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Emotional Processing in Children with Disruptive Behavior Disorder: The Role of Callous Unemotional Traits

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Abstract

Disruptive Behavior Disorders (DBD) are prevalent and severe childhood disorders. DBDs designates a highly heterogeneous group of youths, and research has increasingly focused on Callous Unemotional (CU) traits (i.e., lack of empathy and guilt, shallow affect, lack of interest for others' feelings), which define a subgroup of youths with severe DBDs. Emotional processing deficits, including poor emotion recognition, reduced emotional responsiveness, and gaze impairments (i.e., reduced attention to others' eyes), are thought to be a core feature of children with DBDs and CU traits. Moreover, studies have shown that parenting practices can influence CU traits' development and that negative parenting can compromise emotional processing components. Based on these findings, the present study aimed to investigate, in a clinical sample of children with DBDs diagnosis, CU traits' influences on children's emotion recognition (ER), emotional responsiveness, assessed via skin conductance response (SCR), and gaze pattern toward emotional stimuli, recorded with an eye-tracker. Finally, we explored whether parenting moderated the association between attention to other people's eyes and children's CU traits.

Participants were a clinical group of 116 boys (aged 7–13 years) with DBDs. We assessed children's externalizing problems using the Child Behavior Checklist, CU traits using the combined version (parents and teachers) of the Antisocial Process Screening Device, and parenting using the Alabama Parenting Questionnaire. Participants completed an ER task that required them to watch 24 images depicting happy, sad, angry, fearful, disgusted, and neutral facial expressions on a flat screen. Participants were presented with six emotion labels and asked to select the emotion that best described the displayed expression. Gaze pattern and SCR were recorded during the ER task.

We explored differences between children with high vs. low CU traits as regard ER, emotional responsiveness, and gaze pattern, with a series of independent samples t-tests. We further investigated the association between the emotion processing variables and CU traits using partial correlations and linear regression models. We then used logistic regressions to test the significant predictors' ability to classify children with low vs. high CU traits. Finally, we explored moderation models, in which parenting moderated the link between attention to the eyes of emotional stimuli and CU traits.

Findings showed that children with high CU traits had more difficulties recognizing facially expressed emotions, especially negative emotions (i.e., sadness and anger). Consistent with previous studies, results showed that CU traits were associated with lower attention to the eye region of emotional faces, particularly those depicting negative emotions (e.g., sadness). Results revealed for the first time that CU children also significantly showed reduced attention to the mouths of emotional expressions. The present study confirmed an impairment in attention allocation to emotional cues in children with CU traits and DBDs and suggested that it may not be limited to negative emotions as suggested by extant research but seem to extend to positive emotions. Interestingly, the logistic regression models suggested that emotional processing impairments (e.g., poor negative ER, reduced attention to eyes of sad faces) can help discriminate children with low vs. high CU traits, especially when externalizing problems are also considered. We found that deficits in ER and gaze pattern could classify about 81.00% of the participants correctly, and up to 64.70% of them were correctly categorized as high CU children. Finally, this is the first study to show that parenting moderates the link between attention to the eyes and CU traits. We found that poorer attention to the eyes of facial expressions, especially positive ones, was associated with higher CU traits in children exposed to higher positive parenting practices. Even though it would be expected to find lower CU traits in the higher positive parenting group regardless of how children process emotional stimuli, it may be that due to their characteristics, some of the children cannot benefit from the positive relationship with their parents, and therefore are at greater risk for adverse outcomes. Moreover, negative parenting moderated the link between CU traits and attention to the eyes of emotional stimuli in general and faces depicting negative emotions. This may suggest that the combination of high negative parenting and reduced attention to emotional cues may designate a relevant group of youths at greater risk for severe outcomes (i.e., CU traits).

A deeper understanding of CU traits' underpinnings would improve our capability to identify those who are more likely to head towards the most unfavorable pathways and provide them with more tailored treatment options.

Keywords: *Disruptive Behavior Disorder, Callous Unemotional Traits, Emotional Processing, Gaze Pattern, Parenting*

PART 1: INTRODUCTION

1.1 Disruptive Behavior Disorders in Children

Disruptive Behavior Disorders (DBDs) are widely prevalent and among the main reasons for a childhood referral to mental health and educational services. A research review conducted by Polanczyk et al. (2015) estimated a worldwide-pooled prevalence of DBDs ranging from 4% to 8%, with a mean of 5.7%. Likewise, findings from all over the world, such as the United States of America, Brazil, and the United Kingdom, reported prevalence estimates of DBDs of 4%-7% (e.g., Costello et al., 2003; Fleitlich-Bilyk & Goodman, 2004; Ford et al., 2003). Similar results emerge from Italian epidemiological studies. For instance, Gritti et al. (2014) found that 8.5% (3.85% borderline, 4.7% clinical) of children suffered from behavioral problems. At the same time, it is relevant to take into account that DBDs lead to several adverse outcomes and may represent a significant economic burden for the child, their family, their victims, and, more broadly, for society (Allen et al., 2020; Odgers et al., 2008). Even though there are no Italian data available yet, Foster et al. (2005) estimated that public costs per child related to DBDs exceeded $70000 over seven years due to youths' involvement in various child-serving sectors, such as juvenile justice, child welfare, special education, and mental health services.

DBDs include Oppositional Defiant Disorder (ODD) and Conduct Disorder (CD), which are severe mental disorders characterized by deficits in regulating emotions and behavior. ODD encompasses irritable and angry mood, argumentative and defiant behavior, and vindictiveness (American Psychiatric Association, 2013; Rowe et al., 2010). ODD prevalence ranges from 2.6% to 15.6% in community samples and from 28% to 65% in clinical ones (Boylan et al., 2007), and even if it is usually seen as a childhood disorder, it can persist into adulthood, leading to lower social and occupational functioning (Burke et al., 2014). Increasing evidence also suggests that ODD may be a risk factor for the development of further internalizing (e.g., anxiety and mood disorder) and externalizing (e.g., later antisocial behavior and delinquency) problems (Boylan et al., 2007; Loeber et al., 2009b).

As reported by the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5; American Psychiatric Association, 2013), CD, instead, involves an enduring pattern of behavior concerning the violation of the fundamental rights of others or societal norms, including aggression towards people and animals, destruction of properties, deceitfulness, theft, and serious violations of rules. CD is a persistent disorder, with prevalence rates ranging from 1.8% to 16% for males and from 0.8% to 9.2% for females in community samples (Allen et al., 2020; Loeber et al., 2009b). Besides, CD is predictive of later adverse outcomes, such as delinquency, antisocial behavior, convictions, substance use, school dropout, psychosocial maladjustment, and poorer work functioning (e.g., Loeber et al., 2009b, 2009a).

Overall, these findings suggest that DBDs are serious, highly prevalent, and persistent disorders that significantly burden the child, their family, and the entire society. They are associated with pervasive impairments across contexts and social relationships, leading to severe short- and long-term consequences. Therefore, broadening the knowledge about these disorders should be a priority for clinicians and researchers. This advancement would allow for an improvement in assessment procedures and intervention models.

1.1.1 Disruptive Behavior Disorders Heterogeneity

DBD is an umbrella concept that encompasses a wealth of different behaviors, such as, for instance, aggression, oppositional and defiant behavior, emotion dysregulation, and rule-breaking behavior (Dodge et al., 2007). Regardless of the utility of using DBDs as a summary index, it is essential to consider that children who receive a diagnosis of either ODD or CD may exhibit very different clinical pictures regarding the type of symptoms, their severity, and pervasiveness, the level of impairment associated with their problem behavior, their risk for future maladjustment, and their response to treatment (Frick & Nigg, 2012). Indeed, children have to show 4 out of 8 and 3 out of 15 symptoms to receive an ODD or CD diagnosis, respectively (American Psychiatric Association, 2013), with countless and diversified possible symptoms combinations. Besides, some children with DBDs exhibit milder manifestations, such as tantrums, and noncompliance, limited to a circumscribed number of settings, while others carry out extremely severe behaviors, such as the use of weapons, and violence, in a wide range of settings. Briefly, children may receive a diagnosis of DBDs, be it ODD or CD, even with limited symptoms overlap (Pilling et al., 2013). Moreover, even when children manifest similar symptoms, they may not share the same underlying etiological factors and head towards different developmental trajectories (Viding & McCrory, 2020).

The issues related to DBDs heterogeneity have been partially addressed by separating youths who developed the behavioral problems during childhood from those who showed the first signs of the disorder during adolescence. The first group is characterized by greater biological and temperamental risk, more severe and persistent aggressive behavior. Instead, the latter group is associated with lower levels of aggression and less adverse outcomes, and behavioral problems usually remain limited to adolescence (Dandreaux & Frick, 2009; Moffitt, 2006). Despite there is evidence supporting this distinction, there are also significant limitations: first, it is not clear what should be the age at which to differentiate the two variants of DBDs (Frick & Nigg, 2012); then, the distinction between childhood-onset and adolescence-onset groups is not able to explain the heterogeneity in etiological factors, correlates, and outcomes especially within the childhood-onset group. Indeed, some of these children show mild and transient disruptive behavior problems, while others continue to show them throughout their lives (Fairchild et al., 2013). Other approaches tried to define meaningful subgroups based on comorbidity with other disorders, types of aggressive behavior (e.g., overt vs. covert; reactive vs. proactive; predominant physical aggression) and their frequency (see, for instance, Dodge & Pettit, 2003; Tackett et al., 2005), without being able to explain the variability among children and adolescents with DBDs entirely. As it stands, DBDs heterogeneity is still a cause of concern among clinicians and researchers and poses a serious problem to our capability to identify youths at greater risk and prevent us from fulfilling their peculiar needs. Conversely, disentangling DBDs variability would enhance our understanding of the disorders' etiology and development and improve our ability to develop effective preventive approaches and more targeted and effective intervention models (e.g., Barker et al., 2007).

In conclusion, as stated by Viding & McCrory (2020, p. 812), "the heterogeneity [of DBDs] is still defined at the behavioral level, and we cannot assume that the behavioral indicators we have chosen, or our ability to observe them, are sufficiently accurate or discriminating." Different authors have pinpointed the need to uncover the disorders' underpinnings using a neuroscientific approach based on objective and reliable measurements to improve our understandings of DBDs (e.g., Insel et al., 2010; Viding & McCrory, 2020). In the attempt to reduce DBDs heterogeneity, researchers have begun focusing on the role of psychopathic traits, namely Callous Unemotional (CU) traits, and their underlying mechanism (e.g., emotional processing impairments) as a mean to identify those youths at greater risk to persist on a more disadvantageous developmental trajectory.

1.2 Disentangling DBDs Heterogeneity: The Role of Callous Unemotional Traits

Callous Unemotional traits encompass a constellation of affective and interpersonal features and, alongside impulsivity and narcissism, represent a dimension of adult psychopathy. Even though not completely overlapping with the adult dimension, CU traits can be reliably measured from early childhood (e.g., Masi et al., 2018). Several studies suggested that the presence of significant levels of CU traits designates a subgroup of children and adolescents with serious conduct problems across DBDs referred, community, and incarcerated samples (see, for instance, Ezpeleta, Granero, et al., 2017; Frick et al., 2014;

Masi et al., 2014). Prevalence rates for high levels of CU traits range from 10% to 32% in community samples and 21% to 50% in clinic-referred samples of youths (Herpers et al., 2012).

Callous Unemotional traits involve a lack of empathy and guilt, shallow and deficient emotions, and lack of care or concern about performance on tasks and others' feelings. Due to their clinical relevance, CU traits have been included in the DSM-5 as part of a CD's specifier, named "with limited prosocial emotions," which is attributed to those youths who show two or more of the behaviors mentioned above persistently over 12 months in more than one relationship or context (American Psychiatric Association, 2013). Despite being studied primarily in relation to CD, CU traits are a cross-disorders construct (Herpers et al., 2012) and a useful specifier for other forms of externalizing disorders too, including ODD and Attention-Deficit Hyperactivity Disorder (ADHD) (Frick et al., 2014; Willoughby et al., 2014).

1.2.1 Clinical and Etiological Importance of CU Traits

The research on CU traits has widely increased during the last decades, showing that CU features are able to differentiate a group of children and adolescents with severe disruptive and aggressive behavior that was not entirely captured by the childhood-onset group (Frick & Ray, 2015). Frick et al. (2014), in a hallmark work, thoroughly reviewed the available research on CU traits and concluded that they are predominantly genetically driven. The genetically accounted variations of CU traits ranged from 42% to 68% (Bezdjian et al., 2011; Viding et al., 2005), and genetic factors seem to contribute to the stability in CU traits during development (Blonigen et al., 2006; Fontaine et al., 2010). Frick and colleagues (2014) also delineated CU traits youths' peculiar cognitive and affective characteristics: they are less sensitive to punishment, have a reward-oriented learning style, endorse more deviant values in social situations, and show reduced emotional responsiveness (see also Pisano et al., 2017).

