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Disorganized attachment representations, externalizing behavior problems, and socioemotional competences in early school-age

Tommie Forslund^a, Mikko. J Peltola^b  and Karin C. Brocki^a

^aDepartment of psychology, Uppsala University, Uppsala, Sweden; ^bHuman Information Processing Laboratory, Faculty of Social Sciences, Tampere University, Tampere, Finland

ABSTRACT

Multifactorial research must examine if disorganized attachment is specifically associated with either ODD- or ADHD-symptoms, and the mechanisms through which disorganization may become associated with externalizing problems. The present short-term longitudinal study therefore examined attachment representations, and several competences important for socio-emotional functioning, in relation to ODD- and ADHD-symptoms at T1 ($N = 105$, M age = 80 months) and T2 ($N = 80$, M age = 104 months). There was a main effect of disorganized attachment on ODD-symptoms at both time points but not on ADHD-symptoms. Disorganized children also showed lowered attention to facial expressions, a diminished ability to discriminate facial expressions, and elevated emotional reactivity. Emotional reactivity mediated the link between disorganization and ODD-symptoms at T1, but not at T2. The findings support disorganized attachment as a risk-factor for ODD-symptoms rather than ADHD-symptoms, and suggest that disorganization may become associated with ODD-symptoms through broad effects on multiple competences.

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Disorganized attachment; externalizing behavior problems; oppositional defiant disorder (ODD); attention-deficit /hyperactivity disorder (ADHD); emotion regulation

A robust association has been established between disorganized attachment and externalizing behavior problems (Fearon, Bakermans-Kranenburg, Van IJzendoorn, Lapsley, & Roisman, 2010). Concerns have however been raised that attachment theory may begin to suffer from overextension, with attachment quality now linked to almost all aspects of child development (Sroufe, 2016). Thus, there is a need for multifactorial research that examines for which outcomes disorganized attachment is reliably important. There is also a scarcity of research on the mechanisms through which disorganized attachment may become associated with externalizing problems (Groh, Fearon, van IJzendoorn, Bakermans-Kranenburg, & Roisman, 2017). Theoretically, a multitude of competences important for socio-emotional behavior have been proposed, including social information processing (e.g. attention to social information; Bowlby, 1973; Dykas & Cassidy, 2011), emotional competences (e.g. emotional regulation; Solomon & George, 2011), and cognitive competences (e.g. cognitive inhibition; Bernier, Matte-Gagné, Bélanger, & Whipple, 2014). Integrative research examining multiple potential

CONTACT Tommie Forslund  tommie.forslund@psyk.uu.se  Department of Psychology, Uppsala University, Box 1225, Uppsala SE - 751 42, Sweden

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mechanisms simultaneously is particularly scarce, rendering it unclear whether any hypothesis should take precedence or if disorganized attachment should be regarded as asserting broad effects on multiple competences (Groh et al., 2017).

As elaborated in the following, we therefore examine disorganized attachment representations in relation to two types of externalizing problems; oppositional defiant disorder (ODD) and attention-deficit/hyperactivity disorder (ADHD; American Psychiatric Association [APA], 2013). We also examine several distinct competences that have been implicated in disorganized attachment and externalizing problems, drawing from different theoretical perspectives.

Disorganized attachment and symptoms of ODD and ADHD

Disorganized attachment (Main & Solomon, 1986) has been consistently associated with ODD-symptoms, as reflected by a robust meta-analytic association (Fearon et al., 2010). For instance, Bowlby (1944) found that early child-caregiver separations predicted anti-social outcomes, Lyons-Ruth and colleagues that disorganized attachment predicted hostility and aggression in preschool (Lyons-Ruth, Alpern, & Repacholi, 1993), and Moss and colleagues that externalizing problems were particularly pronounced among disorganized children who showed a controlling-punitive pattern (Moss, Cyr, & Dubois-Comtois, 2004). However, much less is known about the mechanisms through which disorganized attachment may become associated with externalizing problems such as ODD-symptoms. Indeed, a meta-analysis on externalizing problems concluded that there is a notable lack of research on mediating mechanisms (Fearon et al., 2010), and it has been emphasized that there is a particular lack of research examining multiple mechanisms from different theoretical perspectives (Groh et al., 2017).

There is also a growing interest in caregiving based contributions and disorganized attachment to ADHD-symptoms (Deault, 2010; Salari, Bohlin, Rydell, & Thorell, 2017). Associations between disorganized attachment and ADHD-symptoms have also been reported (Bohlin, Eninger, Brocki, & Thorell, 2012; Salari et al., 2017; Thorell, Rydell, & Bohlin, 2012). The few studies that have taken ODD-symptoms into account have however provided mixed results (Bohlin et al., 2012; Thorell et al., 2012). As cautioned by Nigg (2006), the link between attachment quality and ADHD-symptoms may thus depend on ODD-symptoms. An alternative possibility, which to the best of our knowledge remains to be examined, is that disorganized attachment is a non-specific risk-factor for both of these often comorbid symptoms. Research on attachment quality and ADHD-symptoms has also relied on a few methods for assessing attachment representations, and their emphasis on narrative coherence may make the coding of disorganization susceptible to the influences of ADHD-symptoms (Scholtens, Rydell, Bohlin, & Thorell, 2014). Finally, research on mechanisms that may mediate the association between disorganized attachment and ADHD-symptoms is needed.

Disorganized attachment and socioemotional competences

Social information processing

Bowlby (1973) argued that variations in attachment quality manifest in cognitive-affective internal working models (IWMs) of self and others that, grounded in

expectations, guide organization of attention, behavior, and emotion. Thus, he regarded the IWMs as the primary mediating mechanism, and proposed that insecurity manifests in defensive exclusion of threatening information through shifting of attention away from threatening stimuli (Dykas & Cassidy, 2011; Reisz, Duschinsky, & Siegel, 2017). Empirically, secure and insecure infants have been found to differ in attentional processing of child-caregiver separation situations (Johnson et al., 2010). Disorganized infants have also been found to lack an age-typical bias toward fearful faces (Peltola, Forssman, Puura, IJzendoorn, & Leppänen, 2015). Deviations in attention to facial expressions have consequently been proposed as a mechanism that may link disorganized attachment to ODD-symptoms (Peltola, Yrttiaho, & Leppänen, 2018). Empirical research is scarce, however, and it has been argued that the workings of the IWMs have been taken for granted by ad hoc inferences to the examination of attachment per se (Johnson et al., 2010).

Emotional competences

Poor development of emotional competences has been suggested as alternative or complementary mechanisms, with disorganized attachment relationships for instance described as dysregulated (Solomon & George, 2011). Theoretically, such accounts may be particularly close to the safe haven construct of attachment, conceptualizations of the attachment figure as an important external regulator, and notions of dyadic regulation, intersubjectivity, and socialization of emotion (DeOliveira, Bailey, Moran, & Pederson, 2004; Lyons-Ruth, 2007). That is, children are thought to develop emotional competences through close interactions with their attachment figures (see the *attachment-teaching hypothesis*; Van IJzendoorn, Dijkstra, & Bus, 1995). Emotional competence subsumes multiple distinct competences, but the ability to identify emotional expressions, and emotional reactivity and emotion regulation, have been highlighted as main competences (Colle & Del Giudice, 2011).

