unexplored. Therefore, the following findings concerning the associations between individual or social features and quality of attachment in ASD build on the existing early childhood literature.

2.1.2.3. The influence of child characteristic on security of attachment in children with ASD

According to the last metanalysis (Rutgers et al., 2004) and its most recent update version (Teague et al. 2017), security of attachment in ASD is associated with both severity of symptomatology and the degree of intellectual disabilities. In particular, children with ASD with higher socio-communicational impairment and/or developmental delay are less likely to development secure attachment to their caregiver. In general, it is plausible that this two component may negatively contribute to the development of a sensitive caregiving environment, increasing the possibility of relational disruption within the attachment relationship. However, the mechanisms through which these two moderators affect the development of secure attachment at biological and representational levels, still needs further clarifications. In fact, little is known about the strengths of their effect and if they are independent from each other, especially with respect to attachment internalization.

Firstly, several studies proved the association of ASD symptoms not only with attachment security (Rutgers et al., 2007) but also with child atypical responses in the relationship with their parents, both at behavioral (Beurkens, Hobson & Hobson, 2013) and neurobiological level (Naber et al., 2007). Moreover, considering the diagnostic criteria, Rutgers et al., (2004) pointed out that studies which rigorously recruited children with Autism instead of the combination with Pervasive Developmental Disorder (PDD) showed a higher effect size ($r = .38$). Thus, a possible explanation is that the presence of ASD diagnosis may constitute itself a specific risk factor for attachment security. In fact, the most recent investigation on this topic confirmed a significant predictive effect of ASD diagnosis (rather than of severity of symptoms) on security of attachment as reported by the primary caregiver (Teague et al., 2018).

Secondly, higher combined effect size was also found for the studies including children with Autism and high intellectual disability ($r = .37$). In this case, the authors did not find an association between Autism and attachment security in children with higher mental development (Rutgers et al., 2004) which is consistent with study on school-age (Chandler & Dissanayake, 2014). Additionally,

empirical evidences on preschoolers revealed the positive link between cognitive and language abilities and attachment security (Rogers, Ozonoff & Maslin Cole, 1993).

With respect to the chronological age, no moderation effects was found, despite some authors (Rogers et al., 1993) argued about its potential contribution in the development of attachment in ASD population (less security in younger children). Nevertheless, this hypothesis has not been tested in older children with ASD with respect to attachment implicit representations.

Taken together, these findings indicate that children with ASD do not differ from their matched counterpart in cases of high intellectual development and low socio-communicational impairment, as is the case of High-Functioning individuals. However, another study by Rutgers and colleagues (2007) has disconfirmed the significant combined effect of the two moderators, reporting that particularly children with High-Functioning Autism show less security of attachment compared to the clinical and normative controls.

In sum, intellectual disabilities and severity of socio-communicational symptoms seem to play an important role on quality of attachment of children with ASD . Nonetheless, it is still unclear which of these two factors have a greater impact and whether there are specific ASD traits or profiles that could be more susceptible to these associations (Teague et al., 2017).

2.1.2.4. The influence of caregiving environment on security of attachment in children with ASD

Literature identified some crucial features of parenting that successfully promote the development of attachment security in children. In this scenario, a large number of studies confirmed the significant contribution of maternal sensitivity (Ainsworth, Bell & Stayton, 1971) described as the ability to respond promptly to child cues providing adequate caregiving, as well as parental accessibility and responsiveness. Moreover, during the last two decades, research has documented the significance of other related constructs, which are considered to be part of the umbrella concept of sensitivity, such as mind-mindedness (Meins & Fernyhough, 1999), reflective functioning (Fonagy, Target, Steele & Steele, 1991), emotional availability (Biringen, 2000) or insightfulness (Oppenheim and Koren-

Karie, 2002). However, several aspects associated with ASD socio-communicational impairment can negatively affect the quality of parent-child relationship (Ooi, Ong, Jacob & Khan, 2016). The specific characteristic related to ASD neurodevelopment could increase parental difficulties yielding to unique challenges in terms of childrearing (Del Bianco et al. 2018). In particular, children with ASD in early childhood show atypical pattern of distress vocalization (Esposito, Nakazawa, Venuti & Borstein, 2012), psychobiological responses to social distress (Naber et al., 2007), restricted or anomalous postures and gesture, less eye contact and prosocial contact (Seju & Johnson, 2009; Mastrogiuseppe et al., 2015), limited abilities of emotion recognition and regulation (Nackaerts et al., 2012). In addition, older children with ASD may also exhibit significant difficulties in theory of mind, particularly in the understanding of caregiver intentions. On the other hand, the disrupted non-verbal/verbal communication could increase parents' sense of inefficacy (Crowell et al., 2019) given that the "intuitive parenting" (Popusek & Popusek, 2012) may not be sufficient to cope with non-sequential child interactive behaviors and with the higher occurrence of mismatching and non-positive mutual engagement (Guo et al., 2017).

Therefore, these critical issues may in turn have adverse consequences on the construction of secure attachment bonding and subsequent child internal representations (Karst & Van Hecke, 2012).

With respect to the determinants of attachment security, mixed findings has emerged from the few research focused on the role of maternal sensitivity in children with ASD. Specifically, a study on toddlerhood (van Ijzendoorn et al., 2007) reported no significant link between sensitivity and security for the ASD group, despite a predictive effect was found for children with intellectual disabilities and language disorder. Mothers of children with ASD did not differ from the other groups in terms of sensitivity; however, their children were more often classified as disorganized. By contrast, Koren-Karie, Oppenheim, Dolev and Yirmiya (2009) reported higher level of maternal sensitivity in children classified as secure compared to insecure-disorganized. In addition, The same authors published a series of articles (Oppenheim, Koren-Karie, Dolev, Yirmiya, 2009; 2012) examining the role of maternal insightfulness, supporting the hypothesis that mothers who showed higher insightfulness

and resolution of diagnosis are more likely to have children with secure attachment. In this regard, a mediation effect of maternal sensitivity on the link between insightfulness/resolution and attachment security was found. Moreover, they used the Emotional Availability Scales (EAS; Biringen, Robinson & Emde, 1998), to identify potential associations between the quality of parent-child interactions and the severity of ASD symptoms as well as between maternal distress and intrusiveness.

Following the Bowlby's tenet regarding the intergenerational transmission of attachment, Seskin et al., (2010) tested the link between parents' attachment representations, assessed using the AAI and dyadic relational behaviors with their child. Fifty-two percent of the sample was composed by school-age children (6-13), as is the case of the current study. The Functional Emotional Availability Scales (FEAS; Greenspan & Greenspan, 2002) was preferred to the Strange Situation to assess parent-child relationship due to the wide range of age and clinical characteristic in the sample. Notably, this study found significant associations between parents' attachment state of mind and quality of dyadic relational behaviors across different domains. Children with ASD of secure parents showed higher verbal and non-verbal communicative abilities as well as better problem solving and symbolic play. Therefore, despite the contradictory results surrounding the sensitivity-security hypothesis, this is the only study that used an implicit representational assessment (AAI) taking into account the limitations of the standard procedure such as the SSP (Rutter, Kreppner & Sonuga-Barke, 2009) and the unique quality of dyadic exchanges that occur in cases of ASD.

2.1.2.5. The role of parenting stress

Among the wide array of maternal and paternal dimensions the study of parenting stress has been the most investigated in autism research. In general, despite the experience of parenting may constitute itself a source of stress for mothers and fathers (Abidin, 1990), raising a child with ASD may be perceived as an even more demanding task for parents. Parenting stress encompasses a variety of negative feelings about both the self and the child, which might occur cases of ASD or other neurodevelopmental disorder given the more frequently and intense challenging conditions (Baker,

1994; Deater-Deckard, 2004). A case-control study by Duarte, Bordin, Yazigi & Mooney (2005) exploring the factors associated with maternal stress found that having a child with ASD is one of the most robust predictor. In fact, several studies have widely demonstrated that parents of children with ASD reported higher level of stress compared to typical development (Hoffman et al., 2009) as well as other clinical groups (Estes et al., 2009; Schieve et al., 2011). Other significant factors that potentially contribute to the increase of parenting stress in these parents are behavioral problems, learning disabilities and, particularly, cognitive and language impairments, (Karst & Van Hecke, 2012). Nevertheless, the presence of higher level of maternal stress has been confirmed also in studies focused on children with High-Functioning ASD (Rao & Beidel, 2009). Thus, in contrast to previous findings, child verbal and non-verbal intelligence does not seem to moderate this association. In this regard, Davis and Carter (2008) suggested that the effect of ASD on parenting stress is not directly influenced by child socio-communicational impairment but rather by functional difficulties resulting from the interplay of different domains. Hence, it is essential to consider the issue of maternal stress also in children with higher verbal and cognitive functioning as is the case of ASD without intellectual disabilities. Interestingly, a study by Little (2002) indicates a significant decrease of maternal stress in older children with ASD by suggesting a possible positive effect of the resolution of the diagnosis. Consequently, the contribution of specific parental dimensions on child outcomes might change across development. Looking at gender differences, several studies reported higher level of parenting stress in mothers compared to fathers (Davis & Carter, 2008), despite other findings contradict this result (Ozturk et al., 2014). In addition, parenting stress was found to be associated with parental involvement in mothers but not in fathers (Tehee, Honan & Hevey, 2009). This result confirms the need to evaluate separately maternal and paternal dimensions in order to extend our knowledge about the specific role of each parent in ASD, following a transactional and developmental perspective. Importantly, it is essential to consider the impact of parenting stress given that substantial body of research has proven its detrimental effect: higher level of stress may have negative consequences not only on parenting behaviors but also for child development (Crnic & Gaze and Hoffman, 2005),

including attachment organization (Crnic & Low, 2002). These associations between maternal stress and child attachment were also confirmed in school-age children with typical development (Moss, 1998; 2004). Focusing on ASD, Bauminger et al., (2010b) pointed out a significant effect of maternal parenting stress in predicting child psychopathology (internalizing-externalizing behaviors). However, the contribution of security attachment, assessed using a self-reported questionnaire, was not statistically significant in this study.

In sum, higher level of parenting distress were found in ASD even in case of high-functioning children. The increase of distress tend to be more evident in mothers compared to fathers with a potential moderation effect of child age in ASD group, whereas no gender differences were found in parents of typically developing preschool children (Dabrowska & Pisula, 2010). To date, the only study (Keenan et al., 2106) explored the association between child attachment and parenting stress in ASD showing no significant results. Nonetheless, it essential to note that this research only assessed the perception of child attachment security to the caregiver (explicit representations) by using a self-reported measure. Despite the relevance of parenting distress for child development in ASD has been largely established, previous studies have not examined its link by considering attachment implicit representation, particularly in school-age children.

2.1.2.6. The role of parenting style in ASD

The study of parenting style in families of children with ASD has not received much attention so far, especially in relations to attachment representations. However, parenting style is considered one of the most significant component underlying the quality of caregiving context as confirmed by a vast of body of literature in children with typical development (Darling & Steinberg, 2017). The predictive role of parenting styles on attachment pattern has been documented also in children with other neurodevelopmental disorder, also during middle-late childhood (Finzi-Dottan, Manor & Tyano, 2006). Surprisingly, Rutgers et al., (2007) found that parents of children with ASD showed less authoritative style, compared to their typical counterpart showing lower level of control and

supervision in the interaction with their child. By contrast, Dollberg, Feldman, Karen & Guedeney (2003) observed that mothers of referred infant might display higher intrusiveness during free play. In this regard, parental intrusiveness can generate a more directive approach in terms of interactive style. A study on families with toddlers revealed that parents of children with ASD showed higher directiveness (Patterson, Elder, Gusrud, Kasari, 2014) which in turn was significantly associated with mother-initiative joint attention during the interaction. In addition, Venuti, Bentenuto & Villotti (2011) focusing on emotional availability found more attempt of control and physical contact, despite no differences emerged between mothers and fathers.

Similarly, a study on infant sibling at risk of ASD (Wan et al., 2012) found that parent-child interaction of high-risk group were characterized by higher maternal directiveness compared to low risk siblings group. Moreover, Dolev et al., (2009) also reported a relation between parenting stress and intrusiveness in mothers of children with ASD who showed less structuring behaviors in comparison to other non-ASD clinical group. In this case, as opposed to other studies no group differences in level of maternal sensitivity were found. These findings suggest a possible tendency of parents of children with neurodevelopmental disabilities to use a more directive approach because of parenting distress or as an attempt to overcome the less predictable child interactive style.

By contrast, a recent study by Ostfeld-Etzion and colleagues (2015) revealed that mothers and fathers of children with ASD did not differ in terms of parental supportive and disciplinary styles, disconfirming the previous results. With respect to gender difference among parents, mothers rated themselves as more sensitive and positively responsive toward their child compared to fathers considering also school-age children with High-functioning ASD, albeit in small proportion (Ozturk et al., 2014).

In general, the few studies available on the role of parenting style in ASD documented mixed evidences, suggesting the potential role of parental intrusiveness or control to adapt to the unique challenges of ASD interactive qualities. Moreover, very few differences between mothers and fathers

have been observed. However, the contribution of parenting style have not been investigate nor in school-age children with ASD and much less with respect to attachment representations.

2.1.3. Aims and hypothesis

Despite a series of studies investigated the contribution of maternal sensitivity (Rutgers, 2007) and/or other related construct such as insightfulness (Oppenheim eta al., 2009, 2012) to attachment security of children with ASD, little is known with respect to how caregiving and specific parenting dimensions shape child attachment organization in ASD. As mentioned above, several domains of parenting have a central role in ASD such as parenting stress and styles; however, to the best of our knowledge, there is a lack of studies targeting the contribution of these factors to the quality of attachment in individual with ASD. In addition, the few studies available focused on maternal sensitivity including only preschool-age children.

Outside of maternal sensitivity, ASD literature has been mainly interested in examining the effect of child attachment on parenting dimensions and not vice versa. To date, only the recent study by Teague et al. (2018) assessed the predictive role of specific caregiver dimensions such as parenting practices, mental health and family functioning on child attachment in ASD. Notwithstanding, some critical aspects of this study needs to be acknowledged. Firstly, the wide age range of the participants may represent a drawback, given that age-appropriate assessment methods should be used in accordance with a developmental perspective. Furthermore, the assessment of attachment was parent-reported reflecting exclusively the perception of quality of relationship. Thus, this measure is not suitable to capture the interpersonal function of child attachment behavior as well as child mental representation. In addition, this study is only focused on ASD with intellectual disabilities and does not cover the area related to High-functioning ASD.

Therefore, the main aims of the current study are: 1) to determine whether parents of children with High-Functioning ASD differ from matched TD group with respect to parenting distress and parental interactive styles, also considering potential gender differences within groups; 2) to confirm the

predictive effect of ASD diagnosis on attachment representations in school-age children 3) to examine which caregiving environment dimensions contribute significantly in predicting at-risk attachment representations in school-age children with ASD, assessing separately the contribution of maternal and paternal parenting stress and parental interactive social style. Related to this third aim, we also explore whether child age would moderate the association between parental stress and child attachment representations.