More importantly, studies have shown a significant association between CU traits and aggressive behavior. Children and adolescents with high CU traits present an earlier onset of conduct problems and delinquency, which appear to be more severe and more stable compared to those with low levels of CU traits (e.g., Dandreaux & Frick, 2009; Frick et al., 2005). CU traits are associated with premeditated and instrumental aggression, usually enacted for personal gain or to show dominance and solve social conflicts (Lawing et al., 2010; Marsee et al., 2005). Besides, children with DBDs and high CU traits are more likely to show conduct problems throughout adolescence and adulthood. A series of studies have shown that CU traits are predictive of conduct problems and substance use during adolescence (e.g., Muratori et al., 2018), and children and adolescent with CU traits are at greater risk for adult antisocial outcomes, including antisocial personality symptoms, delinquency, and arrests (Marsee & Frick, 2007; McMahon et al., 2010).

Of extreme relevance, findings also suggested that children with DBDs and CU traits show a diminished response to traditional interventions for DBDs (Hawes et al., 2014). For instance, Hawes & Dadds (2005) examined CU traits' impact on treatment outcomes in a behavioral parent-training intervention with young boys referred for DBDs. Overall, CU traits were associated with poor outcomes at a 6-month follow-up. Similar results emerged from studies investigating the efficacy of behavioral intervention delivered directly to children (for a review, see Wilkinson et al., 2016). These results suggest that treatment for children with severe conduct problems could be enhanced by targeting the mechanisms underlying the development of CU traits.

Finally, CU traits are considered the childhood precursors of the affective dimension of adult psychopathy (Frick et al., 2003). This appears of extreme relevance since adult psychopaths are responsible for many violent crimes, they fail to fulfill societal responsibilities, lack any sense of loyalty, and are unperturbed when faced with their behavior's destructive nature (Hare et al., 1988). Taken together, these findings depict children and adolescence with CU traits as a clinically relevant and etiologically distinct subgroup of youths with severe DBDs. This subgroup includes those youths at greater risk for antisocial outcomes and psychosocial maladjustment, and that is why clinicians and researchers are putting so much effort to unveil the roots of CU traits and delineate a clear and objective profile of these youths.

1.3 Emotional Processing in Children with DBDs and Callous Unemotional Traits

The etiopathogenesis of CU traits has not yet been uncovered. Both individual (e.g., genetic factors, temperament) and environmental (e.g., maltreatment, parenting) factors are thought to contribute to CU traits' emergence. From a developmental psychopathology approach, an impairment in conscience development seems to drive CU traits' development (Frick et al., 2014). Two constructs usually define conscience, guilt, and empathy (Thompson & Newton, 2010), and problems in guilt and empathy are considered CU traits' core features (e.g., Frick, 2009).

Two of the leading models explaining the origin of psychopathic traits, including CU traits, have been proposed by Blair (1995) and Dadds and colleagues (2006). The Violent Inhibition Mechanism (VIM) Model proposed by Blair (1995) is a model about moral development, highlighting the importance of empathy in socialization processes, and it describes the requisites for a normative moral development and the development of psychopathic traits. The VIM is a cognitive process for the control of conspecific aggression activated by non-verbal cues, mostly distress signals, such as fearful and sad expressions (Blair, 1995; Blair et al., 2001). Once aroused, the VIM leads to behavioral schemes that should stop the perpetrators from attacking. The VIM activation involves an increase in autonomic activity, attention, and activation of the brainstem threat response system, usually followed by a freezing response. The more intense the distress signals, the greater this set of responses should be (Blair, 1995). The VIM develops at a very early age, as shown by children as young as 4 years old who tend to retreat from an action in front of others' distress signals. Blair (1995) suggested that the VIM is a precursor of moral development since it fosters the development of moral emotions and, at the same time, inhibits aggressive and violent behavior. The arousal elicited by the VIM derived from the representation of others' distress and, the continuous pairing of distress signals, and VIM activation, with representations of the act that caused the distress signals, contributes to moral socialization (Blair, 2006). In normative development, children initially find others' pain and distress aversive, and then, through socialization and classical conditioning, the thoughts of acts that may cause pain become aversive themselves. When, due to biological factors and lack of optimal socialization experiences, the VIM is impaired, individuals are not able to adequately recognize and perceive others' distress, are more likely to show empathy impairments, and act aggressively (Blair & Frith, 2000; Herpers et al., 2014), which are typical manifestations of individuals with CU traits.

Other authors (see, for instance, Dadds et al., 2006) proposed that the impairment in recognizing emotions (i.e., fear and sadness) may be fundamental to, and an etiological driver of, the emotional deficits thought to be a core characteristic of CU traits. This emotion recognition deficit appears to be caused by a generalized impairment in the natural allocation of attention to emotionally salient stimuli (i.e., eye region). To understand someone's emotions and respond empathetically, paying attention to socially relevant cues is crucial. Face, especially eyes, plays a central role in providing information about others' mental and emotional states during social interactions (Emery, 2000), and attention to the eye region is considered necessary for recognizing facially expressed emotions (Bons et al., 2013). These attentional processes are of critical importance in the early years of life when responsiveness to discipline practices depends on the ability to recognize the caregivers' emotional states. In normative development, the first socialization experiences cultivate the bonding with the primary caregivers and make it possible for the child to learn from them (Bedford et al., 2015). The interactions with responsive primary caregivers during the first months of life also give the child the opportunity to tune it to their own and others' emotions (Fonagy et al., 2007), an essential requisite for moral development. Conversely, an early lack of attention to the eyes of the attachment figures may reduce the effects of positive and sensitive parenting and, throughout development, may result in cascading errors in the development of moral conscience and empathic concern (Dadds et al., 2011).

Even though the two described above are different models, they are not mutually exclusive and share some common aspects. Both models highlight the central role of emotional processing in moral development and point to an impairment in this mechanism as a potential cause of CU traits' emergence. Besides, both models state that amygdala dysfunction may be crucially involved in the development of psychopathic traits. The amygdala plays a relevant role in human response to affective and social stimuli; it is involved in emotional and face processing and the learning and memory of emotional events. During the first months of life, faces are processed by a subcortical route that includes the amygdala (Johnson et al., 1991). This route is sensitive to the configuration of the eyes within the face. It is thought to modulate the activation and influence the social brain network's development, which in adults is designated for the processing of emotionally and socially relevant cues. In humans, the amygdala plays a role in recognizing emotion from facial expressions, interpreting eye gaze, and other complex social decisions (Adolphs & Spezio, 2006). Studies have shown that the amygdala is mostly implicated in fear recognition (Adolphs, 2008), though Yang et al. (2002) suggested that the amygdala activation may be associated with the perception of several negative (e.g., fear, sadness) and positive (e.g., happiness) facial expressions. Besides, the amygdala appears to be relevant for processing other people’s gaze and makes it possible to use these signals as a source of information about the external environment and, more importantly, others’ internal states, such as emotions, intentions, or beliefs (Emery, 2000). Also, recent theories (Moul et al., 2012) have underlined the importance of the amygdala, and related cognitive processes in conscience development, such as children’s reflexive shifting of the gaze to emotionally salient stimuli, including the eye region, in response to cues of others fear or distress. It is possible that amygdala lesions or impairments may alter the ability to seek out and make use of the information provided by the eye region, resulting in deficits in emotion recognition. In turn, amygdala activity is itself modulated by emotional facial expression (e.g., fearful faces; Morris et al., 2002) and eye gaze (e.g., direct vs. averted gaze; Sauer et al., 2014). Finally, the amygdala is implicated in emotional learning and allows for the formation of stimulus–reinforcement associations, making a previously neutral stimulus to be valued as either good or bad, and in the expression of conditioned responses (Wilensky et al., 2006).

In the following paragraphs, the main evidence about emotional processing (i.e., emotion recognition, emotional responsiveness, and gaze pattern) impairments in children with CU traits will be presented.

1.3.1 Emotion Recognition in Children with DBDs and CU Traits

A wide amount of studies has revealed the presence of emotion recognition (ER) impairments in children and adolescents with DBDs (see, for instance, Fairchild et al., 2009; Sully et al., 2015), though more recently, much more interest has been aroused by the possible association between CU traits and children’s ability to recognize emotion correctly.

Broadly, studies have shown that high levels of CU traits are associated with ER deficits, especially sadness and fear (e.g., Ciucci et al., 2015; Dadds et al., 2008; Woodworth & Waschbusch, 2008), even in very young children (White et al., 2016). Besides, the ER impairment is not limited to facial expressions but seems to also interest body postures and vocal tones (Blair et al., 2005; Muñoz, 2009). More specifically, Blair et al. (2001) found that in a sample of 132 boys, CU traits were associated with a selective impairment in sadness and fear recognition. Participants were presented with a series of morphed images depicting happy, surprised, fearful, sad, disgusted, or angry faces. Children with high CU traits needed more stages to recognize sad expressions successfully, and even when the fearful expressions were at full intensity, they were significantly more likely to mislabel them. Similar results were found by Stevens et al. (2001). Other studies instead confirmed only a selective impairment in sadness recognition. For instance, in a previous study (Billeci et al., 2019), we found that in children with and without DBDs, high levels of CU traits were associated only with sadness recognition deficits, even after controlling for externalizing problems, group membership, intelligence quotient, age, and family income (see also Woodworth & Waschbusch, 2008).

Even if a wealth of studies suggested an association between CU traits and impairments in recognizing basic negative emotions (i.e., sadness and fear), not all the findings point in the same direction. Sharp et al. (2014) found a unique association between CU traits and complex emotions (e.g., interested, remembering, serious) but weaker associations with basic ER. Woodworth & Waschbusch (2008) found better fear recognition in children with higher CU traits; similar findings were provided by Martin-Key et al. (2018) but only for children with high levels of both CU traits and conduct problems. Finally, Dawel et al. (2012) indicated that the effect of CU traits on ER was not limited to fear or sadness and was evident to some extent for most types of emotions.

1.3.2 Emotional Responsiveness in Children with DBDs and CU Traits

Adult psychopathic traits have been widely associated with general blunted physiological reactivity and reduced response to others’ feelings. For instance, adults with high psychopathic traits have a reduced skin conductance response to sad and fearful facial expressions and emotionally evocative sounds, and low resting electrodermal activity (see, for instance, Lorber, 2004; Verona et al., 2004). Based on these pieces of evidence, studies have started examining whether children and adolescents with high CU traits show a differentiated response to emotional stimuli.

In a recent paper, Northam & Dadds (2020) provided an exhaustive review of the empirical literature about emotional responsiveness in children and adolescents with DBDs and CU traits. The authors operationalized the construct of emotional responsiveness as “a responsive change from baseline homeostasis, reflected in physiological, neurological, and behavioral systems” (Northam & Dadds, 2020, p. 2). Sixty-two percent of the studies included in the review found reduced emotional responsiveness in children and adolescents with CU traits (see, for instance, Anastassiou-Hadjicharalambous & Warden, 2008; De Wied et al., 2012; Fanti et al., 2015; Hwang et al., 2016; Masi et al., 2014; Yoder et al., 2016). For instance, Anastassiou-Hadjicharalambous & Warden (2008) found that children with high CU traits had lower baseline heart rate and magnitude of heart rate change from baseline during the vision of a short film. Hwang et al. (2016) found decreased activation of the ventromedial prefrontal cortex and amygdala for negative stimuli in children with high CU traits during an affective Stroop task. Several studies though found no differences between youths with high CU traits and low CU traits as regards emotional responsiveness (see, for instance, Ezpeleta et al., 2017; Lozier et al., 2014; Martin-Key et al., 2017; Schwenck et al., 2012) and one study even found the opposite effect, with high CU traits associated with greater emotional responsiveness (Dadds et al., 2016). In a very recent study, Oldenhof et al. (2020) investigated the physiological underpinnings of emotion processing in a large sample of 1446 children aged 9-18 years. Heart rate, respiratory sinus arrhythmia (parasympathetic activity), and pre-ejection period (sympathetic activity) were recorded while participants watched two validated film clips. They compared CD children with and without CU traits and typically developing children, and results showed no differences in emotional responsiveness. The inconsistency across studies might be partially explained by methodological differences, such as participants' age, type of stimuli, or emotional measurement methods (i.e., subjective experience, observed behavior, peripheral psychophysiological arousal, fMRI). Northam & Dadds (2020) concluded that physiological measures were more robust predictors of lower emotional responsiveness in youths with CU traits, especially peripheral physiological measures. Among the peripheral physiological measures of emotional responsiveness, skin conductance response (SCR) is considered a reliable measures of sympathetic arousal, as it is not influenced by parasympathetic activity and has been widely used as an index of the physiological reaction elicited by emotionally evocative stimuli (e.g., Lampinen et al., 2018; Taskiran et al., 2018; Tonacci et al., 2019).