The ability to identify facial emotional expressions has been shown to be experience-dependent and to comprise two main components; *discrimination* of emotional expressions, based on processing of the partial perceptual input from others' facial muscles, and *response biases* toward particular emotional expressions, grounded in expectancies of what expressions others are likely to display (Pollak, Messner, Kistler, & Cohn, 2009). A lowered ability to discriminate between facial expressions has generally been found in children who have received insufficient experience with emotional expressions, due to institutionalization, neglect, or parental psychological problems resulting in withdrawal from the child and hampered modelling of facial expressions (Moulson et al., 2015; Pollak, Cicchetti, Hornung, & Reed, 2000). Response-biases have generally been found in children subjected to over-exposure to particular emotional expressions coupled with negative consequences for the child, most typically physical abuse, in which case it is highly adaptive for children to learn to rapidly discriminate particular emotional expressions (e.g. anger) for adaptive responding (Pollak, Klorman, Thatcher, & Cicchetti, 2001). Research on attachment and emotion identification is fairly scarce, regarding both discrimination and response-biases, but secure children have been found to be better at discriminating between facial emotional expressions than insecure children (Steele, Steele, & Croft, 2008). Steele et al. (2008) did not find any difference between disorganized and secure children and hypothesized, in line with the over-exposure hypothesis, that these children may have developed good emotion discrimination skills to know

when to avoid the caregiver and protect themselves. However, there are also reasons to hypothesize a diminished ability to discriminate between emotional expressions in disorganized children; disorganized attachment is not only predicted by frightening/frightened caregiver behavior (Main & Hesse, 1990) but also by atypical/disrupted caregiving behavior (Lyons-Ruth & Jacobvitz, 2016). Atypical/disrupted caregiving may include an inability to provide children with sufficient exposure to clearly modelled emotional expressions, thereby resulting in insufficient emotion socialization and a diminished ability to discriminate between emotional expressions (DeOliveira et al., 2004). Indeed, we found a diminished ability to discriminate facial emotional expressions in children classified as disorganized, but no response-biases, in a previous study of the sample of interest for the current study (Forsslund, Kenward, Granqvist, Gredebäck, & Brocki, 2017). Consequently, it is important to examine discrimination of facial emotional expressions as a potential mediator between disorganization and externalizing problems.

Emotion regulation is a broad and multifaceted construct that is often taken to include both automatic and effortful processes, and intrapersonal as well as interpersonal processes, and it has accordingly proved difficult to reach an agreement on how to best define the construct (Eisenberg & Spinrad, 2004). One salient issue pertains to whether or not emotional reactivity (frequency and intensity of emotional reactions) should be regarded as a bottom-up regulatory process, or restricted to a target of top-down emotion regulation (Nigg, 2017). Therefore, examination of emotion regulation should also include emotional reactivity, both of which are arguably susceptible to environmental influences. For instance, caregivers' behavior toward their children should both model and teach children about strategies for emotion regulation and influence children's mood and emotional reactivity. Multiple studies have also reported associations between insecure and disorganized attachment and poor emotion regulation and emotional reactivity, with dysregulation of anger being the most consistent theme (for a review, see Forsslund & Granqvist, 2017). Poor emotional competence and dysregulation of anger are also prominent in relation to externalizing problems. While dysregulation of anger is integral to ODD it is also common in ADHD (Shaw, Stringaris, Nigg, & Leibenluft, 2014). Therefore, discrimination of facial emotional expressions, and emotional reactivity and emotion regulation, should be considered as mediating mechanisms.

Cognitive competences and executive functioning

The gradual acquisition of executive functioning (EF) is a central part of cognitive development, with cognitive inhibition developing early and potentially constituting a foundation for the other EF-components (Garon, Bryson, & Smith, 2008). It has been increasingly suggested that EF-development, which is of paramount importance for goal-directed behavior, may be influenced by caregiving and attachment quality (Bernier, Beauchamp, Carlson, & Lalonde, 2015). Poor EF is also a robust predictor of externalizing problems, particularly of ADHD-symptoms (Brocki, Nyberg, Thorell, & Bohlin, 2007), wherefore it has been proposed as a potential mediator between disorganized attachment and externalizing behavior problems (Fearon et al., 2010). Accounts suggesting effects of attachment quality on cognitive competences such as EF may be particularly close to the secure base construct, conceptualizations of the

attachment figure as an important reference point for exploration, and autonomy support (Bernier et al., 2014). That is, children's EF-development is thought to depend in part on their caregiver's ability to support their exploration and free up epistemic space for learning (see also the *attachment-exploration hypothesis*; Van IJzendoorn et al., 1995).

Aims and hypotheses

The purpose of the study was to further the understanding of the associations between disorganized attachment, externalizing problems, and socioemotional competences. The first aim was to examine if disorganized attachment representations are specifically associated with either ODD- or ADHD-symptoms or non-specifically associated with both. The second aim was to examine associations between disorganized attachment and distinct competences that are important for socio-emotional functioning, and which may be important for understanding how disorganization becomes associated with externalizing problems. We drew from different theoretical perspectives and examined social information processing (attention to facial emotional expressions), emotional competences (discrimination of facial emotional expressions, emotional reactivity and regulation), and cognitive competences (cognitive inhibition).

We hypothesized that disorganized attachment would be primarily associated with ODD-symptoms, as suggested by the robust meta-analytical link between disorganization and oppositionality and aggression (Fearon et al., 2010). We further predicted that disorganized attachment would be associated with suboptimal functioning of all socio-emotional competences, and that elevated emotional reactivity and poor emotion regulation would mediate the presumed association with ODD-symptoms.

Method

Participants

The final sample consisted of 105 children (49.5% boys) aged 6–7 years ($M = 6$ years 8 months, $SD = 1.8$ months) who lived in a county of Sweden that includes a university town. Families were drawn from the local birth register and sent a letter that described the study and asked about consent to be contacted regarding participation ($N = 1062$). The 156 families (14.7%) that responded positively were contacted with further information about the study and its inclusion criteria: children speaking Swedish and not having any known developmental disability (autism spectrum disorder, intellectual disability).

Ninety-three children (88.6%) lived with both parents and the remainder primarily with their mother or in alternating residence. All children lived at least part time (50%) with their mother, and all but two (98%) were born in Sweden. The educational status was high with eighty-five of the children (81%) having at least one parent with a university degree.

We approached statistical power a priori by calculating the n needed for a desired power level of .80, based on retrospectively derived effect sizes (software available on <https://www.anzmtg.org/stats/PowerCalculator/PowerCorrelation>). Previous research has suggested small to moderate effect sizes between disorganized attachment

status and ODD-symptoms ($d = .34$; Fearon et al., 2010) and ADHD-symptoms ($r = .28$ – $.40$; Bohlin et al., 2012; Salari et al., 2017). We wanted to be able to detect moderate effect sizes ($r = .30$), and the power analysis suggested that this would require $n = 85$ participants. We then decided to recruit an additional 20 participants to guard against attrition at T2.

Procedure

The children took part in a laboratory visit that lasted approximately two hours. The tasks were part of a larger battery designed to assess predictors of developmental adaptation. The children were tested individually while their accompanying parent(s) filled out a questionnaire in an adjacent room. The children received a toy worth approximately \$10 and the accompanying parent(s) a gift voucher worth approximately \$12. The study was evaluated by the regional ethics review board and judged to conform to the ethical standards of the Swedish Research Council (Approval number 2012/397), as stipulated in the Declaration of Helsinki.

All families were asked to participate again at T2 by the parents completing a questionnaire regarding children's developmental adjustment. Parents were also asked for consent to contact the children's teachers. The parents of ninety-six of the children (91%) completed the questionnaire (48% boys), and eighty-seven (90.6%) gave consent to contact the teachers. Eighty teachers completed the questionnaire (76.2%, 48% boys). Parents and teachers who completed the questionnaire each received a gift voucher worth \$12. The longitudinal gap was 2 years (M age at T2 = 8 years 7 months, $SD = 2.8$ months).

Measures

The laboratory tasks are described in their order of administration. The first two tasks were administered in a dimly lit room designed for eye-tracking, in which the children were seated 60 cm away from a corneal-reflection eye-tracker monitor (Tobii T120, Tobii Technology, Stockholm, Sweden) that measured 33.7×27 inches (1280 X 1024 resolution; 0.022×0.023 visual degrees per pixel). The remaining tasks were administered in a room that was decorated to be welcoming but without being distracting.