In the current study, we tested the following hypothesis:

H1a: Based on the previous findings (Rao & Beidel, 2009) mothers and fathers of ASD children would show higher level of parenting distress compared to the normative control group. According to Davis and Carter (2008) we expected that mother of children with ASD reported higher level parenting distress than fathers, due to their greater involvement in child rearing as primary caregiver.

H1b: Parents of children with ASD would not differ in terms of reported parenting style compared to normative control group as highlighted by the most recent study (Ostfeld-Etzion et al., 2015). With respect to gender differences, we expected that mothers of children with ASD rated themselves as more sensitive and responsive in the social exchange compared to fathers, according to previous results by Ozturk et al., (2014).

H2: We expected to find a significant contribution of ASD diagnosis in predicting at-risk attachment representations in school-age children. The socio-communicational impairment may constitute a prominent risk for the development of attachment security (Rutgers et al., 2004) also at representational level. Indeed, we hypothesized that a challenge in the formation of attachment representations (Teague et al., 2017) in children with ASD could increase the risk of maladaptive information processing and self-protective strategies.

H3: Parenting stress would negatively contribute to the development of at-risk attachment representation in both target and control group. We also expected to find a significant influence of parental interactive social style on child attachment representations regardless of clinical diagnosis.

Higher level of parenting distress and poor social interactive style, particularly of primary caregiver, should reveal a detrimental effect on the construction of secure (balanced) attachment representations. Moreover, we explore the moderation effect of age, on the association between ASD status/maternal parenting stress and attachment representations. Despite we do not have clear hypothesis due to the lack of previous studies, parents of children with ASD, particularly mothers, may experience higher level of stress in case of younger children (Little, 2002). Thus, difficulties in the construction of coherent attachment representations could make younger children more susceptible to the adverse influence of ASD diagnosis and/or parenting stress.

2.2. METHOD

2.2.1. Participants

This study includes only the target group (ASD) and the normative control group (TD). Parents of children with LD who take part to the Study 1 were not involved in this secondary study. Thus, mothers and fathers of LD group did not receive the questionnaires on parenting stress and parental style during the data collection process.

Average maternal age is 44.33 (4.61) for TD group and 42.76 (6.10) for ASD group, whereas fathers of our sample have a mean age of 47.90 (6.18) and 46.5 (7.57) for control and clinical group respectively. Family Socioeconomic Status (SES) Index of parents of children with ASD ($M = 44.5$, $SD = 14.54$) and TD ($M = 44.57$, $SD = 15.71$) were similar.

2.2.2. Procedure

For a detailed description of the procedure see Study 1 (Paragraph 1.2.3)

2.2.3. Measures

For a detailed description of the child measures see Study 1 (Paragraph 1.2.4)

2.2.3.1. *The Parenting stress Index – Short Form* (PSI-SF; Abidin, 1995) is a self-reported questionnaire designed to evaluate parenting stress, which is extensively used in both clinical and research. It consists of 36 items concerning parental feelings and experiences that mothers and fathers respond to on a 5 point Likert-type scale ranging from 1 (Strongly agree) to 5 (Strongly disagree). The PSI-SF comprised three subscales focused on different types and sources of stress that accompany parenting: 1) Parental Distress (PD); 2) Parent- Child Difficult Interaction (P-CDI) and 3) Difficult Child. The PD scale investigates the degree to which the individual experiences distress associated with parenting role and its related factors such as life restrictions related to child rearing. An item example of PD is “Since having a child I feel that I am almost never able to do things I like to do”. The P-CDI scale indicates parental perception of a difficult and unrewarding interactional system with the child. A sample item is “Most times I feel that my child does not like me and does not want to be close to me”. The DC scale reflects the extent to which parents perceive their child as difficult to manage considering specific characteristics and behaviors associated with temperamental factors. An item example of this scale is “My child turned out to be more of a problem than I had expected”. The PSI-SF also includes a Defensive Responding Scale (PSI-DIF) to evaluate the degree of individual social desirability given that parents might emphasize their positive self-image, minimizing or denying the distress associated with the parenting role and the parent-child relationship. A raw score of PSI-DIF below 10 indicates a higher defensive response level. In addition, the sum of the three subscales (PD, P-CDI, DC) yields a PSI-Total score. All scores are transformed into percentiles in order to make the interpretation of the results easier. Percentile scores that fall between the 15th and 80th are considered normative, whereas clinically significant levels of stress are above the 85th percentile. The PSI-SF has demonstrated adequate psychometric properties in terms of internal consistency, test-retest reliability and validity (Abidin et al., 1995). Moreover, PSI scales have been commonly used in studies of parents of children with disabilities, including ASD research (Davis & Carter, 2008; Hayes & Watson, 2013). In this study we used the Italian version of the questionnaire (Guarino et al., 2013).

2.2.3.2. The *Parental Style Questionnaire* (PSQ; Bornstein, Hayes et al., 1996; Bornstein et al., 1996) is a self-reported questionnaire developed to assess parenting behaviors and interactive style. The PSQ consist of 16 items comprises three subscales: 1) Social Exchange, Didactic/Material and 3) Limit Setting. Parents is asked to describe how much frequent they use specific parenting behaviors in the interaction with their child using a 5-point Likert-type scale ranging from 1 (hardly at all) to 5 (all the time). The Social Exchange scale focuses on the quality of dyadic exchanges, including parental sensitivity to child signals and needs, reciprocity, affectional expression and positive responsiveness (item: . The Didactic/Material scale to promote child awareness of the objects and the environment through exploration, providing stimulation and more frequent learning opportunities. The Limit Setting scale reflects specific parenting behaviors focused on rule keeping, a disciplinary approach and the exertion of hierarchical authority in the context of parent-child relationship. Previous studies documented adequate reliability and validity of the PSQ (Bornstein et al., 1996). Prior research on ASD has used this questionnaire to evaluate the quality of parental interactive style (Ozturk et al., 2014). In our study, we used the Italian version of the PSQ (Venuti & Senese, 2007) which have shown adequate internal consistency for both mothers and fathers.

2.2.4. Data analysis

Firstly, we checked the normality of the distribution for all the maternal and parental variables for each group and we standardized the variables with elevated kurtosis and skewness. According to the PSI/SF manual guidelines, we removed from the subsequent analysis on parenting stress all the participants who raw score was below 10 on the defensive scale (PSI-DF).

Before testing the study hypothesis, descriptive statistics were reported including the means and standard deviations of all parenting dimensions (parenting stress, styles and attachment) for the target and the control group. In addition, we also reported the percentages of parents in the clinical range on the PSI/SF for each study group. Then a preliminary correlational analysis was performed to test

the strength of potential relationship among the study variables using Spearman coefficients. We reported the correlations between maternal and paternal dimensions on the PSI/SF total scores and subscales and the PSQ as well as among parents and child control and dependent variables (AGE, WISC; SAA). Outliers were removed from statistical analysis on group comparisons.

Moreover, to examine group differences on parenting stress and parental style we conducted a two-way Factorial Analysis of Variance, testing the main effect of group (ASD, TD), gender (mothers, fathers) considered as the independent factors, and their interaction. In particular, we ran separate two-way MANOVA for parenting stress and parental style using respectively four levels (Parental distress, Parent-Child Dysfunctional Interaction, Difficult Child and Total Stress) and three levels (Social Exchange, Didactic/Material, Limit Setting) for the dependent variable. A Fisher's Exact Test was also conducted to test statistical differences on the rates of parents in the clinical range of the PSI. In addition, given that dependent variables were not normally distributed non-parametric test were also used for a supplementary confirmatory analysis of the group differences. We explored potential differences between groups (ASD vs TD) on parenting stress and parental style using the rank-based non-parametric Mann-Whitney Test. Analysis were performed separately to compared maternal and paternal scores for the two domains. With respect to gender comparison on the paired samples, we used the Wilcoxon signed-ranked Test to determine possible statistical differences among maternal and paternal dimensions in each study group.

Next, according to our second and third hypothesis we conducted hierarchical multiple linear regression to assess the contribution of the presence of ASD diagnosis, parenting stress as well as parental interactive style as well as in predicting attachment representations (dependent variable). We ran two different regression model taking into account one parental figure at a time. Given the possible relation between specific predictors and the sample size, sequential variable entry into the analysis was theory-driven in order to test whether first child variable and then parenting style and stress add a significant contribution in explaining the quality of child attachment representations. Therefore, the first step of analysis introduced child ASD diagnosis; next, we entered parenting stress

and social interactive style. Then, the interaction of parenting stress and interactive style with the presence of ASD diagnosis were tested in the third step of the regression model.

Finally, to explore the role of child age on the association between maternal parenting stress and child attachment representations we ran a three-way moderated moderation analysis according to the regression-based approach proposed by Hayes (2017) for each scale of PSI-SF. All the continuous variables entered in the regression model were centered, with the aim to avoid the issue of multicollinearity. In this model, we use maternal parenting distress dimension (P-CDI) as continuous independent variable, child attachment representations (SAA risk) a continuous dependent variable, child clinical status (group) as categorical moderator and child age as a continuous moderator.

We conducted all the data analysis using the software SPSS Statistics for Windows, 22.0 (IBM Corp, 2013). Specifically, the moderated moderation model was performed using PROCESS for SPSS, a statistical package developed for moderation, mediation and conditional process analysis (Hayes, 2012).

2.3. RESULTS

2.3.1. Descriptive statistics

Maternal and paternal dimensions, including parenting stress, interactive and attachment styles are displayed respectively in Table 6 and Table 7. Due to missing data and subjects excluded for high PSI defensive scales scores, data in the tables are based on different sample sizes for each measure. According to the normative range provided in the PSI/SF manual, 55,6% of the mothers of children with ASD was in the clinical range considering the Total Stress (TS), compared to 9,5% of TD group, revealing a significant differences between groups ($p = .003$, Fisher Exact Test). Whereas, rates of fathers in the clinical range were similar between groups, ASD (16.7%), TD (17.6%).

Table 6. Means, Standard Deviations of maternal and paternal dimensions (parenting distress, parental style) for the target and control group.

Variable	Mothers				Fathers			
	ASD		TD		ASD		TD	
	M	SD	M	SD	M	SD	M	SD
Parenting Stress								
PD ^a	51.9	27.5	38.5	25.3	48.8	25.1	50.2	22.0
DC ^a	75.2	24.4	52.8	26.8	66.3	22.7	60.0	26.0
P-CDI ^a	74.1	23.7	47.4	24.4	65.2	20.5	54.4	23.3
TS ^a	71.6	25.2	44.0	26.0	59.4	20.5	54.7	23.1
Parental Style								
Social exchange	4.31	0.49	4.34	0.49	4.12	0.59	3.71	1.06
Didactic/Material	3.74	0.43	4.05	0.53	3.93	0.47	3.57	0.59
Limit Setting	4.07	0.71	4.44	0.58	4.20	0.74	4.19	0.51

Note: TD: Typical Development; ASD: Autism Spectrum Disorder. PSI: Parenting Stress Index; PD: Parental Distress; DC: Difficult Child Characteristics; P-CDI: Parent-Child Dysfunctional Interaction; TS: Total Stress; PSQ: Parental Style Questionnaire;

^aT scores †

2.3.2. Preliminary analysis

Prior to test the hypotheses of the current study, we preliminary investigated the associations among maternal, paternal and child variables using a correlational approach. Spearman correlations between parenting stress and parental styles for both mothers and fathers are displayed in Table 7. Starting from mothers significant negative correlations were found between maternal interactive social exchange and parental distress ($r = -.467, p = .004$). Parent-Child Dysfunctional interaction ($r = -.374, p = .023$) negatively correlates with maternal social exchange ($r = -.374, p = .023$) and didactic style ($r = -.326, p = .049$). In addition, limiting setting in mothers was associated only with the scale DC ($r = .396, p = .016$), despite we observed a moderate trend toward statistical significance for the bivariate correlation with maternal Total Stress scale ($r = .346, p = .066$). Within maternal interactive styles, results only showed a significant association between social exchange and didactic style ($r = .506, p = .001$).

< .001). By contrast, all the measures of maternal parenting stress significantly correlated to each other, revealing from moderate to high positive associations.

With respect to fathers, we observed significant associations between parental style and parenting stress. Specifically, paternal social exchange negatively correlates with PD ($r = .492, p = .004$), P-CDI ($r = -.438, p = .011$) and TS ($r = -.381, p = .029$) and didactic style ($r = .505, p = .001$). In addition a negative correlations at the edge of significance was found between paternal didactic/material style and P-CDI ($r = -.343, p = .051$). Conversely, we did not observed other significant associations between paternal parenting stress variable, didactic style and limit setting. However, this two subscales of which correlate

Table 7. Spearman correlations among parenting stress and parental style for both mothers and fathers (total sample).

Variable	Mother				Father			
	PD ^a	P-CDI ^a	DC ^a	TS ^a	PD ^a	P-CDI ^a	DC ^a	TS ^a
Social exchange	-.467**	-.374*	-.288	-.405**	-.492**	-.438*	.015	-.381*
Didactic/Material	-.246	-.326*	-.275	-.292	.215	-.343 ^a	.134	-.213
Limit Setting	-.119	-.256	-.392*	-.305 ^a	-.255	-.170	-.011	-.166

Note: PD: Parental Distress; DC: Difficult Child Characteristics; P-CDI: Parent-Child Dysfunctional Interaction; TS: Total Stress; ECR: Experiences in Close Relationship

^aT scores; ^b Considerable trend toward significance (between .08 and .05)

Focusing on the associations among maternal and paternal dimensions (see Table 8), we observed a significant correlation between maternal and paternal perception of difficult child characteristics ($r = .415, p = .020$) which also showed a marginal tendency toward significance on the correlation with maternal total stress ($r = .309, p = .091$). Similarly, maternal perception of difficult child found to be approached the statistical significance on the association with paternal Total Stress ($r = .334, p = .061$) Moreover, statistically significant correlations emerged between maternal didactic/material scale and

paternal Total Stress ($r = .380, p = .013$), and didactic/material scale ($r = .363, p = .018$). Within TD group we also found a significant positive associations between maternal and paternal Limit Setting subscale ($r = .433, p = .035$).

Table 8. Spearman correlations among maternal and paternal dimensions (parenting distress, parental style)

		Paternal dimensions						
Variables		1	2	3	4	5	6	7
Maternal dimensions	1. PD ^a	.094						
	2. DC ^a	.083	.415*					
	3. P-CDI ^a	.171	.162	-.141				
	4. TS ^a	.021	.309	.205	.237			
	5. Social exchange	.130	.054	.129	.231	.178		
	6. Didactic/Material	-.168	-.100	.076	.382**	.125	.363*	
	7. Limit Setting	-.072	-.109	.203	-.052	.033	.131	.260

Note: PD: Parental Distress; DC: Difficult Child Characteristics; P-CDI: Parent-Child Difficult Interaction; TS: Total Stress; ECR: Experiences in Close Relationship

^aT scores;

Table 9. Spearman correlations among child variables and selected parenting dimensions (both mothers and fathers) for regression analysis.