Some studies have found that youths with psychopathic traits have reduced electrodermal responses to emotional stimuli. For instance, Blair (1999) found that children with high psychopathic traits showed, compared to controls, reduced electrodermal responses to distress signals and threatening stimuli, while there were no differences for neutral stimuli. Similar results were found by Fung et al. (2005) in a sample of psychopathy-prone adolescents. Despite the association between psychopathic traits and reduced electrodermal activity, only a few studies have so far investigated emotional responsiveness, via SCR, specifically in youths with CU traits and results are rather inconsistent. Besides, in these studies, SCR has been usually recorded during auditory tasks instead of during the vision of emotionally salient stimuli (e.g., facial expressions or video clips). To provide some examples, using a white noise countdown task, MacDougall et al. (2019) found in a sample of 56 adolescent male offenders a negative association between skin conductance activity and CU traits. Similarly, Muñoz et al. (2008) found in a sample of boys in a juvenile detention center that those with high levels of CU traits and severe proactive and reactive aggression showed lower SCR to low provocation. Conflicting results have also emerged. Isen et al. (2010) found in a community sample of 9-10 years old twins that hyporeactivity (reduced SCR magnitude) during a passive auditory task was associated with psychopathy scores in boys, but it was not a characteristic of CU traits (see also Wang et al., 2012).

1.3.3 Gaze pattern in Children with DBDs and CU Traits

Dadds et al. (2006), inspired by Adolphs et al. (2005), who showed that deficits in fear recognition associated with amygdala dysfunction were driven by lack of attention to other people's eyes and evidence suggesting a role for amygdala dysfunction in psychopathic traits, decided to test whether these attentional processes occur in the fear recognition deficits characteristic of children with CU traits. The study tested the relationships of fear recognition and eye gaze to CU traits in a community sample of male children and adolescents. Participants were presented with pictures depicting happiness, sadness, anger, disgust, or neutral expressions and asked to label them while freely watching the images and after being instructed to focus on the eyes and the mouth of the faces. CU traits were uniquely associated with poor recognition of fearful faces, except when children were asked to look at the eyes. These findings suggested that the fear recognition deficit could temporarily be overcome by asking the subject to look at the eyes of the target face.

The same authors also proposed that the failure to attend and respond to emotionally salient stimuli may commence early in life and is expressed as a failure to attend to attachment figures' emotional features and tested their hypothesis in a series of studies. In a first study, Dadds et al. (2011) observed a sample of 92 children (mean age = 8.9) referred for conduct problems in free play and "emotional talk" scenarios with their caregivers and measured eye contact for each dyad, namely child to mother, child to father, mother to child, and father to child. Findings showed that while eye contact levels were reciprocated in parent-child interactions, children with high CU traits showed consistent impairments in eye contact towards them. Interestingly, fathers of high CU boys showed comparable deficits. Later, Dadds et al. (2012) found that children with ODD appeared to show lower levels of affection towards their mothers, and those with high CU traits showed significantly lower levels of affection than children with lower CU traits and also showed lower levels of eye contact towards the caregiver. Similar results have been confirmed by a further study conducted on a larger sample of children (*N* = 99; age 4-8 years) with ODD (Dadds et al., 2014). Mother-child dyads were observed in a brief interaction task where mothers were asked to express love to their children, called the “I-Love-You” task. Results indicated that children with ODD and high CU showed lower eye contact levels towards their mothers and appeared to be actively rejecting their mothers’ eye contact.

After the pioneering study by Dadds et al. (2006), researchers have tried to investigate gaze pattern in children with CU traits using more reliable and objective methods than observation, such as eye-tracking systems. Dadds et al. (2008) investigated in a community sample of 100 male adolescents (mean age = 12.4) whether CU traits were associated with reduced attention to the eyes of other people’s faces. Results indicated that high CU traits were associated with poor fear recognition, lower number and duration of fixation to the eye region, and fewer first foci to the eye region. Moreover, in youths with high CU traits, better fear recognition was associated with more attention to the eye region. More recently, Martin-Key et al. (2018) found that adolescents with CD tend to fixate less on the eye region when viewing emotional faces than typically developing peers. More specifically, within the whole sample, higher levels of CU traits were associated with reduced attention to the eyes of surprised faces.

Finally, in a previous study (Billeci et al., 2019), we measured levels of CU traits and externalizing problems in a sample of DBD and typically developing children, and tested in the whole sample whether the level of CU traits, externalizing behavioral problems, age, intelligence quotient, income, and group membership were associated with ER deficits and impairment in eye gaze to key features of emotional faces. We also explored a mediation model linking CU traits to ER impairments through attention to the eye region. Participants were a clinical group of children with DBDs diagnosis (*N* = 35) and a group of typically developing children (*N* = 23) with no current or past diagnosis of psychiatric disorders. We found that elevated levels of CU traits in children with and without DBDs were associated with a lower number of fixations, and a lower average length of each fixation, specifically to the eyes of sad faces. To test eye gaze mechanisms linking CU traits, number, and length of fixation on the eyes of sad faces and sadness recognition, we performed two mediational models where CU traits predicted sadness recognition via gaze pattern measures. Only in children with DBDs, high levels of CU traits were associated with lower duration of fixations to the eye region of sad faces, which in turn predicted lower levels of sadness recognition, even after controlling for externalizing problems, intelligence quotient, age, and family income.

However, it seems crucial to highlight that only a few studies have investigated gaze pattern impairments in relation to CU traits using eye-tracking systems and that contradictory findings have emerged, with studies showing that CU traits are not related to reduced attention to the eye region (Bedford et al., 2020; Hartmann & Schwenck, 2020).

1.4 Parenting influences on CU traits and emotional processing

Parenting contributes in central ways to the course and outcome of child development and adjustment (Bornstein, 2015). The concept of parenting refers to a biological and social process, which involves the rearing and education of an individual from the day of their birth till adulthood. Firstly, this process is carried out by the primary caregivers (usually the parents) and, on the other hand, by the children themselves, who are active partners in this relationship. Parenting is not just a role or a genetically-driven mechanism, but it is a multidetermined process, a function expressed through several interrelated behaviors that influence the caregiver-child relationship's quality. Parenting is, therefore, a complex function that encompasses a constellation of psychological processes determined by different factors, which interacting build the way a parent behaves (Bornstein, 2015). Parenting practices accomplish various nurturing tasks, including those related to physical needs, such as nourishment, health, hygiene, physical security, living conditions, and those concerning psychological needs, such as the assimilation of knowledge, personal autonomy, and social skills, the acquisition of rules and moral norms, as well as emotional security and stability (see, for instance, Bornstein & Lansford, 2010) .

The relationship between the primary caregivers and their child is the main setting in which development unfolds, and the foundations for risk and resilience begin. A positive parent-child relationship, in which parents recognize and adequately interpret the child's signals, are emotionally available, and, at the same time, provide boundaries and rules (Biringen, 2000; Downing et al., 2008; Juffer et al., 2012) is crucial for children's development at different levels (i.e., physical, emotional, social and cognitive). In contrast, a negative relationship, unable to provide security and emotional support, may increase the child's risk of heading towards a negative trajectory and suffer from psychopathology (Feldman, 2012).

An extensive literature has informed research on child psychopathology on the family factors that influence child adjustment vs. maladjustment, and, in this regard, research on DBDs has been particularly flourishing. Studies have highlighted the role of coercive, harsh, and conflictual parenting practices in the emergence of severe behavioral problems (Odgers et al., 2008), as well as poor parental supervision and low positive parent-child engagement (e.g., Gardner et al., 2003). One of the leading theories stated that coercive family dynamics are a risk factor for DBDs and later antisocial behavior (e.g., Patterson, 1982; Patterson et al., 1992). Coercion theory describes a process of mutual reinforcement during which caregivers inadvertently reinforce children’s aversive control tactics, such as whining, shouting, or hitting, which evoke anger and hostility from the caregiver and make it more likely for the parent to use harsh and negative practices. This process continues escalating until the interaction is discontinued, and the child or the parent is declared the “winner.”

The coercive theory deserves credit for highlighting an important aspect of parent-child relationships: they are reciprocal systems in which both caregiver and child elicit and respond to changes in one another. If, on the one hand, parenting may contribute to some child outcomes (and protect against others), on the other one, it is important to take into account the influences of the child factors on the parent-child interaction. Studies have found that child-driven effects on parenting are as strong, or even stronger, than parent-to-child effects on psychopathology (Pardini, 2008) and Bradley & Corwyn (2013) showed that externalizing problems explain changes in harsh parenting and sensitivity beginning in early childhood.

Despite the vast literature about the association between parenting and DBDs, less is known about its connection with CU traits’ underpinning mechanisms. In the following paragraphs, the main evidence about parenting influences on CU traits and emotional processing will be reviewed.

1.4.1 Parenting and CU traits

CU traits are mainly genetically driven, and it is often believed that children and adolescents with CU traits are less perturbated by the quality of the parenting they experience. Due to some of their main features, such as being less sensitive to punishment and caregivers’ disapproval and distress cues, children with CU traits are thought to be less susceptible to parental socialization and discipline efforts (Oxford et al., 2003) and less influenced by negative parenting strategies (Hawes et al., 2011).

On the other hand, growing evidence suggests that parenting may influence CU features' progress, with negative parenting being associated with increased CU traits and positive parenting shielding children from the worst outcomes (for an exhaustive review, see Waller et al., 2013). Longitudinal studies showed that harsh parenting, physical punishment, and inconsistent discipline are associated with increases in CU traits, while parent-child relationships characterized by positive affects and warmth may lead to lower levels of CU traits. For instance, Frick, Cornell, Bodin, et al. (2003) showed that in a sample of non-referred youths, CU traits were positively associated with parent- and children-reported negative parenting practices. Also, Pardini et al. (2007) found in a sample of 120 moderate to highly aggressive children (mean age = 10.66 years) that a decrease in CU traits over time was predicted by lower levels of physical punishment and higher levels of child-reported parental warmth and involvement. More recently, Waller et al. (2018) tested whether parental harshness and warmth were related to children’s CU traits in an at-risk sample of 227 monozygotic twins. After controlling for genetically mediated effects, they found that twins who experience higher levels of harsh discipline had higher CU traits; conversely, twins receiving warmer parenting had lower CU traits. It is possible that even if children’s characteristics may play an important role in placing them at risk for negative outcomes (i.e., moral socialization impairment), the quality of later socialization, especially parent-child interactions, may also increase or decrease the likelihood the child overcomes this risk. Supportive relationships with the primary caregivers, based on cooperation and shared positive affects, foster the internalization of prosocial norms during childhood (e.g., Kochanska & Murray, 2000) and this may help children with CU traits to be more receptive to parental socialization, to endorse prosocial values and be more emotionally connected with others. On the contrary, harsher discipline does not provide the CU child with optimal socialization experiences, increasing the already existing risk for empathy and moral impairments, and aggression.

However, the relationship between parenting and CU traits needs to be interpreted from a bidirectional perspective. As already mentioned, children's characteristics may drive changes in parenting practices, and this may be particularly relevant for CU traits. Dadds & Salmon (2003) proposed that CU traits features, such as low arousal for aversive stimuli, high reward drive, negative ER deficit, and deficits in attention to social cues, make youths less sensitive to punishment and discipline efforts. This generalized insensitivity to punishment may operate to disrupt parental behavior and elicit escalating patterns of harsh and inconsistent discipline, enacted in the attempt to increase their effectiveness.

Consistently, studies have shown that CU traits lead to a decrease in positive parenting dimensions (i.e., warmth) while increasing negative ones (i.e., harsh and inconsistent discipline). Hawes et al. (2011) examined the relationship between CU traits and parenting over time in a community sample of children (3-10 years old). Findings showed that CU traits predicted changes in parenting practices. Specifically, they were associated with increased inconsistent discipline and, in older boys, also corporal punishment. CU traits were also associated with reduced levels of parental involvement. Similar results have been found in a sample of older children (13-15 years old) by Salihovic et al. (2012). Results from cross-lagged models showed that CU traits predicted changes systematically over four years in parental behaviors, increasing parents' use of negative behaviors (i.e., coldness/rejection, angry outbursts, negative reaction to disclosure) and decreasing their use of positive behaviors (i.e., attempted understanding, warmth).