Attention to facial expressions

Attention to facial expressions was examined using the overlap paradigm (Peltola et al., 2018), which measures attentional dwell time to centrally presented face stimuli during the presentation of peripheral distractors. The task included 48 trials that began with a fixation cross for 2000 ms. One of four face stimuli was then presented centrally for 1000 ms, followed by a peripheral distractor (left or right) that remained in view with the face for 3000 ms. The face stimuli (presented twelve times each) were color images of female models presented neck up with hair who showed fearful, neutral, and happy expressions, and a phase-scrambled control image that retained the facial contour, amplitude, and color spectra. Distractors were patterns of black-and-white circles and a checkerboard.

Stimulus presentation proceeded automatically and was controlled by E-Prime 2 software (Psychology Software Tools, Inc., www.pstnet.com). All data processing was done using gazeAnalysisLib, a library of MATLAB routines (Mathworks, Natick, MA). Preprocessing included interpolation of missing data, and median filtering with a window of nine samples was used to remove abrupt spikes in the data.

Dwell time indices were calculated for each face stimuli as in Peltola et al. (2018). Dwell time per trial was calculated as the last gaze point in the face area that preceded the first gaze point in the distractor area, with a maximum of 1000 ms assigned if children did not disengage within 1000 ms after distractor onset. Trials with (1) more than 150 ms of missing data, (2) more than 25% of gaze points outside the face area preceding disengagement, or (3) anticipatory saccades to the distractor (< 150 ms of distractor onset) were excluded. A normalized dwell time index was calculated with a formula (below) that accounts for dwell time and number of scorable trials within stimulus condition.

$$\text{Dwelltimeindex} = \frac{\sum_{i=1}^n \left(1 - \frac{1000 - x_i}{850}\right)}{n}$$

Two children were excluded due to technical problems, and another nine did not meet inclusion criteria of ≥ 3 valid trials per condition, resulting in 94 children (89.5%) in the final analyses. Mean number of valid trials was 34.23 ($SD = 6.82$), with an average of 8.2–8.8 valid trials per stimuli. A 2 (disorganized vs. organized) X 4 (control, neutral, happy, fearful) mixed models ANOVA showed no main effect of attachment group on the number of valid trials, $F(1, 92) = 1.75, p = .189, \eta^2 = .02$. There was a main effect of facial stimulus type, $F(3, 276) = 5.02, p = .002, \eta^2 = .05$, with the number of valid trials higher for happy expressions ($M = 9.0 [8.35-9.66]$) than for the control stimulus ($M = 8.06 [7.45-8.67], p = .02$), and for neutral expressions ($M = 7.91 [7.32-8.50], p = .002$), but not for fearful expressions ($M = 8.45 [7.93-8.94], p = .51$; all other $ps = .51-1$). There was an interaction between attachment group and stimulus type, $F(3, 276) = 2.78, p = .041, \eta^2 = .03, \text{power} = .67$. Follow-up t -tests revealed that the disorganized group had slightly fewer valid trials for happy expressions ($t(92) = 2.0, p = .049$), and for fearful expressions ($t(92) = 2.18, p = .049$), but there were no differences in the number of valid trials for the control stimulus ($t(92) = .81, p = .422$) or the neutral expressions ($t(92) = -.56, p = .58$).

Emotion discrimination

Emotion discrimination was examined with 40 frontal view color photographs of Caucasian adult faces shown neck up with hair against a grey background (50% female models; for further information, see Forslund et al., 2017). The models showed happy, angry, fearful, and sad expressions (ten photographs per expression) and were taken from the Karolinska Directed Emotional Faces (KDEF; Lundqvist, Flykt, & Öhman, 1998). Photographs were blurred with Photoshop CS5 Gaussian blur to increase performance demands and, hence, the ability to observe individual differences.

The photographs were shown one at a time (562 X 762 pixels; 0.022×0.023 visual degrees per pixel) without any time limit. Hit rates (HR; percentage of correctly identified expressions) and false alarm rates (FAR; percentage of trials where an emotional

expression was incorrectly identified) were used to calculate emotion discrimination (D' ; $HR - FAR$).

The photographs were presented in two semi-randomized sequences with no effect on children's accuracy scores, $t(103) = .626, p = .533$. Seven photographs had hit rates below 35% which, given the sample size, would not be considered different from chance. The final analyses are therefore based on the remaining thirty-three photographs.

Cognitive inhibition

Cognitive inhibition was indexed by the ability to inhibit a pre-potent response in a Stroop-like task (Berlin & Bohlin, 2002). Children were presented with pictures on a computer screen, one at a time, from four picture pairs (boy-girl, night-day, up-down, and small-large). Children were instructed to say the opposite of what they saw (e.g. "boy" when seeing a girl). The task included two conditions with 32 trials each. Inter-stimulus interval was 2500 ms in each condition. Presentation time was 1200 in the first condition and 800 ms in the second. Performance on the two conditions were correlated ($r = .38, p < .001$), and we therefore used the total number of correct responses as a measure of cognitive inhibition.

Attachment representations

Attachment representations were measured with the Swedish translation (Broberg, Wiberg, & Karlsson, 2000) of the Separation Anxiety test (SAT; Kaplan, 1987), which was developed in the Berkley study (Main, Hesse, & Kaplan, 2005). Children were presented with six black and white drawings, in a fixed order, depicting separation situations between an androgynously drawn child and its two parents, who were drawn with neutral affective expressions. After a short vignette (e.g. "in this picture mom and dad are going away for the weekend, and the boy [girl] is to stay with his/her relatives") children were asked (1) how the pictured child (presented as same sex as the interviewee) was feeling, (2) why the child was feeling that way, and (3) what the child would do. Standardized probes were used if children did not respond at all or if they responded that they did not know (e.g. "take a guess"). The interviews were performed, recorded, transcribed, and coded in accordance with Kaplan (1987) coding manual.

Each transcript was initially coded for the constructiveness of each solution (1–9). High scores (7–9) were given for simple constructive solutions (e.g. "play"), complex constructive solutions (e.g. "go to the circus with the relatives"), and attachment behavior (e.g. "cry and ask the parents not to leave"). Intermediate scores (4–6) were given for an inability to recognize the separations (e.g. "they'll all go together"), no solutions (e.g. "I do not know"), and passive responses (e.g. "wait"). Low scores (1–3) were given for solutions in which the parents and/or the child died or were severely injured/ill (e.g. "the car crashes and the parents are killed"), solutions in which the pictured child decreased child-caregiver accessibility (e.g. "run away"), and negative solutions such as destructiveness (e.g. "break the parents' belongings"). Each transcript was then coded into one of the four attachment categories, taking into account the constructiveness of the solutions, the ability to acknowledge and motivate vulnerable feelings, and behavioral responses to the interview situation.

Children were coded *secure-resourceful* if they described vulnerable feelings for the pictured child and provided constructive solutions; *insecure/avoidant-inactive* if they described passive/inactive solutions; and *insecure/ambivalent-aggressive* if they described contradictory solutions such as attachment behavior in one separation situation and aggressiveness in another. Children were coded *insecure-disorganized-fearful* if they imagined markedly frightening situations or reacted to the interview situation with disorganized thought (e.g. marked self-contradictions and lapses in reasoning), disorganized out of control behavior (e.g. hurting oneself), linguistic disorganization (e.g. “yes-no-yes-no-yes-no”), prolonged silences or whispering, or marked resistance against discussing feelings (e.g. insistence that the child feels nothing, refusal to finish the task).

The transcripts were coded by the first author, who was trained with permission by Dr. Kaplan and achieved full reliability (>80% correct classifications across all four categories and 30 transcripts). The SAT does not yield continuous scores for disorganization and we therefore used a dichotomous two-group variable (disorganized vs. organized) as the main study variable, with secure, insecure ambivalent-resistant, and insecure-avoidant children grouped together. Inter-rater agreement on classification over 20 cases, with another certified SAT-coder, was $\kappa = .86$ for disorganized vs. organized status.