Child variable	Maternal variable			Paternal variable		
	PSI-TS ^a	P-CDI	PSQ-SE	PSI-TS ^a	P-CDI ^a	PSQ-SE
Age	-.230	-.059	.007	-.160	.007	-.085
Verbal IQ	.303	.236	-.051	-.159	.052	.329*
SRS	.558**	-.458**	-.098	.321 ^b	.370*	-.223
SAA risk	.436**	.275	.121	.232	.283	-.142
SES	-.108	-.031	.164	.020	.094	-.140

Note: Verbal IQ: Verbal Child Intelligence Quotient; SRS: Social Responsiveness Scale Total Score; SAA: School-Age Assessment of Attachment; SES: Family Socioeconomic Status; PD: Parental Distress; DC: Difficult Child Characteristics; P-CDI: Parent-Child Dysfunctional Interaction; TS: Total Stress;

^aT scores; ^b Considerable trend toward significance (between .08 and .05)

Next, Spearman bivariate correlations between among parenting dimensions and child variables are displayed in Table 9. Specifically, we found significant positive associations between child Social

Responsiveness Scale and maternal P-CDI ($r = .458, p = .004$) and Total Stress ($r = .558, p < .001$), as well as with maternal difficult child ($r = .568, p < .001$) and paternal P-CDI ($r = .294, p = .043$). In addition, significant correlations emerged between SAA variable and maternal Total stress ($r = .436, p = .006$) whereas no association were found with paternal dimensions and other maternal variables, except for Difficult Child scale ($r = -.421, p = .008$). Child verbal IQ only show a positive correlation with paternal Social Exchange scale ($r = .329, p = .036$)

2.3.3. Main results

2.3.3.1. Group and gender differences in parenting stress and parental style

We also investigated potential group differences between ASD and control group. Starting from parenting distress (see Figure 5) the two-way (Group X Gender) multivariate analysis of variance (MANOVA) yielded to a significant effect of group [$\Lambda(4,67) = .842, p = .019$]. Specifically, the effect on Total Stress [$F(1,73) = 8.40, p = .005$], Parent-Child Dysfunctional Interaction [$F(1,73) = 12.14, p = .001$] and Difficult Child [$F(1,73) = 6.04, p = .016$] indicating that parenting stress were significantly higher for mothers and fathers of children with ASD than for parents of TD group . Statistical analysis revealed no effect of group on Parental distress subscale. In addition, the main effect of gender was non-significant, [$\Lambda(4, 67) = .953, p = .517$] as well as the interaction effect [$\Lambda(4, 67) = .913, p = .186$].

With respect to parenting style (see Figure 6), a significant effect was found for group [$\Lambda(3, 73) = .838, p = .005$] but not for gender [$\Lambda(3, 73) = .954, p = .325$] nor for the interaction (Group X Gender) [$\Lambda(3, 73) = .946, p = .254$]. In particular, univariate statistical analysis highlighted that parents of children with ASD reported lower level of Didactic/material [$F(1, 78) = 11.31, p = .001$] and Limit Setting style [$F(1, 78) = 4.61, p = .035$] compared to their normative counterpart. No significant differences between groups were found for Social Exchange scale. Additionally, univariate analysis also indicate that mothers showed higher Social Exchange compared

to fathers, despite it only approached the statistical significance, [$F(1,78) = 3.52, p = .064$]. Except for this trend, gender and the interaction did not show a significant main effect on the PSQ scales.

2.3.3.2 Non-parametric supplementary analysis

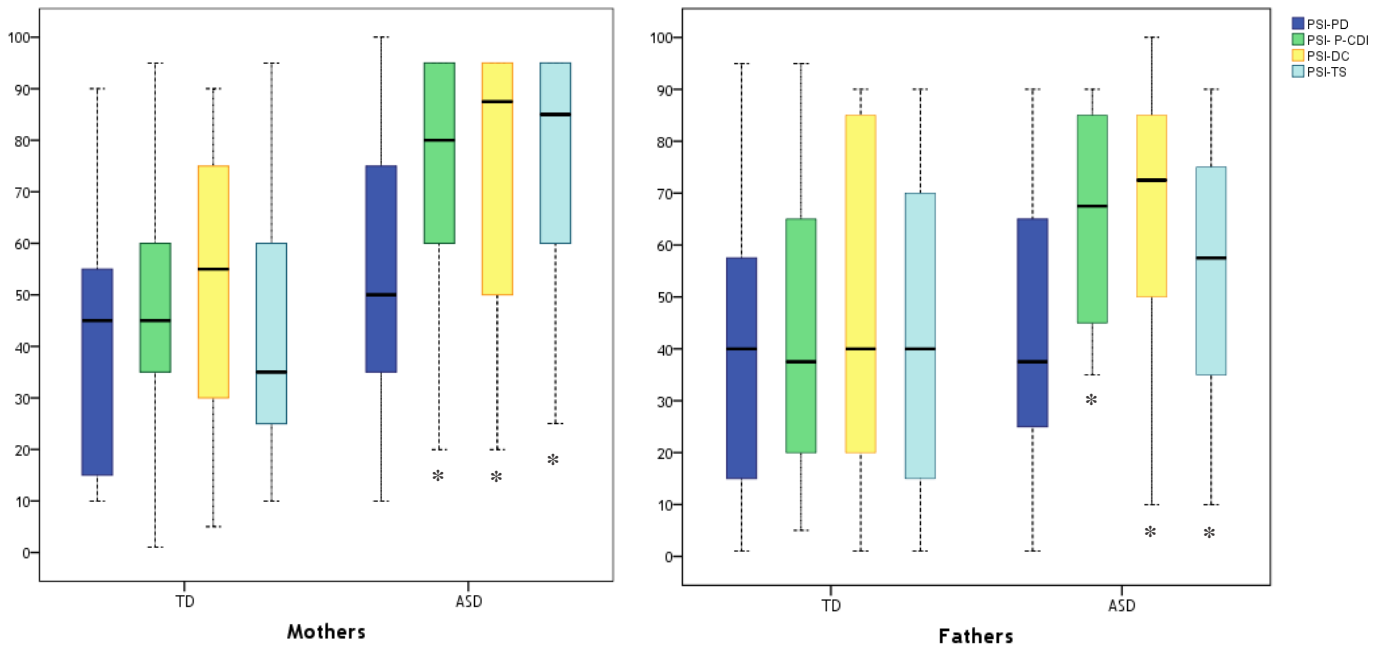
We conducted a supplementary analysis using non-parametric statistics to confirm two-way MANOVA results, given that not all the dependent variables were normally distributed.

Wilcoxon test revealed that mothers of ASD differ from their TD counterpart in P-CDI ($Z = -3.05, p = .002$), DC ($Z = -2.73, p = .006$) and TS ($Z = -2.95, p = .003$), whereas maternal reports on parental distress (PD) does not showed significant differences (see Figure 5). No group differences were found for maternal PD and all parenting stress dimensions in fathers of our sample. Similarly, we observed no gender differences on parenting distress between mothers and fathers ($p > .05$)

Focusing on parenting style, we found that mothers of children with ASD reported lower scores on the Didactic/Material scale compared to control group ($Z = -.271, p = .007$) and Limit Setting ($Z = -.221, p = .027$). In addition, no differences emerged with respect to Social exchange scale ($p > .05$). Furthermore, we observed a significant difference in males group comparisons, with fathers of ASD children reporting lower level Didactic/Material scale ($Z = -2.02, p = .045$). No gender differences emerged on parental style between mothers and fathers ($p > .05$), expect for a marginal trend toward significance with respect to social exchange ($p = .064$).

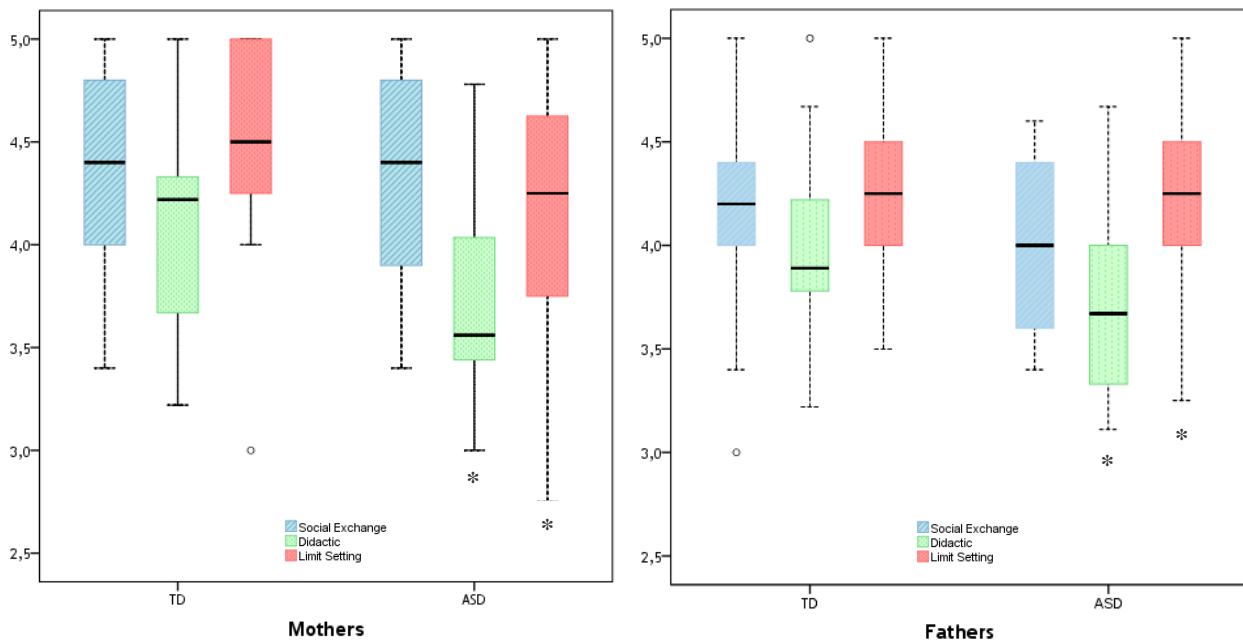
We also analyzed the potential differences between maternal and paternal dimensions for each group. Regarding to parenting distress, mothers reported higher scores on Difficult Child Characteristics scale ($Z = 2.17, p = .030$) compared to fathers within the ASD group. With respect to parental styles, differences were found in ASD group but not in parents of typically developing children. Specifically, fathers showed lower scores on Social exchange scale compared to their partner in ASD group, albeit the result was only close to the statistical significance for the ASD ($Z = 1.92, p = .054$). The analysis on the Didactic/Material and Limit Setting subscale did not revealed gender differences.

Figure 4. Boxplots of the Maternal and Paternal T scores on the Parenting Stress scales clustered by the two study groups.



Note: PD: Parental Distress; DC: Difficult Child Characteristics; P-CDI: Parent-Child Dysfunctional Interaction; TS: Total Stress:

Figure 5. Boxplots of the Maternal and Paternal scores on the Parental Style Questionnaire clustered by the two study groups



Note: TD: Typical Development; ASD: Autism Spectrum Disorder

2.3.3.3. *Child and parental predictors of child attachment representations*

According with our aims, we tested the predictive effect of ASD diagnosis, maternal and paternal variables on quality of child attachment at representational level. Specifically we used a separate regression model for each parental figure including three steps to enter the variables, in the order as follows: a) the presence of ASD diagnosis; b) parenting stress and parental social interactive style c) the interaction between parenting stress and social style with ASD diagnosis.

The hierarchical multiple regression analysis focused on the maternal figure (see Table 10) revealed that the amount of variance explained (adjusted R^2) was .405 considering the overall model, .258 for the Step 1 (ASD diagnosis) and .403 for the Step 2 (ASD diagnosis, maternal parenting stress and Social Style). Among the three steps, the significance was higher for Step 2, ($F_{(3,36)}= 9.08$, $se = 1.80$, $p < .001$). Thus, the addition of maternal parenting stress and social interactive style in the Step 2 contributed significantly to the explained variance of the dependent variable. Indeed, results showed that the R^2 change for the Step 2 was significant ($p = .011$). By contrast, the significant moderation effect of child ASD diagnosis on the association between maternal dimensions and child attachment was found in Step 3.

Specifically, in the first step, the presence of ASD diagnosis ($\beta = .527$, $p = .001$) had a significant main effect on child attachment representations risk. Next, in the second step, data revealed a significant predictive effect of both maternal parenting distress ($\beta = .507$; $p = .004$) and maternal social interactive style ($\beta = -.341$, $p = .026$) on child attachment. Whereas, as opposed to Step 1, we only observed a moderate trend toward significance of ASD diagnosis in the Step 2 ($\beta = .282$; $p = .071$). Similarly, in the third regression model the presence of ASD diagnosis did not contribute significantly to child attachment representations ($\beta = .343$; $p = .804$) as well as maternal parenting stress ($\beta = .316$; $p = .754$), parental social style ($\beta = .340$; $p = .084$) despite it marginally approached statistical significance. In addition, none of the two interactions with ASD diagnosis tested in the third step was statistically significant.

With the respect to the fathers, the amount of variance explained (adjusted R^2) by the hierarchical multiple regression analysis (see Table 11) was .245 for the overall model, .263 for the Step 1 (ASD diagnosis) and .271 for the Step 2 (ASD diagnosis, paternal parenting stress and social style). Among the three models, the significance was higher for Step 1, ($F_{(1,36)} = 12.39$, $se = 2.08$, $p < .001$). Nevertheless, the statistical significance was reached also for Step 2 ($F_{(3,36)} = 4.96$, $se = .2.06$ $p = .007$) and for Step 3 ($F_{(5,36)} = 3.08$, $se = 2.10$, $p = .025$). Thus, the addition of paternal parenting stress and social interactive style in the Step 2 as well as their interaction with child ASD diagnosis (Step 3) did not contributed significantly to the explained variance of the dependent variable.

Specifically, the presence of ASD diagnosis had a significant main effect on child attachment representations in both Step 1 ($\beta = .534$, $p = .001$) and Step 2 ($\beta = .517$, $p = .002$). Next, in the second step, data revealed a non-significant effect of both paternal parenting distress ($\beta = .534$, $p = .145$) and paternal social interactive style ($\beta = .517$, $p = .500$). Moreover, as opposed to Step 1, the significant contribution of of ASD diagnosis observed in the first two steps, was not found in the Step 3 ($\beta = 1.25$; $p = .310$). In the third regression no variables of the model contributed significantly to the explained variance, including paternal parenting stress, parental style and their interaction with ASD diagnosis ($p > .05$). Supplementary analysis performed without three outliers confirmed these results.