1.4.2 Parenting and emotional processing

Even if genetic factors mostly drive brain development, it can also be influenced by the experiences and interactions with the environment. The brain is extremely plastic, and its structure and functioning reflect the history of the individual. Early stressors, either physical or emotional, may condition the brain network's development, eventually causing cascading development errors. The perturbation of early developmental stages may hinder the formation of new structures and functions or limit their elaboration and fruition (Cicchetti, 2002). As Viding & McCrory (2020) stated, the brain may adapt to an adverse environment, though these calibrations may mean that a child may be less well-equipped to function in more normative environments.

As already mentioned, the early relationship with parents is one of the most relevant experiences for children. It has the power to shape the child's neural networks' further development and organization, potentially influencing, for better or worse, important functions and mechanisms. Positive and caring parenting practices during the first years of life have beneficial effects on children's cognitive, behavioral, and psychological development that extend to the entire life span (Eshel et al., 2006; Landry et al., 2008). On the contrary, an aversive growth environment is associated with greater psychopathological risk (Heim & Nemeroff, 2001; Moran et al., 2004), and evidence suggests that this may be due to neurobiological changes (Tupler & De Bellis, 2006).

The majority of the evidence about the influences of the growth environments on emotional processing derived from studies conducted with samples of children who experienced extreme forms of negative parenting, such as physical maltreatment, abuse, and neglect. Maltreated children differ from typically developing children in several aspects of emotional processing: emotional expression (Gaensbauer & Mrazek, 1981), ER (Pollak et al., 2000), emotion regulation (Kim-Spoon et al., 2013), and understanding of emotions (Shipman & Zeman, 1999). Specifically, Pollak et al. (2000) investigated ER ability in children who experience physical abuse and neglect. Compared to the control group, children who experienced aberrant parenting showed more difficulties in recognizing emotions and discriminating emotional facial expressions (i.e., confusing sad faces with happy ones). Findings suggest that being exposed to types of aberrant parenting can compromise the acquisition of simple emotional processing components (i.e., happiness recognition).

Studies focused on less extreme forms of parenting practices highlighted that a family environment characterized by harsh and inconsistent discipline and parental conflict is associated with emotion processing deficits in the offspring, including difficulties in recognizing and labeling their own and others' emotions, as well as in managing emotions in demanding situations (Dunn & Brown, 1994; Repetti et al., 2002). Taylor et al. (2006) found that children living in risky families showed atypical responses to emotional stimuli that are evident at the neural level. They exhibited reduced activation while watching fearful and angry facial expressions, and results showed a positive correlation between the ventrolateral prefrontal cortex and amygdala activation during a labeling task. The latter finding points to a possible dysregulation in the neural networks involved in responses to emotional stimuli. The authors reckoned that this reduced activation might represent an avoidant coping strategy against threatening stimuli.

A possible explanatory mechanism that could link children's emotional processing deficits and aberrant parenting practices concerns the selective allocation and control of attention. Studies have indeed found the presence of attentional biases in maltreated children: for instance, they appear to need more attentional resources to detect angry facial expressions (Pollak et al., 1997) rather than fearful ones (Pollak et al., 2001). Moreover, Pollak & Tolley-Schell (2003) found that physically abused children had more difficulties disengaging from specific facial expressions, namely angry faces, probably because they represent a relevant danger and threat cue.

Overall, the mentioned studies indicate that being exposed to adverse growth environments and negative parenting practices may alter the allocation of attention and sensitivity that children develop to process specific emotional information. Therefore, it is also essential to consider the potential influences of environmental factors (i.e., parenting) on the emotional processing impairments found in children with CU traits.

PART 2: THE CURRENT STUDY

The presence of CU traits designates a clinically relevant subgroup of children and adolescents with DBDs. It has been proposed that an impairment in emotional processing may underpin the development of CU traits. Investigating the association between CU traits and emotional processing in a clinical sample is essential for developing new intervention models for DBD children. If a specific association between CU traits and emotional processing deficits is confirmed in clinical samples, further development of interventions that focus on improving children's ability to process emotions might reduce children's CU traits. Based on these assumptions, the present study aimed to investigate emotional processing in a clinical sample of children with DBDs diagnosis. More specifically, it sought to explore CU traits' influences on children’s ER ability, emotional responsiveness, assessed via SCR, and gaze pattern toward emotionally salient stimuli, recorded with the aid of an eye-tracking system. We first explored differences between children with high vs. low CU traits as regard ER, emotional responsiveness, and gaze pattern. We further investigate the association between the emotion processing variables and CU traits, assessed continuously, using partial correlations and linear regression models. We then used logistic regressions to test the significant predictors' ability to classify children with low vs. high CU traits. Finally, given the importance of parenting practices for both CU traits and emotional processing (i.e., reduced attention to the eye region), we also explored moderation models in which parenting (positive vs. negative) moderated the link between gaze pattern impairments and CU traits.

Based on previous studies, we hypothesized that CU traits would be associated with poorer ER, with specific regard for negative emotions (i.e., fear and sadness), reduced emotional responsiveness for negative emotions, and reduced attention to the eye region of faces depicting negative emotions (i.e., fear and sadness). We also hypothesized that negative parenting practices would mediate the association between gaze pattern impairments and CU traits, with reduced attention to the eye region of negative facial expressions and higher levels of negative parenting being associated with higher CU traits. No formal hypothesis has been stated for positive parenting due to the lack of scientific evidence.

2.1 Method

2.1.1 Participants and procedure

Participants were a clinical group of 116 boys with DBDs diagnosis undergoing assessment at a specialized service for children with DBDs in the Department of Developmental Neuroscience at the Stella Maris Scientific Institute in Pisa, Italy. They were referred to this clinical service from September 2018 to October 2019. They were aged 7–13 years (M = 9.04, SD = 1.30). All families were Italian speaking, and all children were Caucasian. All the subjects received identical diagnostic and cognitive procedures and completed the same ER task individually over four weeks following the baseline evaluation. The inclusion criteria were: Intelligence Quotient (IQ) ≥ 80 (Wechsler Intelligence Scales for Children – 4th Edition; Wechsler et al., 2012); a primary diagnosis of ODD/CD according to the K-SADS-PL (Kaufman et al., 1997); no ongoing medication treatment. All parents and participants provided written permission/assent before the initiation of the study. The study conformed to the Declaration of Helsinki, and the Ethical Committee of our hospital and the Regional Ethical Committee (Meyer Hospital, Florence) approved the study.

Table 1 shows the descriptive statistics for the whole sample and the comparisons between children with high and low CU traits. There were no significant differences between the Low CU and High CU groups as regard age, IQ, and socioeconomic status (SES); as expected, the High CU group had higher levels of Externalizing Problems (t = -5.00, p < .001, d = -1.02). We performed a post-hoc power analysis using the G *Power 3.1.9 (Faul et al., 2007) to estimate the power of our sample size. For an effect size settled at .35, similar to that found by Dadds et al. (2008), and a level of significance for a p-value fixed at < .05, our sample size has a power > .90 to test our hypotheses. This study's sample was completely independent of those examined in previous studies with children enrolled from Stella Maris Scientific Institute.

Table 1. Descriptive statistics for the whole sample with comparisons between low vs. high CU traits.

	Total (*N* = 116)	Low CU (*N* = 82)	High CU (*N* =34)			
	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	*t*	*p*	*d*
Age	9.04 (1.30)	8.96 (1.32)	9.24 (1.25)	-1.019	.310	-.208
IQ	100.20 (7.52)	100.48 (7.58)	99.53 (7.44)	.614	.540	.125
SES	2.81 (.63)	2.87 (.66)	2.68 (.53)	1.478	.142	.302
Externalizing Problems	**64.17 (6.59)**	**62.38 (6.09)**	**68.50 (5.77)**	**-5.00**	**<.001**	**-1.020**
CU traits	**5.96 (2.44)**	**4.68 (1.51)**	**9.06 (1.09)**	**-17.363**	**<.001**	**-3.110**

Note. IQ: Intelligence Quotient; SES: Socioeconomic status.

2.1.2 Measures

Children's diagnosis. The Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime Version (Kaufman et al., 1997) was used to assess the children for DSM-IV disorders. Clinicians conducting the K-SADS interviews underwent training and satisfied reliability criteria (*k* Cohen ≥ .80). Both parents and children participating in the study completed the K-SADS interview independently. The rate of child-parent K-SADS diagnosis agreement was .87 (*k* Cohen).

Intellectual functioning. We assessed children's cognitive abilities with the Wechsler Intelligence Scales for Children – 4th Edition (Wechsler et al., 2012).

Externalizing problems. The Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2004) is a 118 item standardized behavioral checklist completed by parents to record behavioral problems and skills in children aged 6-18 years. We asked mothers to complete the Italian version of the CBCL (Frigerio et al., 2004). For the purposes of the present study, we used the CBCL Externalizing score. Several studies have found convergence between the CBCL statistically derived syndromes and DSM-IV disorders (Edelbrock & Costello, 1988; Kazdin & Heidish, 1984), and CBCL syndromes display good diagnostic efficiency for assessing common externalizing disorders in children (Hudziak et al., 2004).

Levels of CU traits. We assessed CU traits using the Italian version of the Antisocial Process Screening Device (APSD; Frick & Hare, 2001) combined version (comprising both parent and teacher ratings), a widely used method in the research about CU traits (e.g., Kroneman et al., 2011; Pardini et al., 2007; Waschbusch et al., 2007). We combined parent and teacher scores into one score, taking the highest score for each item from parents and teachers after completing the APSD. The APSD comprises seven items to evaluate narcissism, six items to evaluate CU traits, and five items to evaluate impulsivity. Each item was rated following a 3-point Likert scale: Not At All True (0), Sometimes True (1), or Definitely True (2). The APSD is a reliable and valid measure of youths' psychopathic traits (Frick & Hare, 2001). To divide participants into low vs. high CU groups, we used a raw score of 8 as a cut-off. As reported in the APSD manual (Frick & Hare, 2001), a raw combined score ≥ 8 corresponds to a T score ≥ 65, considered moderately/highly atypical. In the current sample, the CU subscale's Cronbach α coefficients were .84 for the parent version and .82 for the teacher version of the APSD.

Parenting. We used the Alabama Parenting Questionnaire (APQ; Shelton et al., 1996) to assess parenting style. The APQ includes 35 items measuring five parenting domains: parental involvement and positive parenting, poor monitoring/supervision, inconsistent discipline, and corporal punishment. For the present study, we used the Italian version of the APQ (Esposito et al., 2016), which consists of two scales based on a two-factor solution: 1) positive parenting (PP), comprising the parental involvement and positive parenting subscales; 2) negative parenting (NP), comprising the poor monitoring/supervision, inconsistent discipline subscales. Items are scored on a Likert- scale ranging from 1 (never) to 5 (always). Higher scores indicate adequate parenting practices for the positive scale and inadequate parenting practices for the negative scale. The Italian validation study of the APQ showed satisfactory internal consistency reliabilities of the positive and negative scales (all Cronbach's α coefficients > 0.74). In the subsample used to test the moderation models, the Cronbach α coefficient was .81.

Emotional Stimuli. The stimuli presented to the participants were images from the NimStim Set of Facial Expressions (Tottenham et al., 2009), which consisted of naturally posed pictures of professional adult actors, specifically instructed to make different facial expressions. We selected the same set of emotions used in other studies (see, for instance, Dadds et al., 2008): happy, sad, angry, fearful, disgusted, and neutral facial expressions. The authors of this set of images tested the percentage of emotion recognition for each expression (Tottenham et al., 2009), and we selected four Caucasian actors (two males and two females) whose expressions' accuracy ratings were above 60%. The pictures were presented on a black background. Children were presented with 24 images (4 actors, each displaying six facial expressions). Each stimulus has been presented individually for 4 s. The order of stimuli was randomized across actors and emotions. The stimuli were interspersed with grey fixation crosses on a black background lasting 20 s. Participants were presented with six emotion labels (anger, sadness, happiness, fear, disgust, and neutral) and asked to select the emotion that best described the displayed expression. We scored correct answers as 1, and incorrect ones as 0.