Emotional reactivity and emotion regulation

Accompanying parent(s) rated children’s tendencies to react with happiness, sadness, fear, and anger, and their ability to regulate each emotion, using the Emotion Questionnaire short form (Rydell, Berlin, & Bohlin, 2003). Emotional reactivity was measured with two items per emotion, covering the frequency and intensity of emotion reactivity (e.g. “When angry or in a bad mood, my child reacts strongly and intensely”). Emotion regulation was similarly measured using two items per emotion, reflecting the child’s capacity to regulate with and without the assistance of others (“My child has difficulties calming down on his or her own”). Each item was scored on a scale ranging from 1 (“doesn’t apply at all”) to 5 (“applies very well”) and mean scores were calculated for reactivity and regulation of each of the four emotions.

Attention-deficit/hyperactivity disorder (ADHD)

Parents rated ADHD-symptoms at T1, and parents and teachers at T2, on the ADHD rating scale (DuPaul, Thomas, & Anastopoulos, 1998). This scale contains the 18 DSM symptom criteria (APA, 2013), with nine items each covering inattention and hyperactivity/impulsivity. Each question was rated on a 4-point scale from 0 (“never-rarely”) to 3 (“very often”). We used the mean score of all eighteen items. Internal consistency was high at T1 ($\alpha = .89$) and T2 ($\alpha = .92 - .93$). Parent and teacher ratings were robustly associated ($r = .51, p < .001$), and a composite score was therefore computed at T2 by averaging parent and teacher ratings. Parent ratings at T1 and T2 were strongly associated ($r = .78, p < .001$), suggesting stability in ADHD-symptoms.

Oppositional defiant disorder (ODD)

Parents rated ODD-symptoms at T1, and parents and teachers at T2, on a scale containing the eight DSM-IV symptom criteria for ODD (APA, 2013; e.g. “he [she] often deliberately annoys others”). A slightly abbreviated version was used at T2, including six of the items (excluding “he [she] is often angry and resentful”; and “he [she] is often spiteful and vindictive”), since teacher’s anonymity could not be fully guaranteed should parents request access to their child’s data, and we were concerned that the teachers would be ill at ease by these items.

Each item was rated on a 4-point scale ranging from 0 (“never - rarely”) to 3 (“very often”). Internal consistency was high at both T1 ($\alpha = .85$) and T2 ($\alpha = .85 - .86$). We calculated mean scores for ODD-symptoms. There was a significant albeit small association between parental and teacher ratings ($r = .24, p = .039$). Though the ODD-ratings differed to some extent they nonetheless showed the same pattern of association with the main study variables. We therefore computed a composite ODD-score by averaging parent ($M = .51, SD = .48$) and teacher ($M = .14, SD = .26$) ratings. Parent ratings of ODD-symptoms at T1 and T2 were strongly associated ($r = .72, p < .001$), suggesting stability of ODD-symptoms.

Preliminary analyses

Nine extreme values ($>3 SD$) were identified: two each for discrimination of facial expressions, cognitive inhibition, and ODD-symptoms, and three for ADHD-symptoms. These were replaced with the next most extreme value within $3 SD$ according to the winsorizing method (Field, 2013). However, the two children with extreme scores for emotion discrimination were excluded from all analyses of tasks with visual stimuli, since these scores may have been due to visual disabilities not yet identified.

ODD- and ADHD-symptoms were positively skewed and ODD-symptoms leptokurtic ($Z > 3.29, p < .001$). This is common in research on ODD- and ADHD-symptoms since relatively few children show high symptom levels (Brocki, Forslund, Frick, & Bohlin, 2017). As advised by Field (2013), we also examined normality within each main study group. Visual inspection of the groups’ distributions (e.g. Q-Q plots, box-plots), and examination of bivariate outliers and influential cases (Cook’s D and standardized residuals), indicated that the distributions were largely similar. However, two bivariate outliers for ODD-symptoms (standardized residuals $> 3 SD$) were winsorized to the next most extreme value. Nonetheless, we also used robust methods (bootstrapping, 1000 samples with bias-corrected accelerated confidence intervals [BCa]) in the final analyses, since robust methods do not rely on a normal distribution and have been argued to constitute the best way of dealing with bias (Field, 2013).

Child sex was associated with cognitive inhibition ($r = .20, p = .04$) and T2 ADHD-symptoms ($r = -.38, p = .001$), with girls higher in cognitive inhibition and lower in ADHD-symptoms. Child age at T1 was positively related to T2 ODD-symptoms ($r = .23, p = .045$). Socioeconomic status (SES), indexed by maternal and paternal education (five-point scale; 1 = primary and lower-secondary school, 3 = post-secondary non-tertiary vocational education and training, 5 = higher education second cycle courses and programs), was marginally associated with ADHD-symptoms ($r = -.21, p = .061$). The number of semesters

that the teachers had been tutoring the children was unrelated to all variables. Analyses were repeated with and without control for the background variables. The significant results remained and the results are therefore presented without controls.

There was a significant association between attachment status and parental follow-up data, $\chi^2(1) = 6.451$, Cramer's $V = .249$, exact $p = .029$. A lower proportion of disorganized children (75.0%) had parental follow-up data than organized children (94.4%). However, there was no association between attachment status and follow-up data from teachers, $\chi^2(1) = 1.95$, Cramer's $V = .136$, exact $p = .203$, with a similar proportion of disorganized children (75.0%) and organized children (78.7%) having follow-up data. There were no significant differences on any of the continuous variables between children whose parents (all $ps > .083$), and teachers (all $ps > .40$) did or did not participate in the follow-up.

Main analyses

Effects of attachment status (disorganized vs. organized) on externalizing behavior problems (ODD- and ADHD-symptoms) were analyzed with two one-way analyses of covariance (ANCOVAs) at each time point, controlling for symptom overlap between ODD- and ADHD-symptoms in the respective analyses. Effects of attachment status on the socioemotional competences were analyzed independently for the respective competences using mixed models ANOVAs. Attachment status (disorganized vs organized) was used as a between-subjects factor and the variables for the respective socioemotional competences as different levels of the within-subjects factor. Interaction effects were followed up by t -tests. Mediation was analyzed with the PROCESS tool (version 3.00; Hayes, 2018), with the indirect effect examined through inspection of the partially standardized indirect effect and bootstrapped confidence intervals (1000 samples).

Results

Descriptive statistics for the continuous variables are presented in Table 1. Fifty-seven children (54.3%) were coded as "secure-resourceful", 27 children (25.7%) as "insecure avoidant-inactive", 5 children (4.8%) as "insecure ambivalent-aggressive", and 16 children (15.2%) were coded as "insecure disorganized-fearful". Based on DSM criteria, 5 children (5.2%) met criteria for ADHD at T2 and six children for ODD (6.3%), corresponding well with meta-analytic prevalence estimates (Polanczyk, Willcutt, Salum, Kieling, & Rohde, 2014).

Disorganized attachment and externalizing behavior problems

There was an effect of attachment status on T1 ODD-symptoms, with control for T1 ADHD-symptoms, $F(1, 102) = 4.32$, $p = .040$, $\eta^2 = .041$. The disorganized group showed higher levels of ODD-symptoms ($M = .64$ [.45–82]) than the organized group ($M = .43$ [.35 – .50]). There was no effect of attachment status on T1 ADHD-symptoms, with control for T1 ODD-symptoms, $F(1,102) = .000$, $p = .98$, $\eta^2 = .000$. The disorganized group showed similar levels of ADHD-symptoms ($M = .67$ [.49 – .85]) as the organized group ($M = .67$ [.59 – .74]).

Table 1. Descriptive statistics for continuous variables at T1 (N = 92–105) and T2 (N = 80).