2.3.3.4. Association between parenting distress and child attachment representations: the moderation effect of ASD diagnosis and child age

In line with the last explorative aim of this study, we used a moderated moderation model (see Figure 7) to explore whether the presence of ASD diagnosis moderates the association between parenting stress dimensions (Parent-Child Dysfunctional Interaction) and child attachment representations, considering the effect of child age. A significant interaction was found only for the model that include maternal Parent-Child Dysfunctional Interaction as focal predictor.

Table 10. Hierarchical regression analysis of attachment representations in school-age children by presence of ASD diagnosis, maternal parenting stress and social interactive style

Predictors	Attachment representations risk				
	β	T	<i>p</i>	ΔR^2	<i>p</i> ch
<i>Step 1</i>			.002**	.258	
ASD diagnosis	.527**	2.45	.001		
<i>Step 2</i>			<.001***	.403	.011
ASD diagnosis	.282 ^a	1.31 ^a	.071		
Maternal Parenting Stress	.507**	1.70	.004		
Maternal Social exchange	.341*	.041	.026		
<i>Step 3</i>			.001**	.405	.352
ASD diagnosis	.343	1.59	.804		
Maternal Parenting Stress	.112 ^a	.009	.084		
Maternal Social exchange	.340	1.70	.754		
Parenting stress X ASD	.441	-.017	.954		
Social Exchange X ASD diagnosis	-.080	-.086	.214		

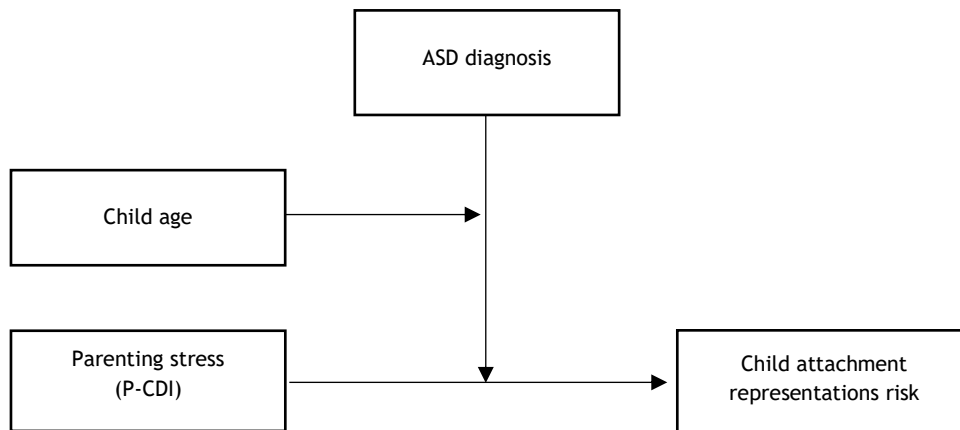
Note: * $p < .05$, ** $p < .01$, *** $p < .001$; ^a p value approached to statistical significance; *p* ch: p value of the R^2 change; IQ: Intelligence Quotient; ASD: Autism Spectrum Disorder;

Table 11. Hierarchical regression analysis of attachment representations in school-age children by presence of ASD diagnosis, paternal parenting stress and social interactive style

Predictors	Attachment representations risk				
	β	T	<i>p</i>	ΔR^2	<i>p</i> ch
<i>Step 1</i>			.001**	.263	
ASD diagnosis	.534	5.59**	.001		
<i>Step 2</i>			.003	.271	.323
ASD diagnosis	.517	3.40**	.002		
Paternal Parenting Stress	.234	1.49	.145		
Paternal Social exchange	.106	.682	.500		
<i>Step 3</i>			.037*	.221	.933
ASD diagnosis	1.04	5.05	.482		
Paternal Parenting Stress	.275	.031	.216		
Paternal Social exchange	.181	.775	.487		
Parenting stress X ASD	-.077	-.005	.880		
Social Exchange X ASD diagnosis	-.470	-.568	.712		

Note: * $p < .05$, ** $p < .01$,
p ch: *p* value of the R^2 change; ASD: Autism Spectrum Disorder;

Figure 6. Moderating effect of child age and ASD diagnosis on the relation between maternal parenting stress and child attachment representations risk

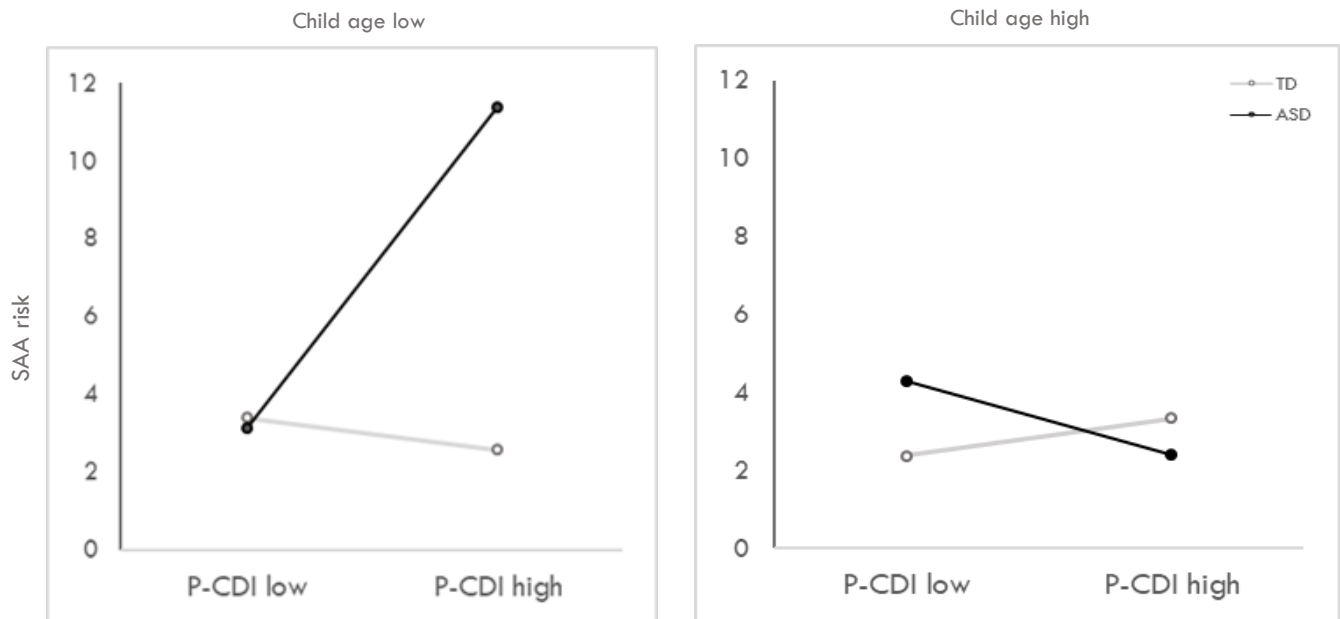


Note: P-CDI: Parent-Child Dysfunctional Interaction

This overall multiple regression model was significant ($p = .001$; $R\text{-squared} = .51$). In particular, we observed only a trend of the focal predictor (maternal P-CDI) ($b = .023$, $se = .36$, $p = .083$) and child age ($b = -.035$, $se = .01$, $p = .073$), whereas ASD diagnosis show a statistical significant contribution ($b = 2.07$, $se = .72$, $p = .007$). The interaction effects between parenting stress and child diagnosis ($b = -.04$, $se = .02$, $p = .074$) and parenting stress and child age ($b = .00$, $se = .00$, $p = .078$) approached statistical significance. By contrast, no significant effect was found with respect to the interaction between child diagnosis and age ($b = -.63$, $se = .039$, $p = .121$). Next, the triple interaction between maternal parenting stress, child age and diagnosis ($b = -.004$, $se = .001$, $p = .008$) significantly contributed in explaining child attachment representations. Specifically, the simple slopes analysis (see Figure 8) revealed a significant positive interaction between maternal parenting distress and child diagnosis only for younger children with ASD (≤ 104.1 months; $p = .002$). Moreover, by adding the triple interaction effect to the multiple regression model we observed a significant increase of the proportion of the variance explained by the multiple regression ($R\text{-squared change} = .123$).

No effect of the tripe interaction (Parenting stress X Group X Child Age) was found in regression models with paternal parenting stress (PD, P-CDI, DC, TS) as focal predictor

Figure 7. Interactions effect between maternal parenting stress (Parent-Child Dysfunctional Interaction; P-CDI) and child attachment representations for different levels of child age clinical status (TD, ASD).



Note: P-CDI: Parent-Child Dysfunctional Interaction; TD: Typical Development; ASD: Autism Spectrum Disorder. SAA: School-age Assessment of Attachment.

2.4. DISCUSSION

The study uniquely contribute to ASD literature by examining child, maternal and paternal predictors of attachment representations in school-age children. Firstly, we explored whether parents of children with ASD differ from the normative control group in parenting stress and interactive style with their child. In our sample, we found that parents of children of ASD showed higher level of parenting stress compared to the normative group. This finding is consistent with previous studies on parenting stress in mothers and fathers of children with atypical neurodevelopment, including ASD (Hayes & Watson, 2013), and regardless of the type of cognitive and verbal functioning (Rao & Beidel, 2009) as is the case of the current investigation. Nevertheless, we did not find differences between groups on the level of parental distress (PSI-PD). A possible explanation of this result is that this subscale refers to the parents' experience of their role as a function of personal factors, without considering child and interpersonal features. By contrast, mothers and fathers of children with ASD reported higher scores

in all the other dimensions of parenting distress, which include difficult child characteristics and parent-child dysfunctional interaction. In fact, recurrent interpersonal impasses may constitute a prominent source of stress, especially with respect to ASD socio-communicational impairment. Literature have widely documented that parents of children with ASD may experience higher level of stress (Hayes& Watson, 2013). Several reasons related to ASD core symptoms can explain these findings, such as the non-mutual dyadic interaction, the frequent interpersonal mismatching (Guo et al., 2017) and the higher sense of inefficacy (Crowell et al., 2019). In addition parenting a child with ASD entails additional sources of stress including worries regarding current and future child autonomy, child protracted dependency and needs of special care and the belated achievement of developmental milestones (Wolf, Noh, Fisman, Speechley, 1989). No gender differences were found in the level of parenting distress between mothers and fathers of children of ASD, as highlighted by a previous research (Ozturk et al., 2014). Consistently, we also found higher rates of mothers in clinical range on the parenting stress in the ASD group, whereas this difference was not observed for fathers. Approximately one mother out of two of our clinical sample reported level of stress of higher clinical significance. Given that mothers in our study are the primary caregiver, it is conceivable that they are exposed more frequently to the multitude of different challenges posed by raising a child with ASD. Thus, the role of primary caregiver could result in higher level of perceived stress in relation to parenting-related experiences and feelings. In addition, this result could be related to the ability of fathers to avoid a maladaptive emotional over-involvement in the relationship with their child.

Moreover, with respect to group differences on parental style, our findings indicate that mothers and fathers of children with ASD reported less Didactic/Material and Limit Setting style in the interaction with their child compared to parents of the typical control group. Our results contradict the study hypothesis of no differences between groups in parenting styles, based on recent data (Ostfeld-Etzion et al., 2015). However, this result is in line with an earlier report by Rutgers et al., (2007) showing less authoritative style in parents of toddlers with ASD. Hence, the current study extend previous

research by confirming this group difference also in parents of school-age children with High-Functioning ASD. These group differences suggested the potential role of parental flexibility of parents of children with ASD in adapting to the atypical quality of child interactive style. Reduced exploratory tendency, passivity and non-functional behaviors displayed by children with ASD (Pierce & Courchesne, 2001) in the context of social relationship may partly explain these findings. Indeed, ASD characteristic may undermine parent's proclivity to propose specific activities aimed at stimulate child exploratory and autonomous behaviors. ASD decreased interpersonal engagement and restricted interests may render ineffective the attempt to promote child stimulation by using a didactic style focused on learning through social interaction. Similarly, the use of a Limit/setting style aimed at increasing rule keeping and well-mannered behaviors toward others in the child could be perceived as unrewarding by the parents. The prolonged effort to adopt a disciplinary approach might not fit child features, given the documented difficulties in the domain of emotion regulation (Sivaratnam et al., 2015) and perspective-taking (Reed & Peterson, 1990) of children with ASD.

With this mind, it is interesting to note the significant relationship between parenting stress and parental style. Specifically, low level of reported Didactic/Material style in mothers are associated with higher stress related to parent-child dysfunctional interaction (see Table 7). In a similar way, Limit/setting in mothers was found to be associated with DC scale of PSI, which refers to having problems in managing challenging behaviors and exerting an age-appropriate discipline.

Taken together, these associations could support the hypothesis of a child-driven effect on parenting behaviors. In fact, according to a bidirectional perspective, lower parental social style and less emphasis on rule keeping could be interpret as specific functional parental responses to cope with the challenging condition of parenting a child with socio-communicational impairment. Nonetheless, on the other hand these parental communicative responses to the child could pose further risks and therefore do not facilitate the development of communicational and regulatory skills in children with ASD across development.

In terms of gender differences fathers reported to have less social exchange with their child in both clinical and control group. Despite the results only approached statistical significance, it would be consistent with a previous investigation, which used the same questionnaire to assess parenting styles (Ozturk et al., 2014). Mothers as primary caregiver have greater contact with the child reporting more affection expression, sensitivity and responsiveness than fathers do. Therefore, mothers seem to be more responsible for engaging the child in social exchanges, as in the case of typical development children. The different quality of paternal and maternal interactive style pointed out the importance to consider roles complementarity in child rearing aimed at providing a flexible developmental context also in ASD (Collins & Russell, 1991).

Additionally, statistical analysis showed significant negative associations between social exchange style and parenting stress in both parents. These data suggest the detrimental role of parenting stress (Deater-Deckard & Scarr, 1996) on quality of interactive exchanges and caregiving behaviors in parents of children with ASD. Moreover, maternal parenting stress related to child characteristics is associated with less Limit Setting style in accordance with prior research on neurodevelopmental disorders, which highlighted the link between a permissive approach and parenting stress in ASD (Hutchinson, Feder, Abar & Winsler 2016).

In general, according to our hypothesis group differences appear to be particularly clear in the case of parenting distress related to child characteristics and parent-child interaction for both mothers and fathers of children with ASD. Parenting stress is in turn negatively associated with quality of social exchanges, a key component of caregiving environment, which constitute itself a critical area in view of the ASD core symptomatology. In addition, mothers and fathers showed the similar tendencies in parenting style regardless of child clinical status.

Consistently with the main aims of the current study, we examined the predictive effects of child ASD diagnosis, and particularly maternal and paternal parenting stress and social interactive style.