Gaze pattern. We recorded gaze pattern using the SMI RED 500 binocular eye tracker provided by SensoMotoric Instruments (Teltow, Germany), with a sample rate of 120 Hz, in a quiet hospital room expressly set up for the experiment. The eye-tracker stood in front of the subject, below a 22-inch flat-screen monitor where the stimuli described above were presented using the SMI Experiment Center Software. The distance between the screen and the subject was approximately 65 cm. Before starting the experimental task, we run a five-point calibration procedure, in which the child had to follow with their gaze a little toy that moved around on the screen. We repeated the calibration task until the deviation from the known calibration target for both the *x* and *y* components was below 1°. Children were then administered the set of emotional stimuli. In order to center the eyes before the presentation of the pictures, each trial was preceded by a colorful attention-getter (i.e., cartoon picture) displayed at the center of the screen until the child looked at it for at least 500 ms. Once attention was secured, the pre-recorded stimuli replaced the attention-getter. We excluded trials with excessive blinking (more than 50% of the trial duration) from the analysis. Using SMI BeGaze Software (SensoMotoric Instruments), we selected four areas of interest (AOIs): face, eyes, nose, and mouth. The outcome measures produced were the number of fixations (FC), the average length of each fixation (FD), and the length of first fixation (FFD). We applied a fixation threshold of 100 ms to the raw data to avoid unconscious looking. The outcome measures for each AOI were calculated separately for each image and collapsed across emotions. We calculated the FD and FC on each AOI as a percentage of the overall FD (or FC) on the whole face to adjust for individual differences due to blinking or momentary distraction from the screen (Kirk et al., 2013; Perlman et al., 2009). The FD (or FC) on the face was computed as a percentage of the overall time spent looking at the screen (Kirk et al., 2013).

Emotional responsiveness. We assessed the physiological component of emotional responsiveness by electrodermal activity signal (sympathetic activity), which has been obtained with the aid of the minimally obtrusive wireless sensor Shimmer3 GSR+ Unit by Shimmer Sensing, Inc. (Dublin, Ireland). The Shimmer GSR+ monitored skin conductivity between two reusable electrodes attached to two fingers of the child's non-dominant hand.

The acquisition-sampling rate, according to the specifications of the manufacturer, was 51.2 Hz. We recorded the electrodermal activity while children were comfortably sat on a chair and were presented with the emotionally salient stimuli described above. The electrodermal activity signal analysis was performed using the MATLAB (v. R2018a, The Math- Works, Inc., Natick, MA, USA)-based Ledalab software v.3.4.9 (Benedek & Kaernbach, 2010). We determine the changes in SCR by subtracting the activity in the 1 s before the stimuli started to be shown from that occurring during the photograph's presentation. More specifically, the SCR was scored as the largest increase in conductance between 1 and 6 s after the beginning of the stimulus presentation compared to the mean activity in a 1s pre-stimulus baseline. The procedure applied for analyzing the SCR is similar to previous studies (see, for instance, Wieser et al., 2009).

2.2.3 Statistical Analysis

All the statistical tests were run on IBM SPSS Statistics 23 unless otherwise stated. The first step of the statistical analysis plan involved missing data handling. The percentage of missing values across all the variables varied between 0% and 9.5%. In total, 14 out of 116 records (12.07%) and 4.88% of the values were incomplete. Little's MCAR test suggested that data were likely missing completely at random ($\chi^2(116) = 114.522$, $p = .521$). Missing data were imputed using multiple imputations. Methodologists currently regard multiple imputations as a state-of-the-art technique because it improves accuracy and statistical power relative to other missing data techniques. Incomplete variables were imputed under fully conditional specification, using the default setting "Impute Missing Data Values (Multiple Imputation)" available on SPSS 23. As regards the APQ scores, it was not available for 24 children (20.68%). Due to the high percentage of missing data, we decided not to include the APQ in the imputation procedure and run the moderation analyses with data from a subsample of 92 children.

To investigate differences between children with low CU traits (APSD CU combined score < 8) vs. high CU traits (APSD CU combined score ≥ 8), we run a series of independent samples *t*-tests using a dichotomous measure of CU traits as the grouping variable. Differences were tested for the following variables: ER Total, ER Positive Emotions, ER Negative Emotions, ER for each emotion individually, SCR Positive Emotions, SCR Negative Emotions, SCR for each emotion individually, gaze pattern variables (FC, FFD, and FFD) Total, Positive Emotions, and Negative Emotions, for each AOI (face, eyes, mouth, nose) and gaze pattern variables for each AOI and each emotion individually. Variables labeled "Total" refer to values related to all emotions; Variables labeled "Positive Emotions" refer to values related to happy + neutral faces; Variables labeled "Negative Emotions" refer to values related to angry + fearful + sad + disgusted faces. It is necessary to underline that we chose the term "Positive Emotions" to juxtapose it to "Negative Emotions." Since it is based on values related to happy and neutral stimuli, the label cannot be strictly considered about positive emotions.

To further investigate the association between continuously assessed CU traits and the variables described above, we run a series of partial correlations and linear regression models. In the partial correlations, we used the CBCL Externalizing Problems score as the control variable. In the regression models, we used a continuous measure of CU traits as the dependent variable and ER, SCR, and gaze pattern variables separately as independent variables while controlling for age, IQ, family SES, and externalizing problems. False discovery rate (FDR; Benjamini & Hochberg, 1995) correction of the *p*-values was applied across all correlations and regression models using the *p.adjust* function on R Statistics.

Then, we ran a binary logistic regression model to test whether the predictors identified during the previous analyses correctly discriminated children with low CU traits from those with high CU traits. Logistic regression is a classification algorithm that is widely used when the target variable's value is categorical. We used a dichotomous CU traits variable (low vs. high CU traits) as the dependent variable and the predictors who reached significance in the linear regression models as covariates.

Finally, to test the parenting practices' moderation role, we tested a series of moderation models. The moderation models were run on SPSS using the PROCESS macro developed by Prof. A. F. Hayes (Hayes, 2017; Hayes & Rockwood, 2017), an observed variable OLS and logistic regression path analysis modeling tool. We specifically tested moderation models linking reduced attention to the eyes of emotional stimuli and CU traits via PP and NP separately. Age, IQ, SES, and Externalizing Problems score were used as covariates across all models. In the models testing the moderation role of PP, we also control for the NP score. In the models testing the moderation role of NP, we also control for the PP score. To further explore significant moderation models, we tested the conditional effects of the focal predictor at different values of the moderator (-1*SD*, mean, +1*SD*). All variables that defined products were mean-centered prior to analysis. False discovery rate (FDR; Benjamini & Hochberg, 1995) correction of the *p*-values was applied across all models with the *p.adjust* function on R Statistics.

2.2 Results

All the details about the statistical models tested are available in Appendix A, and a summary of the significant findings from the independent samples *t*-test, correlations, and linear regression models is provided in Table 2.

2.2.1 Emotion Recognition

Results from the independent samples *t*-tests indicated that children with high CU traits were less accurate in recognizing emotions (t (114) = 3.78, $p < .001$, $d = .772$), especially negative emotions (t (114) = 4.33, $p < .001$, $d = .883$). As regard the single emotions, children with high CU traits were less accurate in recognizing anger (t (114) = 1.98, *p* < .05, *d* = .409) and sadness (*t* (114) = 6.42, *p* < .001, *d* = 1.311). Results also showed that CU traits were negatively associated with ER Negative Emotions (*r* = -.231, *p* < .05) and sadness recognition (*r* = -.348, *p* < .01). Moreover, results from the linear regression models confirmed the association between CU traits and poorer negative emotion (*β* = -.218, *p* < .05) and sadness (*β* = -.309, *p* < .001) recognition.

2.2.2 Emotional Responsiveness

In contrast with our hypotheses, results from the independent samples *t*-tests did not show differences between children with high vs. low CU traits regarding SCR. No significant association between CU traits and SCR emerged from correlations and linear regression models.

2.2.3 Gaze Pattern

Global Emotion Processing. The independent samples *t*-tests indicated that children with high CU traits showed lower FFD to the eyes (*t* (114) = 2.506, *p* < .05, *d* = .511) and FFD to the mouth (*t* (114) = 3.007, *p* < .05, *d* = .613) of emotional stimuli. Results showed a negative association between CU traits and FFD to the eyes (*r* = -.184, *p* < .05) of emotional stimuli. No significant results emerged from the linear regression models.

Positive Emotion Processing. The independent samples *t*-tests indicated that children with high CU traits showed lower FC to the mouth (*t* (114) = 1.989, < .05, *d* = .406), and FFD to the mouth (*t* (114) = 2.793, *p* < .01, *d* = .570) of positive emotions. No significant results emerged from the correlations and the linear regression models.

Negative Emotion Processing. The independent samples *t*-tests indicated that children with high CU traits showed lower FFD to the eyes (*t* (114) = 2.888, *p* < .01, *d* = .589), and lower FFD to the mouth (*t* (114) = 2.843, *p* < .01, *d* = .580) of negative emotions. Results showed a negative association between CU traits and FFD to the eyes (*r* = -.11, *p* < .05) of negative emotions. Moreover, the linear regression models showed an association between CU traits and lower FC to the eyes (β = -.267, p < .05) of negative emotions.

Anger Processing. The independent samples *t*-tests indicated that children with high CU traits showed lower FC to angry faces (t (114) = 2.903, p < .05, d = .592) and lower FFD to the mouth (t (114) = 3.255, p < .001, d = .664) of angry faces. Results also showed a negative association between CU traits and FC to angry faces (r = -.190, p < .05). No significant results emerged from the linear regression models.

Fear Processing. No significant results emerged from the independent samples *t*-test, the correlations, nor the linear regression models.

Sadness Processing. The independent samples *t*-tests indicated that children with high CU traits showed lower FC to the eyes (t (114) = 2.166, p < .05, d = .442), lower FFD to the eyes (t (114) = 3.363, p < .001, d = .742), lower FFD to the mouth (t (114) = 2.444, p < .05, d = .499) and lower FD to the eyes (t (114) = 2.307, p < .05, d = .471) of sad faces. Results showed a negative association between CU traits and FC to the eyes (r = -.253, p < .05), FFD to the eyes (r = -.234, p < .05), and FD to the eyes (r = -.229, p < .05) of sad faces. Moreover, results from the linear regression models confirmed the association between CU traits and lower FC to the eyes (β = -.188, p < .001) and FFD to the eyes (β = -.219, p < .05) of sad faces.

Disgust Processing. The independent samples *t*-tests indicated that children with high CU traits showed lower FFD to the eyes (t (114) = 2.282, p < .05, d = .508) of disgusted faces. Results showed a negative association between CU traits and FFD to the eyes (r = -.202, p < .05) and FFD to the nose (r = -.193, p < .05) of disgusted faces. No significant results emerged from the linear regression models.

Happiness Processing. The independent samples *t*-tests indicated that children with high CU traits showed lower FC to the mouth (*t* (114) = 1.989, *p* < .05, *d* = .406), lower FFD to the mouth (*t* (114) = 3.303, *p* < .001, *d* = .674), lower FD to the mouth (*t* (114) = 2.117, *p* < .05, *d* = .432) of happy faces. Results showed a negative association between CU traits and FFD to the mouth (*r* = -.218, *p* < .05) of happy faces. No significant results emerged from the linear regression models.

Neutral Faces Processing. No significant results emerged from the independent samples *t*-test, the correlations, nor the linear regression models.

Table 2. Summary of the significant findings from (A) independent samples t-tests, (B) partial correlations, (C) linear regression models.

(A) Independent samples *t*-tests					
	Low CU	High CU			
	Mean (*SD*)	Mean (*SD*)	*t*	*p*	*d*
ER Total	15.70 (2.813)	13.32 (3.673)	3.786	< .001	.772
ER Negative Emotions	10.27 (2.398)	8.03 (2.834)	4.330	< .001	.883
ER Anger	2.96 (.808)	2.62 (.954)	1.988	< .05	.405
ER Sadness	2.61(1.039)	1.29 (.906)	6.425	< .001	1.311
FFD_E Total	154.14 (46.56)	128.22 (53.83)	2.506	< .05	.511
FFD_M Total	116.84 (44.03)	90.20 (41.92)	3.007	< .01	.613
FFD_E Negative Emotions	156.51 (46.33)	128.23 (51.84)	2.888	< .01	.589
FFD_M Negative Emotions	117.59 (45.97)	91.24 (44.10)	2.843	< .01	.580
FC_M Positive Emotions	30.72 (18.81)	23.12 (18.53)	1.989	< .05	.406
FFD_M Positive Emotions	115.34 (48.32)	88.12 (46.43)	2.793	< .01	.570
FC_F Anger	97.89 (4.99)	92.90 (13.56)	2.903	< .05	.592
FFD_M Anger	116.47 (61.63)	75.70 (60.85)	3.255	< .001	.664
FC_E Sadness	52.02 (21.66)	41.95 (25.36)	2.166	< .05	.442
FFD_E Sadness	170.45 (62.73)	123.89 (62.89)	3.363	< .001	.742
FFD_M Sadness	115.32 (61.83)	85.57 (53.96)	2.444	< .05	.499
FD_E Sadness	54.09 (22.75)	43.01 (25.37)	2.307	< .05	.471
FFD_E Disgust	153.41 (62.92)	119.10 (77.76)	2.282	< .05	.508
FC_M Happiness	30.72 (18.81)	23.12 (18.53)	1.989	< .05	.406
FFD_M Happiness	123.39 (56.82)	86.91 (46.96)	3.303	< .001	.674
FD_M Happiness	30.16 (17.99)	22.35 (18.30)	2.117	< .05	.432

Table 2 (continued).