Variables	Min	Max	<i>M</i>	<i>SD</i>
Attention to Facial Expressions				
Fearful Dwell Time	.13	1	.65	.20
Neutral Dwell Time	.10	1	.60	.22
Happy Dwell Time	.10	1	.60	.21
Ctrl Dwell Time	.10	.89	.49	.20
Emotion Discrimination (D')				
Fearful Expressions	-.08	.92	.47	.26
Angry Expressions	.05	1	.76	.23
Sad Expressions	-.12	.96	.40	.23
Happy Expressions	.48	1	.85	.12
Emotional Reactivity and Regulation				
Fear Reactivity (Regulation)	1 (2)	4 (5)	2.09 (3.80)	.83 (.71)
Anger Reactivity (Regulation)	1 (1.5)	5 (5)	2.60 (3.74)	1.10 (.79)
Sad Reactivity (Regulation)	1 (1.5)	4.5 (5)	2.22 (3.74)	.90 (.75)
Happy Reactivity (Regulation)	2 (1)	5 (5)	3.93 (3.47)	.64 (.82)
Cognitive Inhibition	30	62	49.73	8.04
T1 ODD-Symptoms	0	1.63	.46	.42
T2 ODD-Symptoms	0	1.17	.32	.28
T1 ADHD-Symptoms	0	1.83	.67	.41
T2 ADHD-Symptoms	.03	1.86	.58	.43

There was also an effect of attachment status on T2 ODD-symptoms, with control for T1 ODD-symptoms and ADHD-symptoms at T1 and T2, $F(1, 75) = 9.45$, $p = .003$, $\eta^2 = .11$. The disorganized children showed higher levels of T2 ODD-symptoms ($M = .49$ [.15 – .84]) than the organized children ($M = -.08$ [–.21 – .04]). There was no effect of attachment status on T2 ADHD-symptoms, with control for T1 ADHD-symptoms and ODD-symptoms at T1 and T2, $F(1, 75) = 2.81$, $p = .098$, $\eta^2 = .036$. The disorganized children showed similar levels of T2 ADHD-symptoms ($M = -.33$ [–.71 – .05]) as the organized children ($M = .02$ [–.12 – .15]).

Disorganized attachment and socioemotional competences

Attention toward facial emotional expressions

There was a main effect of attachment status on attentional dwell-time, $F(1, 92) = 10.29$, $p = .002$, $\eta^2 = .10$ (see Figure 1). The disorganized group showed shorter dwell-times ($M = .47$ [.38 – .55]) than the organized group ($M = .61$ [.57 – .65]). There was no interaction between attachment status and facial stimulus type on dwell-time, $F(3, 276) = 1.03$, $p = .38$, $\eta^2 = .01$. There was a significant main effect of facial stimulus type on dwell-time, $F(3, 276) = 13.42$, $p < .001$, $\eta^2 = .13$. Dwell-times were shorter for the control stimulus ($M = .45$ [.40 – .50]) than for all three facial expressions; happy expressions ($M = .53$ [.48– .59], $p = .004$), neutral expressions ($M = .55$ [.50 – .61], $p < .001$), and fearful expressions ($M = .61$ [.56 – .66], $p < .001$). Dwell-times were also shorter for happy expressions than for fearful expressions ($p = .021$), but there were no differences between happy and neutral expressions ($p = .97$), or between neutral and fearful expressions ($p = .22$). We therefore used the mean dwell-time to all four facial stimuli in subsequent analyses.

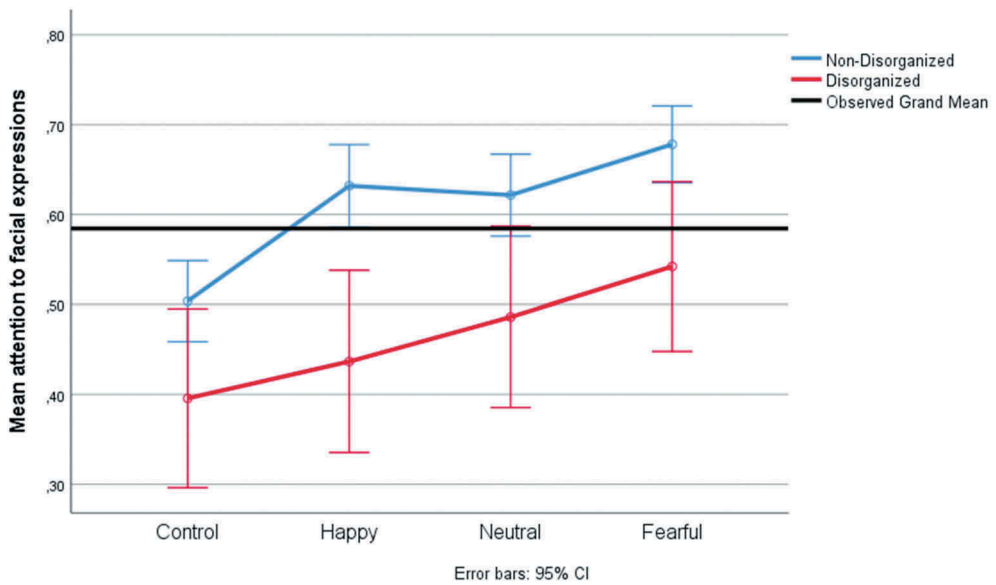


Figure 1. Mean scores of attentional dwell-time to the different types of facial stimuli for disorganized and organized children.

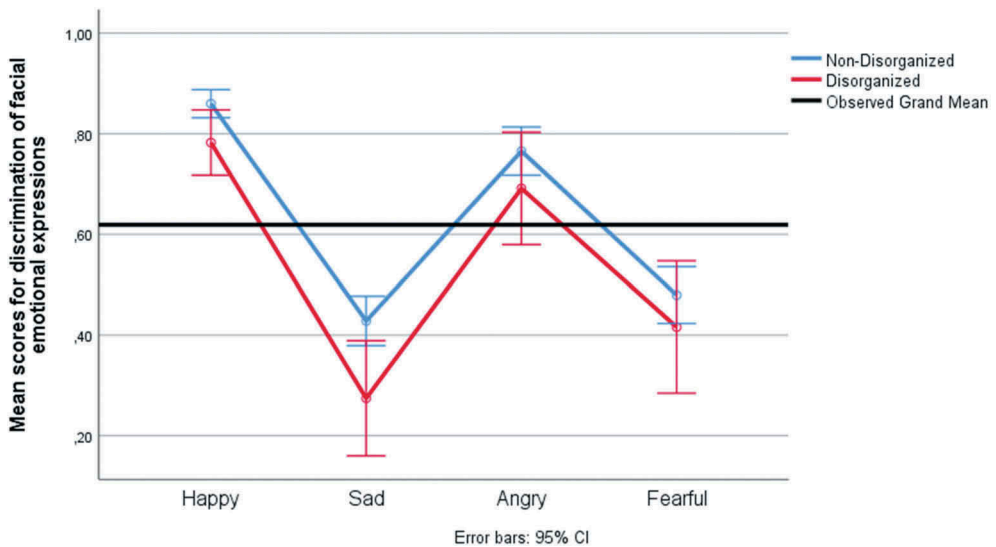


Figure 2. Mean scores of discrimination of facial emotional expressions for disorganized and organized children.

Discrimination of facial emotional expressions

There was a main effect of attachment status on discrimination of facial expressions, $F(1, 101) = 5.10$, $\eta^2 = .048$, $p = .026$ (see Figure 2). The disorganized group showed a lower ability to discriminate between facial expressions ($M = .54$ [.47- .62]) than the organized group ($M = .64$ [.60 - .67]). There was no interaction between attachment status and

facial expression type, Huynh-Feldt $F(2.54, 256.21) = .74$, $\eta^2 = .007$, $p = .51$. There was also a main effect of facial expression type on discrimination, Huynh-Feldt $F(2.54, 256.21) = 86.57$, $\eta^2 = .46$, $p < .001$. Discrimination was higher for happy expressions ($M = .82$ [.79-.86]) than for all other expressions; sad expressions ($M = .35$ [.29-.41], $p < .001$), angry expressions ($M = .73$ [.70-.79], $p = .002$), and fearful expressions ($M = .45$ [.38-.52], $p < .001$). Additionally, discrimination was higher for angry expressions than for sad expressions ($p < .001$) and fearful expressions ($p < .001$), but there was no difference between discrimination of sad and fearful expressions ($p = .15$). We therefore used mean scores for discrimination of all four expressions in subsequent analyses.