Firstly, regression analysis and predictive models including parental variables confirm that the presence of ASD diagnosis seems to represent a robust risk factor for the development of at-risk

attachment internal representations in school-age children, as highlighted in the Study 1. Focusing on the caregiving environment, maternal dimensions considered in this study seems to have a significant impact in explaining the quality of child attachment representations. Specifically, maternal parenting stress increase the risk of insecure attachment representations underlying maladaptive information processing. Despite a substantial body of research have examined the adverse effect of parenting stress on child outcome typical and atypical development, including ASD (Bauminger et al., 2010b), this is the first study to document its link with attachment representations in school-age children. Similarly, maternal social style in the interaction with the child emerged as a significant predictor of attachment risk at representational level, despite the direction of the effect is opposed to what expected. Nevertheless, maternal parenting stress, which is the stronger predictor in our statistical model, is negatively associated with social exchange and other parenting styles. Thus, mothers with higher stress in our sample, tend to perceive themselves as less social in the relational exchanges with their child. In addition, given that the moderation effect of child diagnosis was non-significant for all the maternal dimensions, our findings suggest that the maternal parenting stress and parental social style affect child information processing underlying internal sense of security as well as model of self and the others, regardless of child clinical status.

With respect to the contribution of paternal dimension to the quality of child attachment representations, no significant effect were found of both parenting stress and parental style. Similarly, also the interaction of paternal dimensions with child ASD diagnosis did not revealed a significant moderation effect. In contrast to our hypothesis, ASD diagnosis was the only significant predictor of child attachment within the regression model focused on paternal dimensions. In this regard, several aspects related to the characteristics of our sample, the methodology and the limitations of our study may explain this unexpected result. It is plausible that paternal effect showed a non-significant effect, as opposed to maternal dimensions, because we only included families in which fathers were not the primary caregiver. In fact, despite only marginally, our findings documented lower level of social exchange in fathers compared to mothers in both target and control group. In addition, another

possible explanation is that both the constructs and the self-reported measures we used may not be the most suitable to capturing the unique contribution of paternal figure to the quality of child attachment representations, particularly in school-age children. Despite the absence of significant predictive effects in this study and the group differences we found in fathers corroborate the prominence of its unique role within child developmental context, confirming the need to clarify. Furthermore, we explored whether child age moderates the interaction effect between parenting stress and child ASD diagnosis considering both maternal and paternal dimensions. With respect to child chronological age, no moderation effects was found, despite some authors (Rogers et al., 1993) argued about its potential contribution for the development of attachment security in ASD population, hypothesizing less security in younger children. Nevertheless, it is interesting to note that in our sample, the impact of maternal stress related to parent-child dysfunctional (P-CDI) on child attachment representations was moderate by ASD diagnosis which in turn significantly interact with child age. Specifically, this effect was significant only for younger children with ASD, who appear to be more susceptible to maternal parenting stress compared to their older counterpart. This finding suggests that a potential challenge of children with ASD in the development of secure attachment representations could render younger children more vulnerable to the detrimental effect of parenting stress connected to mother-child interaction disruptions. Moreover, according to similar results from a previous study (Little, 2002) mothers reported lower parenting stress in older children with ASD. This difference may explain a stronger effect of maternal parenting stress on child attachment needs and expectations at representational level in younger children with ASD.

In sum, this research represents the first attempt to evaluate how caregiving environment shape quality of attachment representations in school-age children with ASD. Firstly, we found that parents of the ASD group reported higher level of parenting distress, with particular reference to parent-child dysfunctional interaction. Moreover, mothers but not fathers of children with ASD showed higher rates of clinical parenting stress compared to the control group. In terms of parenting behaviors, parents of children with ASD reported lower didactic and disciplinary style than controls. However,

no differences emerged between mothers and fathers within group, except for a trend on social exchange dimension. Notably, among parental caregiving dimensions, maternal parenting stress showed the most significant contribution in explaining quality of child attachment representations.

Moreover, we also observed that the effect of parenting distress related to parent-child relational dysfunctions have a significant predictive effect only in young children with ASD (below 10 years old).

These findings confirmed that parenting dimensions play a critical role for children adjustment and adaptation also in later development (Rutgers et al., 2007). On this matter, it should be considered that communicational abilities as well as attachment representations continue to develop during middle childhood (Wodka, Mathy, Kalb, 2013; Crittenden, 2015), representing pivotal aspects to work on. Thus, given that they constitute a robust predictor for adolescence and adulthood (Laible, Carlo & Raffaelli, 2000; Howlin, Moss, Savage & Rutter, 2013) it becomes crucial to take into account their association with parenting dimensions in the context of parent-mediated interventions in ASD, which have been extended beyond preschool-age (Green et al., 2018)

2.5. CONCLUSION

No previous research examined the influence of caregiving dimensions on child attachment representations in the context of atypical neurodevelopment.

Nonetheless, several limitations of this study should be acknowledged. The small sample size and the does not allow broad generalizations of these findings, which need to be replicate by future investigation. We only includes families with mothers as primary caregiver of the child. Moreover, the majority of our sample comprised families with middle-high socio-economic status. Self-reported evaluation may do not reflect the actual interactive style in the context of parent-child relationship, constituting a limited source of information. In addition, the selected parental dimensions may only partially capture paternal contribution to child outcome representing another potential drawback. A

longitudinal analysis would be more appropriate to test the nature of these associations. Moreover, we only consider parenting stress, whereas measures of parental mental health were not collected. Future research on this topic should consider the possibility to use observational measures to assess parenting style across development adopting longitudinal designs. With respect to paternal contribution, indirect effect should be tested by considering a wide range of dimensions, with particular reference to the degree of paternal involvement. In fact, it could be relevant to examine the impact of other salient parenting-related variables on child attachment representations, which has not been considered in our study, such as parental sensitivity, reflective functioning, insightfulness or mind-mindedness. Similarly, genetic, emotional, cognitive and behavioral child characteristics might moderate or mediate the influence of caregiving environment on child attachment. Moreover, the use of a developmental perspective may also clarify how the impact of maternal and paternal caregiving can change over time. In this respect, as suggested by prior studies (Oppenheim et al., 2007), the resolution of child diagnosis might constitute a crucial factor for parent-child relationship which in turn may affect child attachment security. Importantly, despite an ever-growing area of research is focusing on the study of fathers in ASD, further investigations are needed to study in great depth the contribution of paternal dimensions to quality child attachment representations during school-age. In this respect, it could be interesting to evaluate the role of co-parenting on child attachment state of mind.

Given that our data suggested a potential mechanism through which parents of children with ASD adapt their parenting behaviors to their child socio-communication difficulties, future studies should adopt a transactional approach of parent-child dyadic (Sameroff, 2009) to elucidate the strengths of these bidirectional effects. Additionally, dyadic statistical models such as the Actor-Partner Interdependence Model (APIM; Cook & Kenny, 2005) may also provide new insights on the specific associations among parenting dimensions in couples. In addition, another possible future direction is to test the predictive role of child attachment representations on several child and parental outcomes in ASD.

Our findings have also several implications for clinicians who should consider the impact of raising a child with ASD on maternal and paternal stress and interactive style. The elevated level of parenting stress confirms the need to increase the attention to family outcomes in ASD with the aim to address potential adverse effects not only on mothers and fathers but on the entire family system. Appropriate early screening, assessment and treatment targeting distress and mental health in parents of children with ASD are essential to improve parental psychological well-being. This aspect is even more critical due to the fact that parent-mediated social communication interventions are considered to be one of the most effective treatment to reduce ASD core symptoms (Green et al., 2010). In this scenario, both parental perception of their own interactive styles and attachment representations underlying child behaviors to elicit caregiving are valuable information to explore the family context. Finally, according to our findings, it is essential to address perceived parenting stress to improve the quality of child attachment representations in children with ASD. In this way, in order to increase child sense of internal security extending psychological functioning, clinicians should account for the impact of caregiver dimensions with particular reference to stress related to parenting experience and feelings. In conclusion, this study extend the limited literature on caregiving environment and attachment representations in clinical samples, also providing initial data on paternal contribution, which has been only partially investigated so far, particularly in the study of developmental outcomes of children with ASD (Braunstein, Peniston, Perelman & Cassano, 2013, Rankin, Paisle, Tomeny & Eldred, 2019). The role of parenting stress and parental style is crucial not only for parental adjustment and well-being but also for quality of child attachment representations that may constitutes a salient predictor of developmental outcomes also in children with ASD.

Study 3. Intergenerational transmission of attachment security in Autism Spectrum Disorder

3.1. INTRODUCTION

3.1.1. Background

Starting from John Bowlby's original tenet of psychological and mental health continuities across generations (1969/1982), during the last three decades attachment research has extensively tested the hypothesis of the intergenerational transmission of attachment providing significant evidences. It has been documented that secure attachment state of mind in mothers is associated to higher reward and neural activation in responses to infant cues generating more prompt, contingent and sensitive caregiving behaviors (Strathearn, Fonagy, D'Amico & Montague, 2009). Specifically, these processes may boost the continuity of attachment security from parent to child constituting an intergenerational protective factor (Shah, Fonagy & Strathearn, 2010). However, earlier meta-analytic findings (van Ijzendoorn, 1995) identified a "transmission gap" due to the limited contribution of caregiver sensitivity in explaining the quality of child attachment. A recent meta-analysis on this topic (Verhage et al., 2016), confirms previous results of an intergenerational transmission with larger effects size for attachment security ($r = .31$). Interestingly, the authors found that several variables moderate this effect narrowing the transmission gap, including child risk status. Nevertheless, most of the studies on this topic focused on low-risk sample rather than clinical populations (Verhage et al., 2018). In this regard, children of high-risk families or clinical population, as is the case of ASD (Rutgers et al., 2004), are more likely to develop insecure attachment (Cyr et al., 2010). Despite some studies on this topic also involved clinical samples, there is a consistent lack of studies on attachment transmission across generations in families of children with atypical neurodevelopment, particularly in ASD.

3.1.2. Intergenerational transmission of attachment in Autism Spectrum Disorder

To date, only few recent studies (Seskin et al., 2010; Keenan et al., 2016) addressed this issue of intergenerational transmission of attachment in ASD, providing initial mixed findings. In this regard, Lau and Peterson (2011) conducted the first study on attachment organization in parents of children with Asperger Syndrome, albeit without testing a direct hypothesis of intergenerational transmission. Despite approximately 40% of parents of children with ASD were classified as Type A (avoidant attachment), no significant differences were found between target and control group. This result is in contrast to an earlier study focused on attachment representations in mothers of children with ADHD (Kissgen et al., 2009).

Similarly, Seskin et al., (2010) studied the link between parents' attachment representations, assessed using the Adult Attachment Interview (AAI, Goerge et al., 1985), and quality of parent-child relationship with their child in the context of ASD. Fifty-two percent of the participants involved in this study were school-age children (6-13), as is the case of the current study sample. The Functional Emotional Availability Scales (FEAS; Greenspan et al., 2001) was preferred to the Strange Situation Procedure (SSP) to assess parent-child relationship due to the wide range of age and the clinical characteristic of the sample. Notably, this study found significant associations between parents' attachment state of mind and quality of dyadic relational behaviors across different domains. Children with ASD of secure parents showed higher verbal and non-verbal communicative abilities as well as better problem solving and symbolic play. Therefore, these data support the expected association between sensitivity-security observed in normative samples also in ASD as confirmed also by other studies (Oppenheim et al., 2012). Moreover, this is the first study based on an implicit representational assessment (AAI) which take into account both the limitations of the standard procedure such as the SSP (Rutter, Kreppner & Sonuga-Barke, 2009) and the unique quality of dyadic exchanges that occur in ASD. However, other studies contradict the hypothesis of transmission of attachment security in ASD as a negative consequence of the socioemotional impairment, which may impede these children to benefit from positive parenting (van Ijzendoorn et al., 2007).

Nevertheless, despite a series of studies has investigated the link between sensitivity and security, only one recent investigation drew attention on the direct association between parent and child attachment in ASD (Keenan et al., 2016). Specifically this study focused on school-age children (7-14 years old) with High-Functioning ASD ($IQ \geq 70$) assessing attachment organization in both primary caregiver and child using respectively two self-reported questionnaires: the Experiences in Close Relationships- Revised (ECR-R; Fraley et al., 2000) and the Security Scale (SS; Kerns et al., 1996). The results of this study indicate that parents of children with ASD reported elevated attachment-related anxiety compared to control, whereas no differences were found for attachment avoidance. Thus, contradicting previous results of no differences (Lau and Peterson, 2011). The discrepancy between the two studies may be due to the different methodological approach for the assessment of attachment security (questionnaire vs vignettes). Importantly, Keenan et al., (2016) examine the relation between child attachment and caregiver dimensions, including attachment styles. However, significant correlations emerged only for the typical development group, raising questions on the mechanism through which attachment is transmitted across generations from parent to child in ASD. The authors suggest that the lack of associations may arise from methodological limitations, such as the inadequacy of self-report measures to capture internal representational models. Additionally, child difficulties in understanding and interpreting the parent's mental states and intentions along with the limited emotional information process documented in ASD (Nuske, Vivanti & Dissanayake, 2013) may hinder the attachment transmission process. Despite offering the first interesting insights on this topic, this study remains the unique attempt to test attachment transmission in ASD so far. Future studies are needed to replicate and extend these initial data, by integrating a more comprehensive assessment, which include age-appropriate semi-projective or semi-structured interview (Keenan et al., 2016).

3.1.3. The current study

The study of attachment organization in parents of children with ASD has not received too much attention so far, with the two studies available indicating conflicting results. There is consequently a lack of data on attachment transmission across generations in this clinical population, which remains largely unaddressed. To date, only one study have examined the associations between caregiver and child attachment in ASD (Keenan et al., 2016) presenting several limitations. In fact, this research only used self-reported questionnaires to measure child attachment, suggesting the use of more suitable method (e.g. semi-projective interview) for the assessment of implicit attachment mental representations in school-age. Furthermore, only the primary caregiver took part in the study, making it impossible to compare potential difference between mothers and fathers.

Thus, in order to narrow this wide gap in ASD literature, the purpose of the current investigation is to explore quality of attachment in mothers and fathers of children with ASD, testing potential differences with respect to a normative group and the continuity across generations, testing the hypothesis of intergenerational transmission in ASD.

Specifically, the aims of the present study are: 1) to determine whether parents of children of ASD reported higher level of attachment avoidance or anxiety compared to their TD counterpart; 2) to explore potential differences between mothers and fathers in reported attachment dimensions in both target and normative group and 3) to test the associations between attachment style of both mothers and fathers, with quality of child attachment representations. As regards to the third study aim, the potential moderation effect of the presence of ASD diagnosis was also analyzed. The substantial lack studies and the inconsistency of the few previous studies (Lau & Peterson, 2011; Keenan et al., 2016) do not allow us to formulate a precise hypothesis for the first two study aims. Similarly, due to the absence of prior research we adopt an explorative approach to examine the impact of paternal attachment style to the quality of child attachment. However, with respect to the third aim we expected to find a significant effect of primary caregiver (maternal) attachment style in predicting quality of

child attachment representations, with a possible moderation effect of child clinical status (Verhage et al., 2015).