(B) Partial Correlations					
	r	Corrected *p*		*r*	Corrected *p*
ER Negative Emotions	-.231	< .05	FFD_E Sadness	-.234	< .05
ER Sadness	-.348	< .01	FD_E Sadness	-.229	< .05
FFD_E Total	-.184	< .05	FFD_E Disgust	-.202	< .05
FFD_E Negative Emotions	-.211	< .05	FFD_N Disgust	-.193	< .05
FC_F Anger	-.190	< .05	FFD_M Happiness	-.218	< .05
FC_E Sadness	-.235	< .05			
(C) **Linear Regression Models**					
	β	Corrected *p*		β	Corrected *p*
ER Negative Emotions	-.218	≤ .05	FC_E Sadness	-.188	≤ .05
ER Sadness	-.309	< .001	FFD_E Sadness	-.219	≤ .05
FC_E Negative Emotions	-.267	≤ .05			

Note. ER: Emotion Recognition; FC_F: Fixation Count Face; FC_E: Fixation Count Eyes; FC_M: Fixation Count Mouth; FC_N: Fixation Count Nose; FFD_F: First Fixation Duration Face; FFD_E: First Fixation Duration Eyes; FFD_M: First Fixation Duration Mouth; FFD_N: First Fixation Duration Nose; FD_F: Fixation Duration Face; FD_E: Fixation Duration Eyes; FD_M: Fixation Duration Mouth; FD_N: Fixation Duration Nose.

2.2.4 Logistic Regression Model

The predictors included in the logistic regression model as covariates were: ER Negative Emotions, ER Sadness, FC_E Negative Emotions, FC_E Sadness, and FFD_E Sadness. The model had a Nagelkerke $R^2 = .48$; the Hosmer–Lemeshow test, an inferential goodness-of-fit test, yielded a $\chi 2$ (8) of 8.123 and was insignificant ($p > .05$), suggesting that the model was fit to the data well. The intercept-only model (or null model) had an overall correction percentage equal to 70.70%, with 100% of children with low CU traits and 0% of children with high CU traits correctly classified. As shown in Table 3, 90.20% of children with low CU traits and 58.80% of children with high CU traits were correctly identified, suggesting that the tested model had greater sensitivity than specificity. Sensitivity measures the proportion of correctly classified events (i.e., children with low CU traits), while specificity is the proportion of correctly classified nonevents (i.e., children with high CU traits). The false-positive rate, namely the proportion of observations misclassified as events over all of those classified as events, was 15.38%. The false-negative, which is the proportion of observations misclassified as nonevents over all those classified as nonevents, was 28.57%.

Table 3. Percentage of subjects correctly classified by the model.

		Predicted		
		CU traits		
Observed		Low CU	High CU	% Correct
CU traits	Low CU	74	8	90.20
	High CU	14	20	58.80
Overall % Correct				81.00

Overall, the model correctly classified 94 children out of 116 (81%), representing an improvement over the chance levels of about 11%. The contributions of the single predictors are shown in Table 4. Results showed that ER Sadness, FC_E Negative Emotions, and FFD_ E Sadness were the most influencing variables.

Table 4. Contributions of the single predictors.

						95% C.I.for EXP(β)	
	β	*S.E.*	Wald	*p*	Exp(β)	Lower	Upper
ER Negative Emotions	-.148	.116	1.635	.201	.862	.687	1.082
ER Sadness	-1.127	.328	11.784	**.001**	.324	.170	.617
FC_E Negative Emotions	.060	.026	5.260	**.022**	1.062	1.009	1.118
FC_E Sadness	-.031	.021	2.198	.138	.969	.930	1.010
FFD_E Sadness	-.012	.005	6.127	**.013**	.988	.978	.997

Note. ER: Emotion Recognition; FC_E: Fixation Count Eyes; FFD_E: First Fixation Duration Eyes.

Since externalizing problems are some of the strongest predictors of CU traits, as also confirmed by our analyses, we decided to run a second logistic regression model, with the CBCL Externalizing Problems score added to the predictors. The second model had a Nagelkerke R^2 = .567, and the Hosmer and Lemeshow test a $\chi 2$ (8) of 14.687 and was insignificant (p > .05), suggesting that the second model was also fit to the data well. As expected, the CBCL Externalizing Problems score significantly contributed to the model (β =

.144, *S.E.* = .051, *Wald* = 9.198, *p* = .002), along with ER Sadness (β = -1.209, *S.E.* = .358, *Wald* = 11.414, *p* = .001), FC_E Negative Emotions (β = .68, *S.E.* = .029, *Wald* = 5.667, *p* = .017), and FFD_E Sadness (β = -.014, *S.E.* = .006, *Wald* = 5.728, *p* = .017).

Table 5. Percentage of subjects correctly classified by the model with Externalizing Problems.

		Predicted		
		CU traits		
Observed		Low CU	High CU	% Correct
CU traits	Low CU	73	9	89.00
	High CU	12	22	64.70
Overall % Correct				81.90

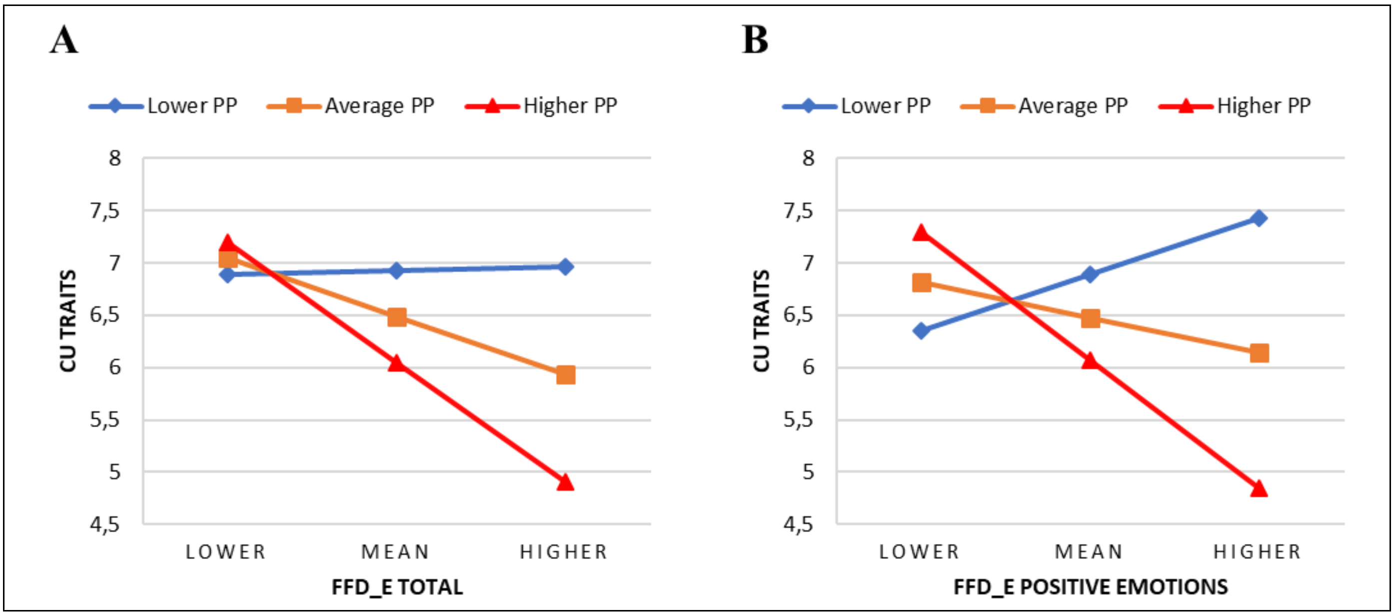
As shown in Table 5, adding the new predictor increased the overall correction prediction slightly, and more importantly, it increases the specificity of the model by about 6%. The false-positive rate decreased (14.11%) without a major change in the false-negative rate (29.00%).

2.2.5 Parenting Moderation

In order to test the moderation role of parenting practices, we run a series of moderation models. The analyses have been conducted on a sample of 92 children, drawn from the whole samples described in paragraph 2.1.1. This subsample included those participants for whom the APQ was available. CU traits were not significantly associated with neither PP nor NP. Children with low CU traits did not significantly differ from those with high CU traits as regard parenting practices.

Positive Parenting. Results showed that PP moderated the link between FFD to the eyes of emotional stimuli and CU traits (b = -.002, p < .05). Further analysis revealed that FFD_E Total score was significantly associated with CU traits in children with average (b = -.013, p < .05) and higher (b = -.025, p < .001) PP levels.

Figure 1. Positive Parenting moderating the link between (A) FFD_E Total, and (B) FFD_E Positive Emotions.



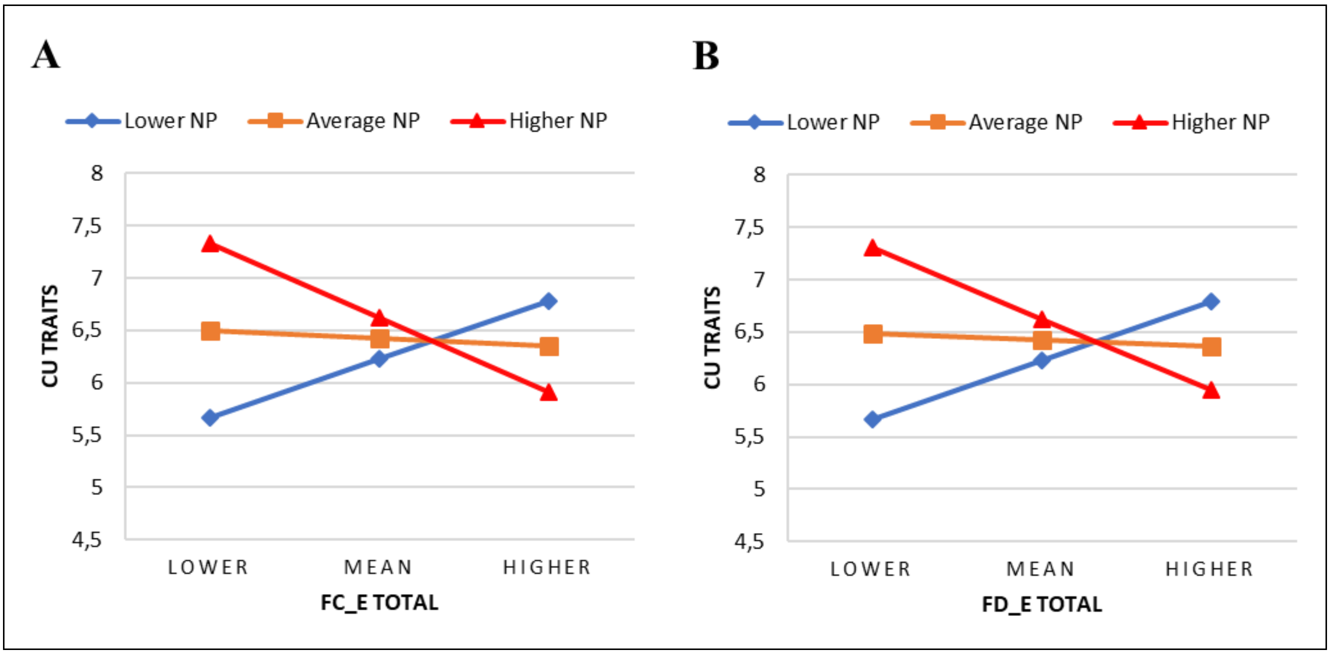
Note. PP: Positive Parenting; FFD_E: First Fixation Duration Eyes.

As shown in Figure 1A, in children with average and higher PP, higher CU traits are associated with lower FFD_E Total. PP also moderated the link between FFD to the eyes of positive emotions and CU traits (b = -.002, p < .05). Further analysis revealed that FFD_E Positive Emotions was significantly associated with CU traits in children with higher PP (b = -.022, p < .001). In children with higher PP, higher CU traits were associated with lower FFD_E Positive Emotions. (Fig. 1B).