Emotional reactivity and emotion regulation

There was a main effect of attachment status on emotional reactivity, $F(1, 103) = 11.62$, $p = .001$, $\eta^2 = .10$ (See [Figure 3](#)). The disorganized group showed higher levels of emotional reactivity ($M = 3.21$ [2.89–3.53]) than the organized group ($M = 2.62$ [2.48–2.75]). There was also a significant main effect of emotion, Huynh-Feldt $F(2.89, 297.31) = 75.73$, $p < .001$, $\eta^2 = .42$. Emotional reactivity was higher for happiness ($M = 4.0$ [3.82–4.17]) than for all other emotions; sadness ($M = 2.45$ [2.22–2.69], $p < .001$), anger ($M = 2.94$ [2.66–3.22], $p < .001$), and fear ($M = 2.27$ [2.05–2.49], $p < .001$). Additionally, reactivity was higher for anger than for sadness ($p < .001$), and for fear ($p < .001$), but there was no difference between sadness and fear ($p = .50$). There was also an interaction between attachment status and emotion, Huynh-Feldt $F(2.89, 297.31) = 3.44$, $p = .018$, $\eta^2 = .032$. Follow up t -tests showed that disorganized children were higher in reactivity for sadness ($M = 2.78$ [$SD = .88$], $M = 2.12$ [$SD = .87$]), $t[103] = -2.77$, $p = .007$), anger ($M = 3.44$ [$SD = 1.08$], $M = 2.44$ [$SD = 1.04$], $t[103] = -3.45$, $p = .001$), and fear ($M = 2.54$ [$SD = 1.07$], $M = 2.01$ [$SD = .76$], $t[103] = -2.38$, $p = .019$), but not for happiness ($M = 4.09$ [$SD = .58$], $M = 3.90$ [$SD = .65$], $t[103] = -1.15$, $p = .268$). We therefore used mean scores of reactivity for negative emotions in subsequent analyses.

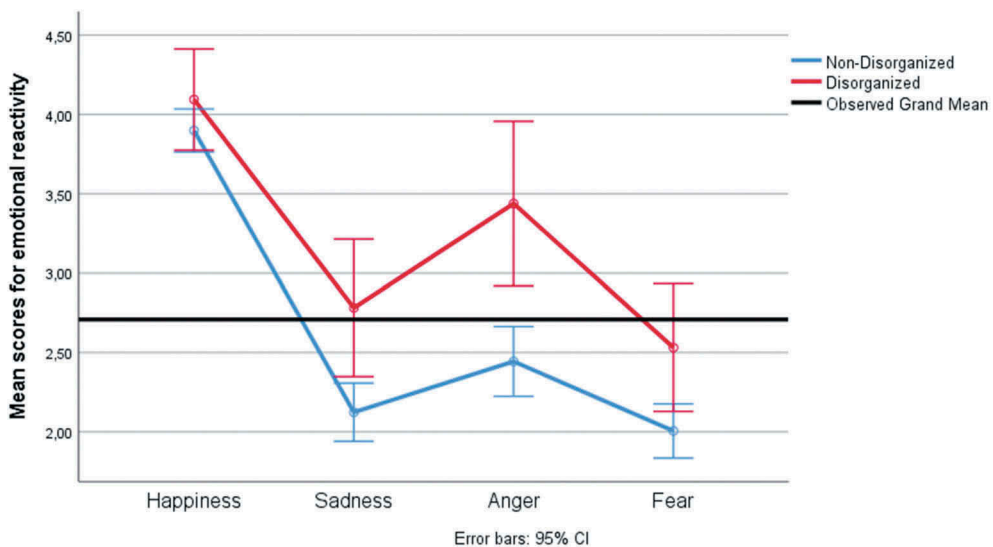


Figure 3. Mean scores of emotional reactivity for disorganized and organized children.

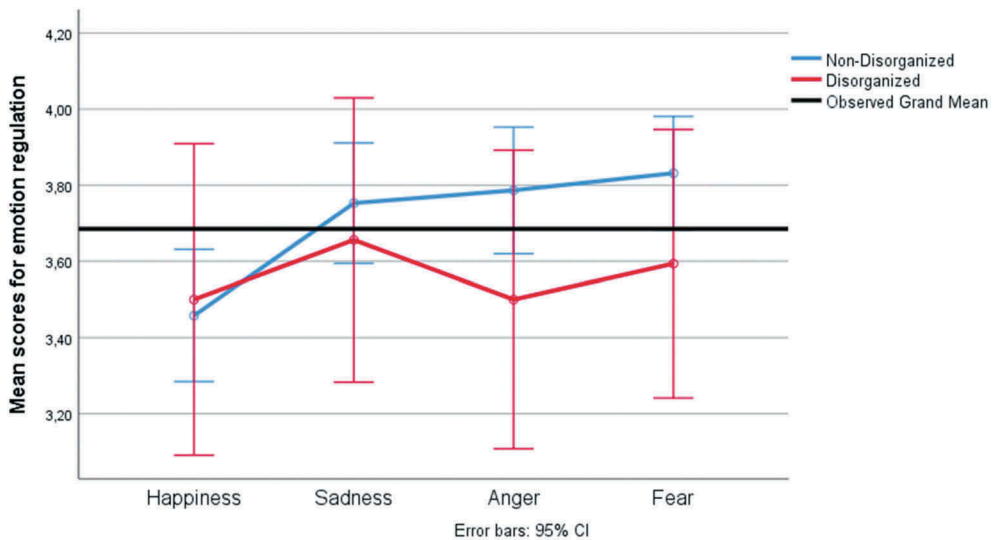


Figure 4. Mean scores of emotion regulation for disorganized and organized children.

There was no effect of attachment status on emotion regulation, $F(1, 103) = .74$, $p = .391$, $\eta^2 = .007$ (See Figure 4.). The disorganized group showed similar levels of emotion regulation ($M = 3.56$ [3.26–3.87]) as the non-disorganized group ($M = 3.71$ [3.58–3.84]). There was no effect of emotion type, $F(2.48, 255.61) = 2.26$, $p = .094$, $\eta^2 = .021$, and no interaction between attachment status and emotion regulation, $F(2.48, 255.61) = 1.06$, $p = .360$, $\eta^2 = .01$. Emotion regulation was highly similar for regulation of happiness ($M = 3.48$ [3.26–3.70]), sadness ($M = 3.71$ [3.50–3.91]), anger ($M = 3.64$ [3.43–3.86]) and fear ($M = 3.71$ [3.52–3.90]); $ps = .239$ – 1). We therefore used mean scores of regulation of all four emotions in subsequent analyses.

Cognitive inhibition

There was no difference in cognitive inhibition between the disorganized group ($M = 48.38$, $SD = 9.12$) and the organized group ($M = 49.98$, $SD = 7.86$), $t(103) = .73$, $p = .465$.

Mediation analyses

Bootstrapped bivariate correlations are presented in Table 2.

Mediation analyses were restricted to instances where disorganized attachment status (the predictor variable), socio-emotional competences (the proposed mediators), and externalizing behavior problems (the outcome variables) were associated (Baron & Kenny, 1986). Analyses were therefore restricted to ODD-symptoms at T1 and T2. Of the socio-emotional competences, attention to facial expressions and emotional reactivity fulfilled criteria for mediation analysis at T1, and discrimination of facial expressions and emotional reactivity at T2. Analyses were performed with control for ADHD-symptoms and other socio-emotional competences that were significantly associated with the

proposed mediator or ODD-symptoms, using 95% Bias Corrected accelerated confidence intervals (1000 samples).

There was no indirect effect of D-status on T1 ODD-symptoms through attentional dwell-time, with control for T1 ADHD-symptoms, cognitive inhibition, emotional reactivity, and emotion regulation, $b = .058$ ($-.031 - .212$). There was an effect of D-status on attentional dwell-times ($b = -.478$, $p = .032$), no effect of attention dwell-times on ODD-symptoms ($b = -.052$, $p = .292$), and no direct effect of D-status on ODD-symptoms ($b = .042$, $p = .684$).