3.2. METHODS

3.2.1. Participants

For a detailed description of the procedure see Study 1 (Paragraph 1.2.3)

2.2. Measures

For a detailed description of the child measures see Study 1 (Paragraph 1.2.4)

The *Experiences in close Relationship-Revised* (ECR-R; Fraley, Waller & Brennan, 2000) is a self-reported questionnaires designed to assess individual differences in adult romantic attachment. Specifically, the questionnaire measures the two main attachment dimensions of avoidance and anxiety. It consist of 36 item rated on a 7-point Likert-type scale ranging from 1= strongly disagree to 7 = strongly agree. ECR-R comprises two subscales composed by 18 item measuring attachment-related avoidance and anxiety. Avoidance refers to discomfort with closeness and intimacy whereas anxiety dimensions reflect the preoccupation regarding the availability and responsiveness of the partner. In this study, we used both continuous and categorical ECR variables. To generate a dichotomous ECR-categorical variable (secure-insecure) we classified participants into one of four attachment proposed by Bartholomew and Horowitz (1991) (secure, preoccupied, fearful-avoidant, dismissing). We used Italian normative scores clustered by gender and age to determine lower or high level of both anxiety and avoidance (Picardi, Bitetti, Puddu & Pasquini, 2000). Due to the small sample size, we only used the dichotomous categorization (secure-insecure) instead of the four-attachment style classification. ECR-R have shown strong reliability and validity for both scales (Sibley & Liu, 2004; Ravitz, Maunder, Sthankiya & Lancee, 2010), and it has been widely used extensively in psychological research. Moreover, this questionnaire has been already used to assess

individual differences in adult attachment in parents of children with ASD (Keenan et al., 2016).

3.2.4. Data analysis

Data related to both attachment dimensions were normally distributed – thus we use parametric statistics in the current study. Preliminary analysis were conducted to test the associations between parental attachment dimensions and child attachment score using Pearson bivariate correlations. ECR continuous variables were used both for maternal and paternal attachment dimensions (avoidance and anxiety). Next, according to the first purpose of this study we examined potential differences between groups using a two-way MANOVA (gender X group). The two continuous ECR attachment dimensions were the dependent variables whereas we used parent gender and group (based on child clinical status) as independent factors, testing also their interaction effect.

With respect to our second aim, we tested the effect of parental attachment style of both mothers and fathers on child attachment representations using a hierarchical multiple linear regression model. After entering the group variable as unique predictor of the first step, we used the ECR dichotomous categorical variables (secure vs insecure) as predictors of the second step. In the third step of analysis, we tested the potential moderation effect of the presence of ASD diagnosis on the association between parental attachment style and child attachment representations.

Moreover, consistently with our third research questions we explored the predictive effect of couple attachment style matching (secure-secure vs secure-insecure/insecure-insecure) conducting a separate linear regression. Given that all these predictors were generated from the same assessment tool, we performed a separate analysis testing also the moderation effect of the presence of ASD diagnosis on the association between couple attachment style matching and the quality of child attachment at representational level.

3.3. RESULTS

Table 12 shows descriptive statistics of maternal and paternal attachment continuous and categorical variables clustered by child clinical status. Only 33.3% of mothers of children with ASD showed an secure attachment style compared to 56% of the control group, however this difference does not reach the statistical significance ($p = .20$, Fisher Exact Test). Whereas similar rates of insecure attachment style were found in fathers of children with ASD (61%) and TD (39%).

Table 12. Means and standard deviations of maternal and paternal attachment dimensions and percentages of parents' attachment style categorized by the two study groups.

Variable	ASD		TD	
	Mother	Father	Mother	Father
<i>Continuous</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>
ECR avoidance	41.83 (16.52)	35.33 (8.31)	33.39 (10.69)	32.17 (9.63)
ECR anxiety	48.89 (17.11)	50.89 (20.39)	52.22 (18.77)	52.52 (19.47)
<i>Categorical</i>	<i>% (N)</i>	<i>% (N)</i>	<i>% (N)</i>	<i>% (N)</i>
ECR secure style	33.3 (6)	61.1 (11)	56.5 (13)	50.0 (12)
ECR insecure style	66.7 (12)	38.9 (7)	43.5 (10)	50.0 (11)

Note: ECR: Experiences in Close Relationship

Next, we examined the correlations between parental attachment dimensions and child attachment representations (see Table 13). We only observed that the positive association between child attachment representations risk and maternal attachment avoidance showed a statistical trend toward significance ($r = .281$, $p = .075$).

With respect to the first study aim, the two-way MANOVA (gender X group) on continuous parental attachment dimensions revealed a main effect of group [$\Lambda(2,77) = .913$, $p = .031$]. In fact, a significant difference emerged between groups on ECR avoidance, ($F_{(1,78)} = 5.11$, $p = .027$). Specifically, higher scores on attachment avoidance were found in parents of children with ASD

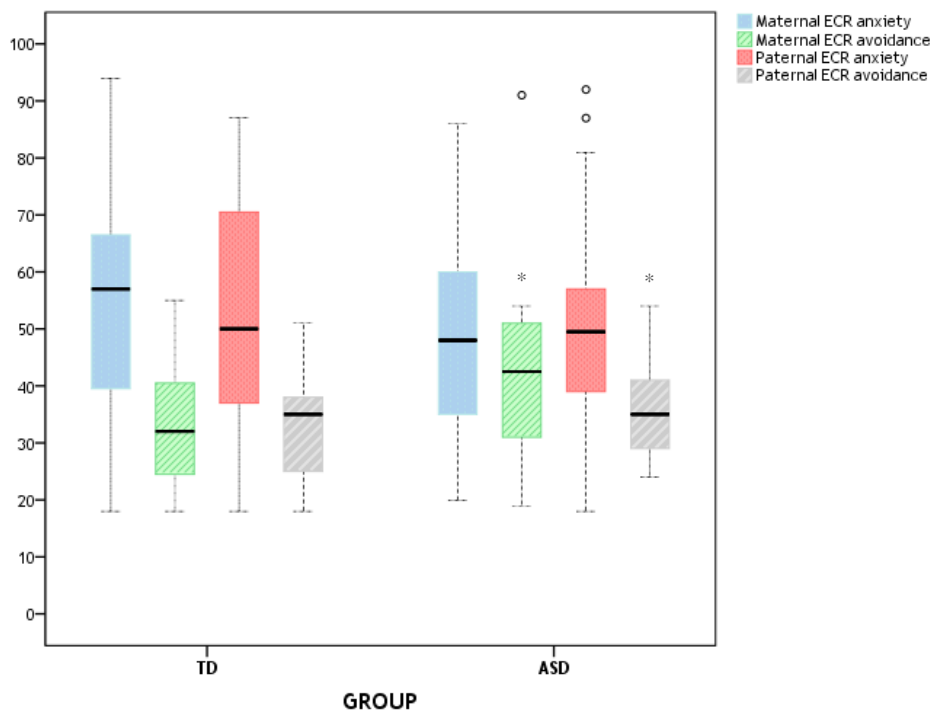
compared to their normative counterpart, whereas, no group differences emerged for ECR anxiety (see Figure 9). In addition, multivariate analysis highlighted that gender differences as well as the interaction between gender and group were not statistically significant. These results were confirmed also by supplementary analysis without two outliers.

Table 13. Correlations among parental attachment dimensions and child attachment representations

Variable	SAA risk
ECR avoidance mother	.281 ^a
ECR anxiety mother	-.241
ECR avoidance father	.081
ECR anxiety father	-.167

Note: ^a: p value approached the statistical significance

Figure 8. Boxplots of maternal and paternal attachment dimensions (ECR avoidance and ECR anxiety) for each study group.



Note: ECR: Experiences in Close Relationship

Moreover, we performed a regression model (see Table 14) to test our second aim concerning attachment intergenerational transmission, by examining the predictive effect of maternal and paternal attachment style on the quality of child attachment representations.

Table 14. Hierarchical regression analysis of attachment representations in school-age children by presence of ASD diagnosis, maternal and paternal attachment style (secure vs insecure).

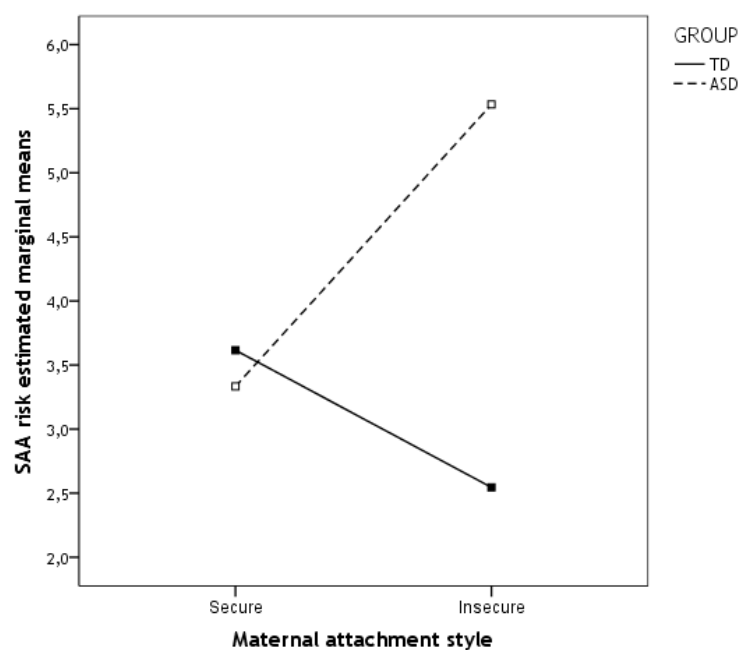
Predictors	Attachment representations risk				
	β	SE	<i>p</i>	ΔR^2	<i>p ch</i>
<i>Step 1</i>				.174	
ASD diagnosis	.441*	.649	.004		
<i>Step 2</i>				.206	.182
ASD diagnosis	.376*	.661	.014		
Maternal attachment style	.187	.674	.220		
Paternal attachment style	-.248	.661	.099		
<i>Step 3</i>				.332	.018
ASD diagnosis	-.137	.997	.539		
Maternal Attachment Style	-.830	1.93	.062		
Paternal Attachment Style	-.549	1.90	.202		
Maternal AS X ASD diagnosis	1.23*	1.25	.014		
Paternal AS X ASD diagnosis	.378	1.23	.372		

Note: *: $p < .05$; ASD: Autism Spectrum Disorder; AS: Attachment Style

The overall model was significant explaining 33% of the variance ($p = .002$). As highlighted in previous analysis (see Study 2), we found the significant effect of child ASD diagnosis in the first step of the model ($\beta = .376$, $p = .004$). The second step which include parental attachment style did not add a significant contribution to the model (R^2 change = .071, $p = .182$). Specifically neither maternal ($\beta = .187$, $p = .220$) nor paternal attachment style ($\beta = -.248$, $p = .099$) showed a significant predictive effect on the quality of child attachment. Nonetheless, we found that the third step of analysis which include the interaction between the presence of ASD diagnosis and paternal attachment style was statistically significant (R^2 change = .150, $p = .018$). In particular, the interaction

between maternal attachment style and child ASD diagnosis revealed a significant predictive effect on the dependent variable ($\beta = 1.23$, $p = .014$). The simple slopes analysis highlighted that the conditional effect of the ASD diagnosis increase with reference to maternal insecure attachment style ($p = .001$) but not for maternal security (see Figure 10). Moreover, no effect of the interaction between paternal attachment style and child clinical status was found.

Figure 9. Interaction effect between maternal insecure attachment style and child ASD diagnosis on the quality of child attachment representations.



Note: SAA: School-age assessment of attachment; TD: Typical Development; ASD: Autism Spectrum Disorder

3.4. DISCUSSION

The current study aimed at examining parental attachment style in mothers and fathers of children with ASD and its influence on quality of child attachment representations in school-age. Firstly, approximately one in two mothers of the target group reported an insecure attachment style, despite the difference with the controls was not statistical significant. On the other hand, fathers showed similar rates of insecure attachment style, regardless of the study group. No significant correlations were found between both parental attachment dimensions and quality of child attachment

representations. The different approach underlying the two instruments could explain the lack of significant bivariate correlations. In addition, previous studies have shown weaker convergence between attachment methods and self-reported measurement (Riggs et al., 2007).

Next, by considering attachment dimensions rather than categorical variables, parents of children with ASD, regardless of gender, reported higher level of attachment avoidance compared to the control group. Our finding is only partially consistent with prior research on this topic, given that greater attachment insecurity in parents of the target group was associated to avoidance dimension rather than anxiety dimension as highlighted by Keenan and colleagues (2016). According to previous research on parenting and maternal attachment style (Rholes, Simpson & Bakeley, 1995), avoidance dimension may be related to higher emotional detachment, which could reflect a parental defensive response to cope with the challenging condition of child socio-communicational impairment in ASD. Moreover, parents with higher avoidance could find more difficulties in providing supportive care to their partner and their child. Interestingly, considering ECR categorical classification, the majority of the mothers of the target group (60%) reported an avoidant attachment style, with 47% showing an avoidant fearful style and 13% an avoidant dismissing style. In this regard, according to Bartholomew's postulation (1990) fearful style is characterized by a tendency to inhibit the desire of social contact for fear of its negative effects such as grief and rejection. Therefore, by evading these potential adverse consequences mothers of children with ASD may find a way to cope with the non-sequential and less predictable child communicative pattern of interaction. It is reasonable that a fearfully avoidant behavioral approach may allow mothers of children with ASD to avoid negative feelings associated to more frequent disruption and mismatching (Guo et al., 2017) which occur in the context of parent-child relationship. Another crucial element of the fearful avoidant style is the increased vulnerability to loneliness derived from scarce interpersonal sources, which may reflect the poor social support and the feeling of isolation documented in parents of children with ASD (Bromley, Hare, Davison & Emerson, 2004; Kinnear, Link, Ballan & Fischbach, 2015). In addition, the different aspects of avoidance dimension could be associated to the significant

reorganization (Hock, Timm & Ramisch, 2012) and the lifelong burden on couple relationship and family adjustment related to the impact of rearing a child with ASD (Sim, Cordier, Vaz & Falkmer, 2016).