Negative Parenting. Results showed that NP moderated the link between FC to the eyes of emotional stimuli and CU traits (b = -.008, p < .05). Further analysis revealed that FC_E Total was associated with CU traits in children with higher NP levels (b = -.041, p <

.05). As shown in Figure 2A, in children with average and higher PP, higher CU traits were associated with lower FC_E Total. NP also moderated the link between FD to the eyes of emotional stimuli and CU traits (*b* = -.008, *p* < .05). Further analysis revealed that FD_E Total was associated with CU traits in children with higher NP levels (*b* = -.037, *p* < .05). As shown in Figure 2B, in children with average and higher NP, higher CU traits were associated with lower FD_E Total.

Figure 2. Negative Parenting moderating the link between (A) FC_E Total, and (B) FD_E Total and CU traits.

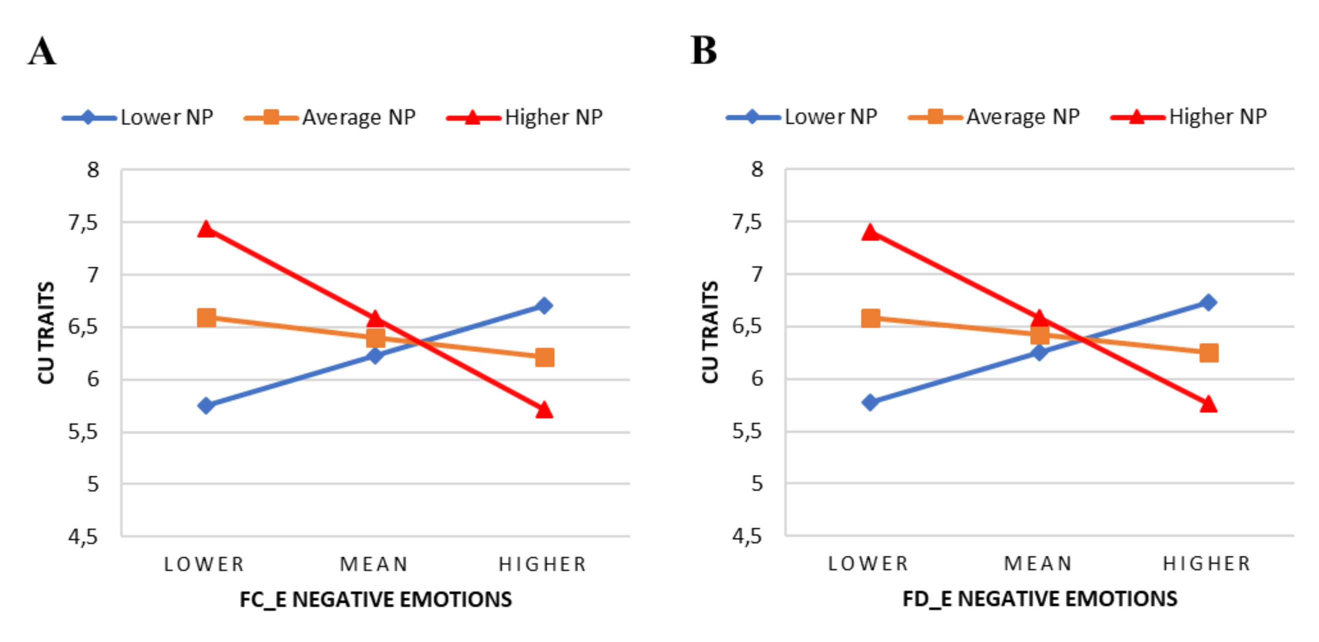


Note. NP: Negative Parenting; FC_E: Fixation Count Eyes; FD_E: Fixation Duration Eyes.

Results showed that NP moderated the link between FC to the eyes of negative emotions and CU traits (*b* = -.008, *p* < .05). Further analysis revealed that FC_E Negative Emotions was associated with CU traits in children with higher NP levels (*b* = -.049, *p* < .010). In children with higher NP, higher CU traits were associated with lower FC_E Negative Emotions (Fig. 3A). Also, NP moderated the link between FD to the eyes of negative emotions and CU traits (*b* = -.008, *p* < .05). Further analysis revealed that FD_E Negative Emotions was associated with CU traits in children with higher NP levels (*b* = -.045,

p < .05). As shown in Figure 3B, in children with average and higher NP, higher CU traits were associated with lower FD_E Negative Emotions.

Figure 3. Negative Parenting moderating the link between (A) FC_E Negative Emotions, and (B) FD_E Negative Emotions and CU traits.



Note. NP: Negative Parenting; FC_E: Fixation Count Eyes; FD_E: Fixation Duration Eyes.

PART 3: DISCUSSION

DBDs are common and severe childhood disorders, which may lead to long-lasting negative outcomes. The term DBDs designates a highly heterogeneous group of youths, and this variability is a cause of concern for clinicians and researchers because it undermines our ability to identify and treat those children at higher risk properly. In the attempt to disentangle DBDs heterogeneity, research has increasingly focused on CU traits, a constellation of behavioral and interpersonal features (i.e., lack of empathy and guilt, shallow affect, lack of interest for others' feelings) that characterized a clinically relevant and etiologically distinct subgroup of youths with severe DBDs.

Emotional processing impairments are thought to be a core feature of children with DBDs and CU traits. Broadening our knowledge about the deficits that underpin CU traits may inform us about new intervention targets that will improve already existing intervention models for DBDs and foster the development of new treatments designed explicitly for addressing CU traits. With this in mind, the current study sought to explore CU traits' influence on emotional processing in a clinical sample of boys with DBDs. Precisely, we investigated children's ER ability, emotional responsiveness, assessed via SCR, and gaze pattern toward emotionally salient stimuli, recorded with an eye-tracking system. We first explored differences between children with high vs. low CU traits and the associations between continuously assessed CU traits and ER, emotional responsiveness, and gaze pattern. Finally, given the importance of parenting practices for CU traits and emotional processing, we also explored moderation models to test whether parenting (positive vs. negative) moderated the link between attention to the eye region and CU traits.

3.1 CU traits and ER impairments

The present study showed that compared to children with low CU traits, those with high levels of CU traits had more difficulties in recognizing facially expressed emotions. In line with our hypotheses and scientific literature (see, for instance, Blair et al., 2001; Dadds et al., 2006, 2008), it held particularly true for negative emotions. Regarding single emotions, children with high CU traits were moderately less able to correctly recognize angry facial expressions, while a more considerable difference emerged for sadness recognition. Furthermore, findings from partial correlations and linear regression models confirmed the association between CU traits and reduced ability to recognize negative emotions in general and sadness.

Our findings were partially consistent with most previous studies, which have shown that high levels of CU traits are associated with ER deficits, especially for negative emotions (e.g., Ciucci et al., 2015; Dadds et al., 2008). Several studies have indeed found that children and adolescents with CU traits showed a selective impairment in sadness recognition (see, for instance, Blair et al., 2001; Billeci et al., 2019; Woodworth & Waschbusch, 2008). However, our results contrast with the wealth of studies suggesting an association between CU traits and poorer fear recognition. In our sample, children with low and high CU traits did not differ in fear recognition, and no association emerged from correlations or regression models. Since most previous studies used community samples, we can reckon that the difference between our results and previous ones on fear processing may be due to samples' composition. Differences in methodological procedures and stimuli selection may also account for the discrepancies across studies. Finally, our study also suggested, as proposed by Dawel et al. (2012), that children with high CU might show to some extent impairments across all emotion types: in our sample, when compared to children with low CU traits, children with high CU traits had a significantly lower total ER score, and also a lower anger recognition score. To the author's knowledge, the latter findings has never been found in previous studies.

Correct recognition of emotional facial expressions is considered an initial step of empathic responding. Marshall et al. (1995) proposed a model of empathy according to which

ER is the first step of an ongoing process that leads to an empathic response. If one cannot decode and read other people's emotional signals, they will not be able to proceed to the following steps, namely perspective taking, emotion replication, and response decision. Similarly, Blair (1995) proposed that individuals are equipped with a cognitive mechanism, the VIM, activated by distress signals (e.g., fearful or sad faces), which is implicated in aggressive behavior control and moral development (for more details, see par. 1.3). If an individual cannot recognize others' distress cues, the whole process will not unfold, and they will likely not retreat from the action that is causing others to suffer. Moreover, if the ER deficit begins early in life, this impairment may hinder the child's moral development. Consistently, studies found an association between ER and empathy measures (Gery et al., 2007; Martin et al., 1996). Therefore, we can hypothesize that ER deficits may contribute to some of the characteristics of children with CU traits, such as aggressive behavior, lack of empathy and remorse, and a reduced interest in others' feelings and well-being.

3.2 Emotional responsiveness and CU traits

In contrast with our hypotheses, we did not find evidence of reduced emotional responsiveness, assessed via SCR, in children with CU traits. Children with low CU traits showed SCR similar to those with higher CU traits, and correlations and regression models did not show any significant association between SCR and CU traits.

Our findings are in contrast with a series of studies that found, with different methods (i.e., behavioral, subjective experience, physiological measures), reduced emotional responsiveness in children and adolescent with high CU traits (see, for instance, Fanti et al., 2015; Hwang et al., 2016; Yoder et al., 2016). However, as highlighted in paragraph 1.3.2, results are often inconsistent and sometimes even contradictory. For instance, Martin-Key et al. (2017) found no differences between children with low and high CU traits in self-reports of emotional experience in response to watching an actor talk about emotional memories.

Similarly, Schwenck et al. (2012) found that children with high CU traits reported being as emotionally affected by video scenes in which a character experienced different events as low CU children.

Methodological differences, especially sample composition, may somewhat explain the variability across studies. Northam & Dadds (2020) critical review highlighted that adolescents show reduced emotional responsiveness in high vs. low CU traits more frequently than younger children. Thus, it is possible that reduced emotional responsiveness may characterize adolescents with CU traits but not younger children. Several studies have consistently found signs of heightened autonomic functioning in toddlers who later show CU traits or psychopathic traits (for an exhaustive review, see Glenn, 2019). Mills-Koonce et al. (2015) found that at 15 months of age, children who later develop conduct problems and CU traits showed greater high-intensity fear behavior in response to a scary mask task, higher cortisol levels before the task, and overall cortisol levels. Similarly, Willoughby et al. (2011) found evidence of greater autonomic functioning in children who showed ODD symptoms and CU behaviors at 36 months of age. Finally, in a 25 years long longitudinal study, Glenn et al. (2007) found that increased autonomic arousal and skin conductance at age 3 were associated with higher psychopathic traits at 28. The findings described above suggest that young children who develop CU traits may exhibit a hyper-reactivity of the stress response system that later turns into low responsiveness, typically observed in adolescents and adults with psychopathic traits.

A possible explanation for the differences between younger children and older ones regarding emotional responsiveness may be drawn from the Adaptive Calibration Model (ACM; Del Giudice et al., 2011). It is an evolutionary-developmental theory of individual differences in stress responses, which assumes that individuals are built to function in a specific context optimally. In this perspective, psychopathic traits, including CU traits, are seen as an evolutionary and adaptive strategy. As it stands, CU traits would be a consequence of early life chronic stress. Challenging environments cause the frequent activation of stress responses, and this eventually, maybe due to epigenetic changes, leads to a shift from normal (during childhood) to lower responsivity of the sympathetic nervous system (during middle childhood or adolescence). This blunted stress responsivity would lead to risk-taking behavior and immediate reward-seeking, increasing the risk of aggression, violence, and psychopathy.

3.3 CU traits' influence on gaze pattern towards emotional stimuli

Research has proposed that a generalized impairment in the natural allocation of attention to emotional stimuli may drive emotional processing deficits exhibited by children with high CU traits. Children with CU traits would not spontaneously direct their attention to essential cues provided by the eye region of others' faces, preventing them from recognizing and interpreting people's emotional states. This inability to use these kinds of information during the early years of life may have severe negative consequences for the child, ultimately increasing CU traits' risk.

In this regard, several studies have found that CU traits are associated with reduced attention to the eyes of emotional faces (e.g., Billeci et al., 2019; Martin-Key et al., 2018; Dadds et al., 2008), and our results are consistent with this. Indeed, in our sample, children with high CU traits showed lower FFD to the eyes of all the emotional stimuli (FFD_E Total) and FFD to the eyes of negative emotions. Partial correlations and linear regression models confirmed this association between CU traits and reduced attention to other people's eyes. In terms of single emotions, we found that children with CU traits showed lower FFD to the eyes of disgusted faces. They also showed lower FFD, FC, and FD to the eyes of sad faces. The latter evidence replicated those of our previous study (Billeci et al., 2018), which highlighted that CU traits in children with and without DBDs were associated with a lower number of fixations, and a lower average length of each fixation, specifically to the eyes of sad faces.