There was an indirect effect of D-status on ODD-symptoms through emotional reactivity for negative emotions, with control for T1 ADHD-symptoms, cognitive inhibition, emotion regulation, and attention to facial expressions, $b = .147$ ($.003 - .351$). There was also an effect of D-status on emotional reactivity ($b = .377$, $p = .039$), an effect of emotional reactivity on ODD-symptoms ($b = .167$, $p = .006$), and no direct effect of D-status on ODD-symptoms, $b = .042$, $p = .684$.

There was no indirect effect of D-status on T2 ODD-symptoms through discrimination of facial emotional expressions, $b = .113$ ($-.080 - .359$). There was an effect of D-status on discrimination ($b = -.659$, $p = .014$), no effect of discrimination on ODD-symptoms ($b = -.131$, $p = .210$), and a direct effect of D-status on ODD-symptoms ($b = .823$, $p = .001$).

There was no indirect effect of D-status on T2 ODD-symptoms through emotional reactivity for negative emotions, with control for T1 ODD-symptoms, T1 and T2 ADHD-symptoms, discrimination of facial expressions, emotion regulation, and cognitive inhibition, $b = .034$ ($-.061 - .224$). There was no effect of D-status on emotional reactivity ($b = .254$, $p = .181$), no effect of emotional reactivity on ODD-symptoms ($b = .102$, $p = .421$), and a direct effect of D-status on ODD-symptoms ($b = .580$, $p = .005$).

Discussion

We investigated whether disorganized attachment representations are primarily associated with either ODD- or ADHD-symptoms or with the overlap between the symptoms. We also examined several competences important for socioemotional functioning that may be important for understanding how disorganized attachment becomes associated with externalizing problems. We drew from several theoretical perspectives and examined social information processing (attention to facial emotional expressions), emotional competences (discrimination of facial emotional expressions, emotional reactivity and regulation), and cognitive competence (cognitive inhibition). The disorganized group showed elevated levels of ODD-symptoms at both T1 and T2, but there were no differences in ADHD-symptoms at either time-point. The disorganized group also showed lower attention to facial emotional expressions, a diminished ability to discriminate facial emotional expressions, and elevated emotional reactivity for negative emotions. However, there were no differences in cognitive inhibition. The present findings corroborate the link between disorganized attachment and ODD-symptoms while cautioning against suggestions of a pathway from disorganized attachment to ADHD-symptoms. The findings also suggest that disorganized attachment may become associated with ODD-symptoms

Table 2. Bivariate associations between disorganized attachment status, socio-emotional competences, and externalizing behavior problems at age 6 (n = 92–105) and age 8 (N = 71–80).

	Att. Expr.	Emo. Discr.			Cog. Inhib.	ADHD-Symptoms		ODD-symptoms	
		Emo. Discr.	Emo. React.	Emo. React.		T1	T2	T1	T2
Disorganized Attachment	-.32**	-.23*	.32**	-.07	.11	.13	.23*	.40***	
Attention to Facial Expressions ^a		.16	-.33**	-.00	-.04	-.05	-.23*	-.16	
Emotion Discrimination ^b			-.26**	.23*	-.19 ⁺	-.37**	-.10	-.24*	
Emotional Reactivity ^c				-.16	.50***	.33**	.60***	.50***	
Cognitive Inhibition					-.36***	-.43***	-.21*	-.24*	
T1 ADHD symptoms						.63**	.48***	.44***	
T2 ADHD-symptoms							.24*	.54***	
T1 ODD-symptoms								.55***	
T2 ODD-symptoms								-	

Notes: ^a Mean scores for attention to all four face stimuli. ^b Mean scores for discrimination of all four facial emotional expressions. ^c Mean scores for reactivity for sadness, anger, and fear. ^d Mean scores for regulation of all four emotions.

+ p < .10, * p < .05, ** p < .01, *** p < .001

through broad effects on multiple competences important for socio-emotional functioning.

Disorganized attachment and externalizing behavior problems

The association between disorganized attachment and ODD-symptoms supports the longstanding link between these constructs (Fearon et al., 2010). The SAT (Kaplan, 1987) puts comparatively little emphasis on narrative coherence, which is a key variable for organized attachment classifications in other representational measures of attachment (e.g. George & Solomon, 2000). The present findings therefore support previous representational research, which has suggested that associations between disorganized attachment status and ADHD-symptoms may depend on difficulties for children high in ADHD-symptoms to adhere to the administration of some attachment tasks (Scholtens et al., 2014). This line of thought also resonates with research that has linked neurological vulnerability in newborns to later D-classifications in the strange situation procedure (SSP; Padrón, Carlson, & Sroufe, 2014; Spangler, Fremmer-Bombik, & Grossmann, 1996), and with research suggesting false-positive D-classifications in the SSP following over-stress (Granqvist et al., 2016). That is, disorganized *behavior* can have multiple causes and does not necessarily imply disorganized *attachment* (Granqvist et al., 2017).

Empirical research thus far, including the present study, has been largely restricted to associations between disorganized behavior and ADHD-symptoms, without supporting evidence from observations of caregiver behaviors that is linked to the development of disorganized attachment. Since neurological difficulties may give rise to disorganized *behavior* in attachment observations, these designs are unable to disentangle disorganized *behavior* from disorganized *attachment*. In fact, suboptimal caregiving has primarily been observed among caregivers of children with ADHD who also show comorbid ODD-symptoms (Deault, 2010). Attachment theory is often misinterpreted in clinical work, for example due to assuming relational antecedents to disorganized behavior (Granqvist et al., 2017). Our findings are therefore important in lending credence to words of caution in trying to explain ADHD-symptoms from an attachment framework, which has been voiced from both the field of ADHD (Nigg, 2006) and the field of attachment (Sroufe, 2016). It would be premature to disqualify the possibility of a pathway from disorganized attachment to ADHD-symptoms. There are however reasons to temper the current enthusiasm, which has gone as far as inviting considerations of attachment quality in the assessment and treatment of ADHD-symptoms (Salari et al., 2017; Storebø, Rasmussen, & Simonsen, 2016).

Disorganized attachment and attention to facial emotional expressions

The disorganized group showed less attention to facial expressions. Bowlby (1973) argued that defensive exclusion, by shifting attention away from threatening stimuli, constitutes a primary defense mechanism against potentially disorganizing conflict and anxiety. Children's IWMs have also been argued to include templates (or filters) of the attachment figure's face as punishing or rewarding (Magai, 1999). Despite its centrality to Bowlby's account, relatively little research has examined attentional processing of

facial expressions in relation to attachment quality (Dykas & Cassidy, 2011). The current study therefore addresses a knowledge gap, and adds to research on infants that has found a lack of a normative bias to fearful expressions in infants later classified as disorganized (Peltola et al., 2015). However, whereas Peltola et al. (2015) found specific effects for attention to fearful expressions, we found generally lowered attention to all facial expressions included in the study. Neutral expressions have been found to be perceived as hostile and fear-inducing for children with impaired emotional functioning (Rich et al., 2006). Thus, disruption to the fear-bias by processes related to disorganized attachment may possibly, later in childhood, manifest more globally in generally decreased processing of facial expressions.

Vision is one of the most important means by which we gather information about the world, and selection of information through attention is crucial to social behavior and learning (Findlay & Gilchrist, 2003). Lowered attention to facial expressions may thus be a risk-factor for hampered social learning and suboptimal social behavior (Dadds, Cauchi, Wimalaweera, Hawes, & Brennan, 2012). Supporting this line of reasoning, lowered attention to facial expressions was also associated with elevated levels of T1 ODD-symptoms in the present study.