Secondly, we observed that maternal insecure attachment style moderates the relationship between the presence of ASD diagnosis and the quality of child attachment representations. Namely, our finding revealed that the risk of developing at-risk attachment representations significantly increase in children of the target group, whereas no effect was found for the controls. In other words, it seems that school-age children with ASD showed greater susceptibility to maternal insecure attachment style compared to controls. It is conceivable that these children may be more sensitive to the influence of the maternal attachment style for different reasons. Firstly, they tend to overrely on caregiver feedback and supervision showing less autonomy than their typical and clinical counterpart (Newman et al., 2007) even in middle childhood and adolescence, despite these developmental stages are traditionally characterized by increased independency. In the second place, a restricted extra-familial social environment may decrease the opportunity to be exposed to the direct effect of other significant interpersonal relationship. Specifically, attachment representations of primary caregiver are hierarchically the most salient for the child, despite the coexistence of multiple attachment figures (Laible et al., 2000). In this regard, according to our finding, the impact of the principal attachment figure may be even more influential in children with ASD compared to typical developing children during school-age. In fact, the ASD restricted interpersonal context and the greater social exclusion (Dean et al., 2014) may amplify the impact of primary caregiver attachment insecurity on child attachment representations. On the other hand, typically developing children may be more sensitive to the influence of multiple sources of information arising from diverse attachment relationship established with extra-familial figures.

By contrast, no moderation effect of maternal secure attachment style was observed. In fact, both children with TD and ASD who have a securely attached primary caregiver showed low-risk attachment representations. Despite the predictive effect of maternal attachment style was not

significant in our control group, it seems that secure attachment may constitute an important protective factor for children with ASD.

As previously mentioned, we did not find a direct effect of maternal attachment style on quality of child attachment representation in the control group. Possible explanations of this finding may be related to methodological reasons and the typical developmental trajectory of these children in terms of socio-communicational abilities. Firstly, previous research on attachment intergenerational transmission has focused on other specific construct such as maternal sensitivity, insightfulness and reflective functioning or attachment state of mind rather than self-reported attachment style. Therefore, it is more likely that these constructs might be more suitable to assess attachment continuity across generations in non-ASD sample. Additionally, child proclivity to tap into others significant close relationship outside the familial context during school-age, could have limited the impact of maternal attachment style. In fact, attachment state of mind in these children may also reflect the influence of a multi-faceted social environment in which extra familial figures play a significant role since early middle childhood. In addition, our data showed an association between social responsiveness and low-risk attachment representations in children with typical development, suggesting that the lack of socio-communicational impairment and the presence of adequate social motivation may increase the probability to benefit from diverse interpersonal relationships and to use more adaptive information processing related to attachment representations.

Furthermore, it is important to consider possible explanations for the lack of statistically significant results regarding the impact of paternal attachment style on child outcome. Firstly, fathers included in this study were not child primary caregiver at the time of the assessment. In addition, it is plausible that the influence of fathers on the quality of child attachment representations is not explained by attachment style. In fact, other parenting-related constructs may intervene in the transmission of attachment from father to child such as paternal involvement, sensitivity in caregiving and attachment state of mind (Verhage et al., 2016). Moreover, the effect of paternal attachment style on child attachment may be indirect, with other potential salient variables mediating this association.

In conclusion, some limitations need to be mentioned. It is essential to consider that different theoretical and methodological approach underlying child and parent attachment measurements were used in the present study. In the first place, child and parent attachment data stems respectively from different sources (self-evaluation vs external coding). Secondly, quality of child attachment method is based on Dynamic-Maturational Model (DMM; Crittenden, 2015), following a developmental and ecological perspective. Whereas adult attachment style measures and model (Bartholomew and Horowitz, 1991) find their roots in personality psychology and are exclusively derived from self-reported assessment. However, prior research have already used these different methods to assess parent-child attachment strategies matching of (Kwako et al., 2010). Moreover, the small sample size and the cross-sectional design represent additional limitations of the current study.

Due to the scarcity of research on this topic, further investigations are needed to replicate these findings with larger sample. In addition, future research should adopt converging theoretical and methodological perspective in order to improve clarity and consistency of findings. For this purpose the use of AAI, the gold standard method for the assessment of attachment in adulthood, may provide a more robust framework to test attachment intergenerational transmission in ASD. Longitudinal designs are recommended to test the nature of these effects across development. Additionally, in order to cover the variety of mechanisms potentially involved in attachment intergenerational transmission (van Ijzendoorn & Bakermans-Kranenburg, 2019), research on this topic should consider the influence of context, susceptibility and other salient parenting dimensions.

Furthermore, our findings also have specific clinical implications. Despite the inefficacy of attachment interventions in improving social-communicational abilities in ASD, quality of primary social environment seems to play a role in reducing the risk of maladaptive information processing in school-age children. Professionals in the field of ASD should consider the influence of security of adult romantic attachment of mothers and fathers paying attention to couple relationship (Sim et al., 2016), in a way that partner may fulfill their respective attachment needs. In conclusion, sustaining couple relational satisfaction and attachment security in parents of children with ASD might

contribute to promote a positive familial context in which the risk transmission of insecurity across generations and its consequent adverse effects are minimized.

Study 4. Alexithymia, not autism spectrum disorder predicts perceived attachment to parents in school-age children

4.1. INTRODUCTION

Autism Spectrum disorder (ASD) is a neurodevelopmental condition characterized by socio-communicational impairments and restricted and repetitive patterns of behaviors and interests (APA, 2013). Empirical studies has widely documented the presence of significant difficulties in the domain of emotion processing and regulation in ASD (Silani et al., 2008). In particular, during the last two decades the construct of alexithymia has received greater attention in the arena of cognitive explicit emotion processing in ASD (Kinnaird, Stewart & Tchanturia, 2019). Namely, the concept of alexithymia refers to individual difficulties in identifying, describing and distinguishing one's own feelings, which are often accompanied by an externally oriented thinking instead of a focus on internal experience (Sifneos, 1973). Previous studies have consistently shown elevated alexithymia in individuals with Autism Spectrum Disorder (ASD) compared to matched control groups, regardless of the level of intellectual abilities (Hill, Berthoz & Frith, 2004; Lombardo, Barnes, Wheelwright, & Baron-Cohen, 2007; Griffin, Lombardo & Auyeung, 2014), reporting higher rates of adults with ASD above the clinical level (Bird & Cook, 2013). Nevertheless, only few studies investigated alexithymia in children and adolescent showing similar findings (Griffin, Lombardo & Auyeung, 2016; Milosavljevic et al., 2015).

Interestingly, a series of studies found that alexithymia and not ASD status underpinned the specific sensory emotion-processing difficulties reported in this clinical population (Heaton et al., 2012), including empathic brain responses (Bird et al., 2010). This area of research did not attribute emotion-processing and interoception difficulties to ASD core symptoms, but suggested instead a predictive effect of alexithymia (Bird and Cook, 2013; Shah, Hall, Catmur & Bird, 2016). In addition, several studies underlined a considerable overlap between ASD and alexithymia neurobiological and anatomical correlates (van der Velde et al., 2016), including altered activation of specific brain areas

such as amygdala and anterior cingulate cortex (Bernhardt et al., 2013; Caria & de Falco, 2015). Moreover, alexithymia as well as ASD are associated with impaired mentalizing abilities, (Moriguchi et al., 2006) possibly in light of the reduced integration between physiological states interoception and emotional consciousness (Gaig, Cornell & Bird, 2018). In addition, recent studies also showed that the co-occurrence of ASD and alexithymia is associated with increased mental health problems (Milosavljevic et al., 2015; Morie et al., 2019). For these reasons, scholars suggest to consider alexithymia as a significant predictor of developmental outcomes of individuals with ASD and a key concept to identify cognitive profiles of specific subgroups within the ASD heterogeneity (Lai et al., 2013; Fietz, Valencia & Silani, 2018). Despite its clinical relevance, prior research on ASD focused almost exclusively on adulthood – hence the investigation of alexithymia in childhood remains largely unexplored. To date, only one study (Griffin et al., 2015) has been conducted on young children, confirming higher level of alexithymia for ASD group using both- self and parent-reports. However, no data are available on the estimate of alexithymia in children with ASD during middle childhood.

4.1.1. Attachment and Alexithymia in ASD

Among the several factors associated with alexithymia, quality of attachment to parental figures constitutes a crucial predictor of children healthy psychological development (Carlson & Sroufe, 1995), showing a significant contribution to several indicators of socioemotional adjustment and adaptation. In fact, developmental research has documented a robust relationship between attachment to caregiver and emotion processing and regulation (Laible et al., 2007; Thompson & Meyer, 2007). Data revealed that children with insecure attachment reported more difficulties in emotion processing (Brumariu, Kerns & Seibert, 2012). However, the association between attachment and alexithymia has been mostly investigated in adulthood (Picardi, Toni, Caroppo, 2005). In fact, studies on children and adolescent focused on this link are still scarce, particularly on clinical samples (Oskis et al., 2013; Koelen, Eurelings-Bentekoe, Stuke & Luyten, 2015). Therefore, there is a substantial lack of research concerning the association between alexithymia and attachment in children with ASD. A recent study

(Costa, Steffgen & Vögele 2019) found that alexithymia predicts reduced parent-child-interaction more than ASD status, suggesting the need to consider its impact on quality of relationship in future research. In fact, the study did not include a specific measure of attachment relationship to parents, which represent a core feature of child socio-emotional development.

In this regard, literature on attachment showed no differences between ASD and their typical counterpart in the perception of quality of attachment to parents (Chandler & Dissanayake, 2014; Sivaratnam et al., 2018). Nonetheless, only few studies are available on school-age children showing contradictory results using the same attachment measure (Bauminger, Solomon, Rogers et al., 2010). Thus, the study of attachment in ASD during middle childhood remain poorly investigated and further replications are needed to clarify the absence of significant differences with typical controls. Additionally, understanding the mechanism underlying perception of attachment security to parents in children with ASD may elucidate the association among key aspects of socio-emotional development in this clinical population, explaining which child features may contribute to positive explicit representations of trustful, sensitive and available parents. Given that neither ASD status neither symptoms severity showed a significant influence on perception of attachment security in ASD, it could be interesting to consider the role of alexithymia in predicting this socio-affective domain. According to a bidirectional perspective, child characteristics may influence the quality of parent-child interaction (Costa et al., 2019), altering parental attitudes and caregiving behaviors. Therefore, specific sub-clinical phenomenon such as impairments in identifying and describing one's own feelings as well as difficulty in distinguish emotion from bodily sensations (Silani et al., 2008) can affect the way in which children perceive their attachment relationship with their parents.

Based on the current state of the art, the present study aimed at investigating alexithymia in school-age children with ASD (without intellectual disability) by examining its predictive role on child perception of attachment security to parents. Firstly, we explored potential differences between groups for both attachment and alexithymia. To this purpose, we also estimated the percentage of children above the normative cut-off of alexithymia. Next, the predictive effect of child features,

including alexithymia, were tested with the aim to identify which mechanisms intervene in shaping perception of attachment security to parents in ASD. We primarily hypothesized to find higher levels and rates of alexithymia in children with ASD compared to the controls, according to previous studies on this topic (Kinnaird et al., 2019). Whereas no differences were expected with respect to the perception of attachment security to parents as highlighted by prior research (Teague, Gray, Tonge & Newman, 2017). As regard to our second aim, we expect to find a significant link between alexithymia and attachment according to literature on neurotypical population.

4.2. METHOD

4.2.1. Participants

Of the 52 contacted families, four refused to participate (2 of ASD and 2 of TD group) – hence our final sample included 24 children with High-Functioning ASD and 24 children with Typical development (TD). Children mean age is 126.4 months ($SD = 16.45$) for the clinical group and 115.88 ($SD = 25.14$) for the normative group. The majority of the participants involved in this study were males, (75% of the total sample and 62.5% of TD), particularly in the ASD group ($n = 19$; 87.5%). Family Socioeconomic Status (SES; Hollingshead, 1975) is similar for both groups ranging from medium to high. All the children of the target group had a certified clinical diagnosis of Autism Spectrum Disorder without intellectual disability (IQ greater than 70), based on clinical judgment according to the *Diagnostic Statistical Manual of Mental Disorder 5th Edition* (DSM V; American Psychological Association, 2013). Children with intellectual disability, severe impairment of cognitive functioning and deficits in expressive and receptive language were excluded from the study. For the TD group, we did not include children with a history of psychiatric disorder.

4.2.2. Procedure

For a detailed description of the procedure see Study 1 (Paragraph 1.2.3)

4.2.3. Measures

For a detailed description of child measures see Study 1 (Paragraph 1.2.4.)

The *Children's Alexithymia Questionnaire for Children* (CAQ; Rieffe, Osterveld & Terwogt; 2006) is a self-reported measure to assess alexithymia in young children. It is adapted from the well-validated measure used for the assessment in adulthood (TAS-20; Bagby, Taylor & Parker, 1994) to be developmentally appropriate preserving similar structure and content. CAQ is composed by 20 items rated on a three-point Likert-type scale ranging from 0 = not true to 2 = often true. In this study we used the Italian version of the questionnaire (Di Trani et al., 2009) considering only the total score as a measure of alexithymia, higher scores corresponding to elevated presence of symptoms. Validity and reliability of this measure were confirmed by empirical data (Rieffe et al., 2006; Di Trani et al., 2009). This measure has already been used in children with ASD and other neurodevelopmental disorder (Donfrancesco et al., 2013; Griffin et al., 2016).

4.2.4. Data analysis

The statistical analysis of the data was carried out using the statistical package SPSS (22.0 for Windows). As preliminary analysis, we checked for normality of the distribution, outliers and linearity. Given the wide age range in the study sample, we used a two-level age categorization (lower or greater than 125 months) to analyze potential differences on the dependent variable based on child chronological age. A one-way Multivariate Analysis of Variance (MANOVA) was used for the group matching with the aim to detect potential covariates among child continuous variables. Similarly, with chi-squared test we assessed potential differences between groups regarding gender distribution. In addition, we transformed IPPA and CAQ total scores into z scores in order to standardize both variables of interest. With respect to first study aim, we performed a Mann-Whitney test to compare the two study groups on attachment total scores. For group differences on alexithymia, we performed a Student's t -test, removing three outliers (2 ASD, 1 TD) from the analysis. Using a

categorical cut-off score based on normative values of CAQ Italian validation study (Di Trani et al., 2009), we calculated rates of children at-risk of alexithymia. Differences between groups on this categorical variable were tested using Fisher exact test. Next, we used a hierarchical linear regression to test which child variables contributed significantly in predicting child attachment to parent scores. Specifically the first step of the regression model included child age, verbal IQ, and ASD status (presence/absence). In the second step of analysis, we added child self-reported alexithymia score to test its independent predictive effect on overall IPPA scores model. A third step was included to test whether the effect of the alexithymia on attachment is moderated by ASD status.

4.3. RESULTS

According to Kolmogorov-Smirnoff tests, CAQ scores were normally distributed in both target and control group as opposed to IPPA total scores. Children with ASD did not differ from their typical counterpart with respect to the control variables such as child age, verbal and non-verbal ability, family SES. Similarly, no difference were found in gender distribution between groups (Fisher exact test, $p = .09$) - thus, no potential covariates were identified. Descriptive statistics are shown in Table 15. No difference emerged between the two age groups (lower or greater than 125 months) on the CAQ total score ($t_{(43)} = 1.10$, $p = .277$).