Disorganized attachment and discrimination of facial emotional expressions

The disorganized group showed a generally diminished ability to discriminate facial emotional expressions, and discriminatory ability was in turn associated with T2 ODD-symptoms. However, the lowered ability to discriminate facial emotional expressions did not mediate the association between disorganization and ODD-symptoms. It has been suggested that the protracted development of emotion identification (discrimination and response-biases) is experience-dependent (Leppänen & Nelson, 2008). Caregivers have been argued to be of special importance in providing relevant experience since they are responsible for a substantial amount of the facial expressions that children are exposed to and model facial expressions (e.g. DeOliveira et al., 2004). The diminished ability among the children classified as disorganized is in line with similar findings in children who have presumably received lowered exposure to facial expressions, and hence reduced learning opportunities, for example due to neglect or parental psychological problems that result in caregiver withdrawal and reduced child-caregiver interaction (Pollak et al., 2000). The diminished ability is also in line with research suggesting that disorganized children may withdraw from close interactions with their caregivers, which may thereby reduce their learning opportunities (Main & George, 1985). The present study was however based on a low-risk sample from a country where corporal punishment is illegal and rates of physical abuse are generally low (Annerbäck, Sahlqvist, Svedin, Wingren, & Gustafsson, 2012). As suggested by Steele et al. (2008), it is possible that disorganized children with a documented history of frightening/frightened caregiver behavior and abuse may display another pattern of deviations in emotion identification, including an intact ability to discriminate between facial emotional expressions, response-biases toward particular expressions that these children have been overexposed to, and perhaps even expertise in discriminating particular emotional expressions. Deviations in emotion identification pertaining to response-biases, most notably toward anger (cf. "hostile attributional bias"), may moreover increase the risk for

externalizing behavior problems in disorganized children and should therefore be examined as a potential mediator.

Disorganized attachment, emotion regulation, and emotional reactivity

The disorganized group was characterized by elevated reactivity for negative emotions, but not for happiness. This finding is in line with theory and research characterizing disorganized relationships as dysregulated, with caregivers thought to be unable to help their children regulate emotions and achieve homeostasis (Solomon & George, 2011). Indeed, disorganization has been described as a “toxic mixture of fear, sadness, and anger” (DeOliveira et al., 2004, p. 442). Interestingly, Bowlby argued that anger and anxiety “go hand in hand” (Bowlby, 1988, p. 79), that anger is a natural reaction to threats of separation (i.e. as in separation anxiety) and losses of caregivers (i.e. as in mourning), and that anger at attachment figures can become redirected toward the self or third parties. Bowlby (1988) also highlighted the social behavior among children who, given their conflicted approach-avoidance behavior, would likely have been classified as disorganized (Main & George, 1985). Not only did these children show the same approach-avoidance behaviors in relation to their peers’ social overtures; they were also aggressive and disagreeable. Subsequent research has corroborated this theme, with a robust link between disorganized attachment and aggression and oppositionality (Fearon et al., 2010). The present findings, which also include associations between emotional reactivity and ODD-symptoms at both time-points, therefore suggest that disorganization may give rise to emotional reactivity which in turn may convey risk for oppositionality and defiance.

Disorganized attachment and cognitive inhibition

The disorganized group did not differ in cognitive inhibition, contrasting previous reports (Bohlin et al., 2012; Forslund, Brocki, Bohlin, Granqvist, & Eninger, 2016; Thorell et al., 2012). Poor EF was a robust predictor of ADHD symptoms, attesting to the validity of the task. Associations between poor EF and disorganization have hitherto been obtained primarily in samples at elevated risk for ADHD. Bowlby (1969) that the functioning of the attachment system hinges on abilities that support or hamper complex goal-directed functioning, abilities which he termed effector equipment. EF corresponds very well with the notion of effector equipment, and neurologically channeled impairments in EF may thus constitute a risk-factor for difficulties with organization of attachment behavior. The present sample was however low-risk, and it may well be that cognitive inhibition was, overall, at sufficient level to support organized behavior in the SAT in the majority of cases. Consequently, associations between cognitive inhibition and disorganized attachment, when found, may denote effects of neurological vulnerability.

Mediation of the link between disorganized attachment and odd-symptoms

The mediation analyses did not yield robust support for any of the socio-emotional competences as a mediator of the link between disorganized attachment and ODD-

symptoms. Emotional reactivity for negative emotions was linked to disorganization and ODD-symptoms at both time points, and there was an indirect effect of disorganization on ODD-symptoms through elevated emotional reactivity at T1, but this effect did not replicate at T2.

Emotional reactivity is one of the core features of ODD, which apart from argumentativeness and vindictiveness includes anger and irritability (Loeber, Burke, & Pardini, 2009). The robust links between disorganized attachment, emotional reactivity, and ODD-symptoms, therefore suggest that emotional reactivity may constitute a prime candidate for a mediating mechanism. However, it may also be argued that emotional reactivity should co-exist with and perhaps be situated downstream from deviations in social-cognitive processes related to information processing that in part are grounded in suboptimal workings of IWMs. Thus, disorganized attachment may rather have broad and cascading effects on social-cognitive functioning and emotional competences that, ultimately, convey risk for ODD-symptoms. The broad pattern of associations obtained in the present study is also in line with theory and research suggesting the involvement of an amygdala-striatal-ventral prefrontal cortex circuit in both the processing of facial expressions and emotion regulation (Rich et al., 2006).

Limitations and future directions

The present study has a number of limitations that present opportunities for future research. First, the current sample was rather small. This is of particular importance for the group of children classified as disorganized which, although corresponding to meta-analytical prevalence estimates, included a low number of children at T2 due to attrition. Though the power in detecting main effects was satisfactory in general, with the majority of the effects of medium size in line with our a priori power analysis, the power for detecting interaction effects and mediation may have been insufficient.

Second, the sample was a community based low-risk sample, and research on high-risk samples is therefore needed to corroborate the present findings. ADHD-symptoms may for instance be more closely connected with comorbid ODD-symptoms in high-risk samples, in which case disorganization may conceivably be more closely connected with the overlap between the respective symptoms.

Third, the correlational design of the study precludes causal reasoning. The links between disorganized attachment, ODD-symptoms, and the socio-emotional competences under study, may for instance have been driven by dispositions of more genetic origin, which had joint influences on all these variables. Callous unemotional traits, which have been linked to reduced attention to faces (including to those of caregivers), and to externalizing behavior problems, may represent one such factor (Dadds, Jambrak, Pasalich, Hawes, & Brennan, 2011). It also remains possible that some of the oppositional children, who were high in emotional reactivity, may have had difficulties adhering to the administration of the SAT and therefore were coded as disorganized (i.e. potential “false positive classifications”). Future research should therefore adapt an approach similar to Scholtens et al. (2014) regarding narrative coherence and ADHD-symptoms, and measure oppositionality and defiance during the SAT and control for such behavior in the analyses.

Fourth, we conducted multiple analyses, and this may have increased the risk of capitalizing on chance findings. However, it should be noted that the pattern of associations between disorganized attachment and the socio-emotional competences, as well as with externalizing problems, is generally in line with previous research (e.g. Bohlin et al., 2012; Fearon et al., 2010; Forslund et al., 2016; Peltola et al., 2015). The association between disorganized attachment and ODD-symptoms, but not with ADHD-symptoms, also replicated at both time points. The disorganized children's pattern of results were also highly similar to those of the organized children for the socio-emotional competences, though the disorganized group's performance was diminished (lowered attention to and discrimination of facial emotional expressions, elevated emotional reactivity).

Conclusion

The present study was informed by calls for multifactorial research that examine whether disorganized attachment should be understood as a specific risk-factor for ODD- or ADHD-symptoms, or as a non-specific risk-factor for both disorders (Sroufe, 2016). The study was also informed by a need to examine potential mechanisms through which disorganized attachment may become associated with externalizing problems (Fearon et al., 2010; Groh et al., 2017). Our findings indicate that disorganized attachment should be viewed a specific risk factor for ODD-symptoms, and cautions against theories suggesting a link between disorganized attachment and ADHD-symptoms. The findings also suggest that disorganized attachment may convey risk for ODD-symptoms through broad effects on several socio-emotional competences.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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ORCID

Mikko. J Peltola  <http://orcid.org/0000-0001-9993-9963>

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