By addressing the first study aim there was a significant differences between the two group on CAQ total score ($t_{(43)} = -2.18$, $p = .035$, Partial eta squared = .101) with children of the target group showing higher level of symptoms. In terms of alexithymia rates, we found significant group differences (Fisher exact test, $p = .047$) with 27% of children with ASD above the normative cut-off versus 4% of the typical development group. Whereas, Mann-Whitney test did not reveal significant differences between children with ASD and the control group on IPPA total scores ($Z = 1.69$, $p = .090$, Partial eta squared = .064).

To ascertain the effect of child features and the contribution of alexithymia, a hierarchical linear regression including two separate steps was carried out (see Table 16). The first step which included

child age, verbal IQ and ASD status was not statistically significant ($F_{(3,42)} = 2.44, p = .078$). Nevertheless, child age was positively association with attachment to parents ($\beta = .349$), whereas the contribution of verbal IQ and ASD status was not statistically significant. By entering CAQ total score as independent predictor in the second step of the linear regression, the overall model was significant ($F_{(4,42)} = 3.51, p = .016$) explaining 19,3% of the variance. The p value associated with adjusted R squared change for the second step is also statistical significant ($F_{(1,38)} = 5.91, p = .020$). Specifically, data revealed that Alexithymia was the significant independent negative regressor ($\beta = -.361$), whereas no effect was found for child age, verbal IQ and ASD status. Similarly alexithymia was still significant in the third step of the regression ($\beta = -1.10; p = .041$) whereas no interaction effect with ASD status was observed.

Table 15. Descriptive statistics of the study variable for the target (ASD) and control (TD) group.

	ASD		TD		Group differences	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>p</i>	<i>Eta</i>
Age (months)	126,43	16,455	117,52	24,32	.185	.045
Verbal IQ	22,45	4,00	22,91	4,94	.722	.003
Perceptual Reasoning ^a	.52	80	.67	.78	.590	.008
Family SES	43.52	13.79	45.39	15.23	.607	.007
Alexithymia	39,55	6,47	36,09	3,90	.035*	.101
Attachment to parents	61,19	8,442	66,43	13,75	.090	.064

Note: ASD: Autism Spectrum Disorder; TD: Typical Development; IQ: Intelligence Quotient; SES Socioeconomic Status
^a z scores; * $p < .05$

4.4. DISCUSSION

The current study examined alexithymia in school-age children with ASD (without intellectual disability), exploring its influence on perception of attachment security to parents. To this aim, we tested the hypothesis that alexithymia may contribute to a negative view of quality of relationship

with parents from the child perspective. To date, no other studies investigated the presence of this specific link in children with atypical neurodevelopmental condition, including ASD.

Table 16. Hierarchical regression analysis of perceived attachment to parents by child age, verbal IQ, ASD status and self-reported alexithymia.

Predictors	Attachment to parents				
	β	SE	<i>p</i>	ΔR^2	<i>p ch</i>
<i>Step 1</i>			.078	.091	
Age	.347	.085	.031*		
Verbal IQ	.127	.399	.410		
ASD status	-.283	3.51	.068		
<i>Step 2</i>			.016*	.193	.020*
Age	.251	.083	.106		
Verbal IQ	.112	.377	.438		
ASD status	-.169	3.48	.263		
Alexithymia	-.361	.351	.020*		
<i>Step 3</i>			0.14*	.218	.145
Age	.246	.082	.109		
Verbal IQ	.074	.377	.610		
ASD status	-.134	3.48	.375		
Alexithymia	-1.10	1.23	.041*		
Alexithymia*ASD status	.766	.714	.145		

Note: ASD: Autism Spectrum Disorder; TD: Typical Development; IQ: Intelligence Quotient; SES Socioeconomic Status; * $p < .05$

Firstly, we found that children with ASD and TD showed no significant differences in perception of attachment security to parents. Despite a limited number of studies has been conducted on this topic, our results are consistent with previous findings. According to earlier meta-analytic findings, recent empirical evidences revealed that school-age children with ASD (without intellectual disability) reported similar level of security in the relationship with their parents to those found in typically developing children (Teague et al., 2017). However, considering the negative impact of ASD socio-communicational difficulties and emotional reactivity on quality of attachment bond and parent-child

interaction, these findings raised questions about which mechanism may explain child positive perception of the attachment relationship.

Second, in line with the only study available (Griffin et al., 2006) our results showed that school-age children with ASD reported higher level of alexithymia compared to their typical counterpart. Moreover, we found that alexithymia is a more common condition in ASD, also in school-age, with approximately one in three reporting scores of alexithymia above the cut-off. Our finding confirms the difficulties in cognitive explicit emotion processing in children with ASD, documented to previous research on adolescent and adulthood (Bird & Cook, 2013; Milosavljevic et al., 2015). As expected, we did not find a large effect of this group difference given that children self-report may be less reliable compared to other ratings provided by child-informants. In fact, the limited abilities of individual with ASD with respect to self-referential cognition (Lombardo et al., 2007) and psychological insight may undermine the accuracy of self-reported measurement. It is essential to consider other aspects associated to ASD phenotype that are strictly interrelated to alexithymia (Fitzgerald & Bellgrove, 2006) such as impairment in mentalizing and self-reflection, less coherent representations of emotional experience (Losh & Capps, 2006), absence of emotional vocalization (Heaton et al., 2012), behavioral rigidity and impaired inhibitory control (Mosconi et al., 2009; D'Cruz et al., 2013;). Thus, even if we controlled for linguistic abilities, elevated level and rates of alexithymia in children with ASD may be explained at least to some extent by these specific disorders of cognitive, emotional and behavioral functioning.

According to the second aim of this study, we found a significant link between alexithymia and perception of attachment security in children with and without ASD. In particular, among child characteristics, alexithymia level and not ASD diagnosis predicts the extent to which children perceive their relationship with their parents as a source of security in middle childhood. It is conceivable that specific deficit in identifying and describing one's own feelings may hinder the construction of a positive representation of parent-child attachment relationship regardless of child clinical status. With respect to ASD, despite a growing area of research is linking alexithymia and

children psychological outcomes (Brewer et al., 2015; Morie et al., 2019), this is the first investigation documenting the significant impact of alexithymia on the perception of attachment security to parents. An ongoing debate in ASD is whether the occurrence of alexithymia affect social motivation, influencing attitudes and behaviors at interpersonal level (Pastore, Dellantonio, Mulatti & Esposito, 2014). Studies reported that alexithymia in children with ASD was associated with less expressive coherence (Costa, Steffgen & Samson, 2017), empathy and perspective taking (Lartseva, Dijkstra & Buitelaar, 2016) as well as lower enjoyment of prosocial interactions (Gebauer et al., 2014). Moreover, as highlighted by Costa and colleagues (2019) alexithymia in children (more than ASD status) can negatively affects parent-child relationship explaining the reduced amount of dyadic exchanges. The mismatch between arousal activation and subjective experience of feelings (Gaigg, Cornell & Bird, 2018) may also contribute to the formation of less coherent child representation influencing how information are encoded and processed. Therefore, the possibility to develop unbalanced representations of the attachment figures may significantly increase given the potential negative consequences of alexithymia on different levels of emotion processing and relational exchanges. Furthermore, giving a coherent meaning to their own interpersonal experiences with parental figures may be more complex not only for the limited personal resources in emotional self-understanding, regulation and expression. In fact, children with ASD and alexithymia may also exhibit difficulties in interpreting and responding to emotion in others (Poqerusse et al., 2018) as in the case of child caregivers. Impaired mentalizing associated with low self-memory in ASD (Lombardo et al., 2007) and difficulties with episodic autobiographical memories (Lind et al., 2010) constitute additional risk factors for the construction of coherent explicit representations based on past relational experiences. Following this direction, our findings extend literature on the influence of alexithymia on socioemotional development by considering child self-perspective on attachment to parents during school age.

In sum, school-age children with ASD in our sample, showed higher levels of alexithymia compared to the control group, whereas perception of attachment security was similar between groups. Notably,

alexithymia, not autism, was found to be the only significant predictor of child attachment to parents. Thus, this sub-clinical condition seems to play a key role on the way children with ASD perceive their relationship with their mother and fathers. In this regard, several aspects associated with alexithymia such as impaired emotion processing, neurophysiological atypical processes, reduced mentalizing and low self-memory may hamper parent-child relationship and consequently child explicit representation.

Lastly, some limitations of this study need to be acknowledged. We do not include a measure of alexithymia rated by child informants as suggested by prior research (Griffin et al., 2016). Thus, a comparison between two different sources of information on alexithymia scores was not possible.

In addition, small sample size, cross-sectional design and the lack of a continuous measure of ASD symptoms severity represent other specific drawbacks of this study. Moreover, future research can expand these findings including a measure of child implicit attachment representations. In general, our results confirmed that alexithymia could be useful in subgrouping and identifying specific cognitive profiles within the autism spectrum condition. We also recommend alexithymia as a potential covariate in the comparative study on ASD. Another possible indication for future studies is to assess alexithymia in parents to examine whether there are direct associations with child outcomes according to an intergenerational perspective.

In conclusion, our findings confirmed the importance to target children alexithymia in ASD, considering its clinical significance not only on explicit emotion processing but also on other significant domains of socioemotional development, as is the case of attachment to parental figures. Interventions involving mothers and fathers aimed at boosting quality of relational exchanges and child emotional capacities should evaluate and address alexithymia given its prominent contribution to child adjustment in ASD during middle childhood.

GENERAL CONCLUSIONS

To the best of our knowledge, these are the first studies available on attachment internal representations in school-age children with ASD. Thus, the current work represent an initial attempt to bridge this gap in ASD research, by covering different controversial topics, which constitute salient missing pieces in the study of attachment and ASD.

In the first place, Study 1 showed that children with ASD are able to develop secure and coherent attachment implicit representations, albeit with a lesser extent compared to typically developing children. They were able to engage and sustain the attachment interview, confirming the suitability of this method also in clinical sample with atypical neurodevelopment. Importantly, children with ASD showed high-risk attachment implicit representations, self-protective strategies and greater presence of unresolved trauma and modifiers, despite no differences emerged on perceived attachment to parents. From one side, these findings suggested the predictive negative contribution of ASD diagnosis on quality of child attachment state of mind by identifying pivotal risk factors for ASD developmental pathways. On the other hand, the lack of group difference on perceived attachment suggested that implicit and explicit attachment representations of children with ASD originate from different sources of information. Additionally, our results provide first data in support of the hypothesis that children with ASD (without intellectual disability) may experience more difficulty in the development of attachment representational level. While these children showed normative rates of security in the context of attachment relationship, the development of integrated internal models seems to be more challenging. It is plausible that low reflective functioning, impaired metacognition as well as unusual psychobiological processes of children with ASD contributed to attachment maladaptive information processing.

Secondly, we replicated the well-established finding of higher parenting distress in parents of children with ASD compared to controls also in fathers. Moreover, the Study 2 documented less didactic and limit/setting style in parents of children with ASD. In accordance to a bidirectional perspective, these parenting behaviors were interpreted as parental functional responses to adapt to child unusual social-

communication. Interestingly, data revealed a significant effect of maternal parenting stress and social exchange style on child attachment implicit representations. In particular, these results underlined that primary caregiver parenting stress is a crucial predictor of quality of attachment state of mind even for children with ASD. Thus, the study supports the coexistence of both child-driven and parent-driven effects in the context of parent-child relationship in ASD.

Similarly, the Study 3 documented that children with ASD who have an insecurely attached primary caregiver showed at-risk attachment implicit representations. In other words, the continuity of attachment security across generations revealed a clear effect in ASD, suggesting that these children may be more susceptible to this mechanism during school-age compared to controls. In addition, parents of children with ASD reported higher attachment-related avoidance in comparison to their TD counterpart. This difference could be associated to the significant couple reorganization and adjustment associated to the impact of rear a child with ASD.

In addition, the Study 4 showed that alexithymia, but not ASD predicts perceived attachment to parents highlighting the different nature of attachment explicit and implicit representation. Moreover, our results confirmed higher co-occurrence of alexithymia and ASD also in school-age, extending literature on adulthood.

In general, the assessment of attachment representations might constitute a prominent way to explore the inner world of children with ASD, providing useful information regarding their interpersonal expectations and needs. Professionals should consider the impact of potential traumatic events on these children due to the greater risk to be exposed to adversity (e.g. bullying, illness). Insights on child information processing could improve the possibility to personalize interventions for children with ASD by integrating manually based diagnosis. Moreover, from these studies emerged the need to support mothers and fathers of children with ASD, addressing their parenting distress and attachment security in the context of couple relationship. In this scenario, following an attachment-informed approach, it becomes crucial to construct a cooperative relationship with parents of children with ASD, by recognizing their adaptive efforts to cope with unusual child communicative and social

dynamics. Furthermore, alexithymia also represents an essential factor to consider in school-age children with ASD; its impact on perceived attachment confirm the complex interplay among explicit domains of child socioemotional development.

In general, the partial overlap between social functioning and attachment processes along with the difficulties to find age/abilities-appropriate assessment should not discouraged research on attachment and ASD. This series of study as well as Taylor and colleagues work (2008) on adults, showed promising results, suggesting the importance to conduct intensive in-depth investigations of internal attachment representations in ASD. The increased prevalence of ASD across the globe urges the attachment scientific communities to expand the knowledge of attachment processes. Attachment approaches with different theoretical underpinnings should strive to build a constructive and productive dialogue (Fonagy et al., 2013) in order to address the puzzling scenario of attachment and ASD.

Finally, beyond the work on early-diagnosis, an ever-growing amount of research focuses on identifying potential risks in order to promote positive developmental pathways for individual with ASD. With this in mind, the potential role of quality of attachment representations across the lifespan should be considered, especially as the resources invested on supporting psychological well-being in adolescents and adults with ASD are scarce. Thus, it become essential to minimize the risk for mental health problems, traumatic experiences and maladaptive information process in individuals with ASD. For this purpose, enhancing internal sense of security and psychological functioning in children with ASD should constitute an imperative goal, for which the understanding of attachment state of mind appears to be an unavoidable prerequisite.

In conclusion, these studies raise new hypothesis and questions in the arena of attachment and ASD, suggesting the relevance of internal representations to understand how children adapt to their own developmental context. This could be of particular interest given that ASD socio-communicational impairment could make these strategies less intelligible in the interpersonal context, increasing the difficulties of parents and professionals. In this regard, our studies confirmed that attachment

representations seem to be a useful instrument to tap into children inner world in High-Functioning ASD and assess their self-protective strategies. Therefore, the possibility to shed light on individual needs of protection and comfort in ASD should be a primary aim for clinical and research, in order to consider these children in their uniqueness and singularity and not only as a part of a monolithic diagnostic category.

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