However, in contrast with other studies (e.g., Dadds et al., 2008; Dadds et al., 2006), we did not find an association between CU traits and fear processing impairments. Children with low and high CU traits showed comparable gaze patterns and continuously measured CU traits were not associated with reduced attention to the eyes of fearful expressions.

Interestingly, our results revealed that the eyes were not the only AOI to which CU traits children paid reduced attention. Compared to children with low CU traits, those with high CU traits also significantly showed reduced attention to the mouths of emotional expressions. Specifically, they showed lower FFD to the mouths of both negative and positive emotions. Regarding single emotions, children with CU traits showed lower FFD to the mouth of angry, sad faces and lower FFD, fixation count, and duration to the mouths of happy expressions. This is the first study to identify reduced attention to the mouth region in children with DBDs and CU traits to the best of the author's knowledge.

Overall, our findings confirmed an impairment in attention allocation to emotional signals in children with CU traits and DBDs and suggested that it may not be limited to the eye region. Most studies have focused on the importance of attention to the eyes since they are thought to be necessary for ER (e.g., Bons et al., 2013). However, the mouth's configuration (e.g., lip corners depressed for sadness; smile for happiness) can also provide relevant information about one’s emotional state, and looking at the mouth region contributes too to adequate ER (e.g., Ithaya Rani & Muneeswaran, 2016; Wegrzyn et al., 2017). Moreover, the relative importance of the eye and mouth regions may depend on the emotion depicted, with eyes being more relevant for fear and sadness processing and mouths for disgusted and happiness processing (Wegrzyn et al., 2017).

Most of our significant findings regard the FFD to eyes or mouths of emotional stimuli, namely the amount of time children spend looking at a specific AOI the first time they lay eyes on it. Based on this evidence, we can reckon that children with CU traits may process more superficially specific social cues, rapidly disengaging from significant features of others' faces. However, facial emotional expressions are fleeting phenomena that last a limited amount of time. Not paying enough attention to relevant cues (i.e., eyes and mouths) when first met or rapidly shifting the gaze from an AOI to another may make it challenging to recognize emotions and capture valuable information. It may be that, due to biological factors, CU children's attention is less easily captured by social and emotional cues, which may prevent them from dwelling enough on meaningful face regions. Amygdala is involved in guiding endogenous attention towards emotional and social stimuli (Adolphs, 2008; Pessoa, 2010), and amygdala impairments have been linked to CU traits (e.g., Cardinale et al., 2019).

Finally, this is the first study to find gaze impairments towards positive emotional stimuli in children with DBDs and CU traits. Our findings showed that children with high CU traits did not only pay less attention to emotional cues with negative valence, but their emotional processing deficits seem to extend to positive emotions too. Even though largely speculative, we can assume that the reduced attention to the smiling mouths of happy faces might be related, or contribute, to the atypical affiliation seen in adult psychopaths (Viding & McCrory, 2019). One of the strongest expressions of emotion is laughter and it plays an important role in establishing and maintain social relationships (Gervais & Wilson, 2005). It is highly contagious and facilitates the coupling of emotions and behavior in groups, cooperation, bonding, and affection (Scott et al., 2014). However, extant research has shown that adult psychopaths may be less prone to resonate with and join others' laughter, and this deficit might be found even in youths. O'Nions et al. (2017) investigated how children aged 11-16 years at risk of developing psychopathic traits process genuine laughter. They found that boys with DBDs and high CU traits showed atypical neural responses to laughter. The authors proposed that atypical laughter processing could represent a novel mechanism that denatures social relationships and increases psychopathy and antisocial behavior risk.

Overall, our findings confirmed the association between CU traits and impairments in different emotional processing components and also suggested that they may be more extended than previously supposed. It is possible that these deficits may contribute to the impairment in other essential aspects of social and emotional processing, such as mentalization. We hypothesize that the superficial processing of the salient features of facial expressions (i.e., eyes and mouths) depicting both negative and positive emotions may alter children's ability to make proper evaluations of thoughts, feelings, and intentions in real-time. A recent study by Roberts et al. (2020) consistently showed that children with conduct problems and high CU traits struggled mentalizing during a complex, ecologically valid task assessing their ability and propensity to incorporate judgments about others' mind type into inferences about their mental states. Thus, even if CU children can represent mental states, especially when complex information is not involved and/or there is an instrumental advantage, they seem less prone to update mental state inferences as a function of different minds.

3.4 CU traits and emotional processing deficits: the role of parenting practices

The bond children establish with their primary caregivers significantly contribute to their development and adjustment (Bornstein, 2015). Growing up in a positive and caring environment has long-lasting beneficial effects on the child's physical, cognitive, social, and emotional development. On the contrary, a negative and challenging family context is associated with greater psychopathology risk. Studies have shown that children with CU traits are frequently exposed to harsher and more inconsistent parenting practices and physical punishments (Waller et al., 2013) and that while negative parenting can lead to an increase in CU traits, positive parenting can curb their emergence (Pardini et al., 2007; Waller et al., 2018). Besides, findings suggested that being exposed to negative parenting can compromise the acquisition of emotional processing components, such as ER (Pollak et al., 2000), and understanding of emotions (Shipman & Zeman, 1999), and that it may be associated with impairment in the selective allocation and control of attention (e.g., Pollak et al., 2001). Based on this evidence, we decided to test whether parenting moderated the association between attention to other people's eyes and children's CU traits. To the best of the author's knowledge, this is the first study to test the moderation role of parenting practices on the link between gaze pattern and CU traits in a clinical sample of DBD children.

Our findings showed that positive parenting moderated the association between CU traits and FFD to the eyes of all the emotional stimuli, and the images depicting positive emotions. Precisely, in children exposed to positive parenting practices, lower first fixation duration to the eyes was associated with higher CU traits. As shown in Figure 1, compared to the other groups, children in the higher PP group with lower FFD to the eyes are among those with the highest levels of CU traits; while children in the higher PP group and higher FFD to the eyes appeared to have the lowest levels of CU traits. These results, at first, may seem partly contradicting. Studies have shown that positive parenting practices are associated with lower CU traits; thus, it would be expected to find lower CU traits in the higher PP group regardless of how children process emotional stimuli. On the one hand, we can hypothesize that the children showing poor attention to the eyes, even if exposed to higher PP, may be part of a group whose causal pathway to high CU is more biological and less associated with adverse environments (e.g., Dadds et al., 2018). Also, due to their characteristics (i.e., reduced attention to eyes), some of these children may not benefit from the positive relationship with their parents and therefore are at greater risk for adverse outcomes.

The child-parent bonding is an interactive process whose quality is equally influenced by the child and the caregiver. Children explore their environment and learn from it, coupling their physical sensations with other cues, including visual ones, that the parent mirrors back to them to help the child make proper predictions. The harmonious unfolding of these interactions is named biobehavioral synchrony and is thought to play an essential role in the establishment of attachment and affiliative bonds, primarily with the parents (Feldman, 2017; Fonagy et al., 2007). This process sets the foundation for the child’s development, including sharing, attending to, and understanding others’ minds and affective states. However, children may vary in their ability to detect and process environmental stimuli. As highlighted by the current study, children with high CU traits fail to attend to social cues, including positive ones. Positive affective signals help individuals connect to each other, maintain social interactions, and perceive relationships as rewarding (e.g., Gervais & Wilson, 2005). Even though speculative, we can argue that the impairments in emotional processing shown by children with CU traits may misalign the interaction that creates the biobehavioral synchrony and disrupt the parent-child relationship and its beneficial effects, as also suggested by previous studies that found that children with CU traits are less responsive to parents displays of affection (Dadds et al., 2012, 2014).

As regards negative parenting, the results were consistent with our hypotheses. Negative parenting practices appeared to moderate the link between CU traits and the number and length of fixations to the eyes in general and faces depicting negative emotions. Specifically, in the group characterized by the highest NP levels, higher CU traits were associated with lower attention to the eye region of others’ faces. As shown in Figures 2 and 3, children with lower FC and FD levels to the eyes and exposed to higher negative parenting levels had the highest CU traits. Instead, children exposed to equally high negative parenting levels but had higher FC and FD to the eyes exhibited lower CU traits.

There is burgeoning literature showing that being exposed to harsh and inconsistent discipline strategies is a risk factor for severe adverse outcomes, including CU traits (Fontaine et al., 2010; Pardini et al., 2007). Children learn about others' feelings by observing how those around them express them verbally and physically. Caregivers are the most important source of information during the first years of a child’s life and the first window to the complex world of emotions. Parents who use harsh and inconsistent disciplines may be less prone to spend time communicating with their children or may communicate their feeling poorly or uneasily. As suggested by Daversa (2010), this may leave children with little ability to recognize or understand the perspectives or emotional demonstrations of others and increase the risk for psychopathic-like behaviors.

Detecting and understanding the relevant cues provided by facial expressions is essential for interpreting other people’s emotional states and is necessary for the normative development of conscience, empathy, and social skills (Skuse, 2003). Consistently, impairments in eye gaze are associated with some of the core characteristics of CU children, such as ER (Billeci et al., 2019; Dadds et al., 2008) and low empathy (Blair, 2008). Children who live in a family characterized by harsh discipline but adequately process emotional cues may draw the constructive emotional experiences they need from others than their caregivers. Relationships with significant others, such as other relatives, siblings, teachers, or peers, may help them explore the emotional sphere and in some measure obviate the parents’ failures, hypothetically reducing the risk for CU traits. This would not be possible for those children showing eye gaze impairments. Since social and emotional stimuli do not easily capture them, relationships with other individuals will probably not be sufficient to curb CU traits' development.

In conclusion, we can propose that the combination of high NP and reduced attention to emotional cues (i.e., eyes) may designate a relevant group of youths at greater risk for severe outcomes (i.e., CU traits). On the contrary, in children with higher FC and FD to the eye region, their ability to focus on emotional cues may act as a protective factor, partially shielding them from the worst consequences of harsh and inconsistent parenting.

3.5 Limitations

The results of the present study need to be interpreted in light of some limitations. First, our sample included only referred children with DBDs, and we did not enroll a control sample of typically developing children. Besides, the sample was composed only of male children. Thus, generalizability to the general population and female subjects cannot be assumed. It could be fascinating to include females in the sample to explore emotional processing impairments in girls with DBDs and CU traits, a currently under-investigated issue. Since studies showed that females usually show higher empathy skills (see, for instance, Albiero et al., 2009; Dadds et al., 2009), we might expect to find more preserved emotion processing skills even in the presence of high CU traits. Moreover, even though consistent with epidemiological studies (Herpers et al., 2012), low CU children represent most of our sample (about 70%). Future studies may benefit from including a larger number of children with high CU traits.

We relied only on a single informant (i.e., parent) to assess children's externalizing problems, while multiple-informant assessment would have provided a more comprehensive view. We also assessed parenting practices with self-report measures administered to parents, which can be influenced by social desirability and dissimulation. Further studies would benefit from the use of complementary parenting measures, including observational and child-reported ones.

Moreover, we did not differentiate between primary vs. secondary variants of CU traits. Studies showed that CU traits in children might be associated with different correlates (i.e., low vs. high anxiety, emotional stability vs. emotional instability, presence of trauma history), and emotional processing deficits (e.g., Dadds et al., 2018). Future studies should consider the role of different moderators to disentangle even further the heterogeneity among youth with DBDs and CU traits.

Then we used static facial expressions, which may not be particularly realistic. Future studies should use more ecological stimuli, such as videos or embodied conversational agents, which are more similar to the real-life interactions children experience every day. Finally, since our design is cross-sectional, we cannot infer that elevated CU traits are causally related to ER and gaze pattern deficits in children with DBDs.

3.6 Clinical implications

High CU traits designate a clinically relevant subgroup of youths with severe DBDs, at greater risk for antisocial outcomes and psychosocial maladjustment. A deeper understanding of CU traits' underpinnings and the definition of a clear and objective profile of these youths would improve our capability to identify those who are more likely to head towards the most unfavorable pathways and provide them with more tailored treatment options.

Even though preliminarily, our results suggest that emotional processing impairments (e.g., poor negative ER, reduced attention to eyes of sad faces) can help to discriminate children with low vs. high CU traits. Using logistic regressions, we found that deficits in ER and gaze pattern were able to classify 81.00% of the children in our sample correctly, and 58.80% of them were correctly inserted in the High CU group. However, we feel it is necessary to point out that it is important to consider the emotional processing variables in conjunction with clinical ones (i.e., externalizing problems) to best classify DBDs children. Indeed, the addition of the CBCL Externalizing Problems scores to the logistic regression model increased the model specificity by about 6%.

Eye-tracking systems allow for an objective and precise assessment of eye movements and gaze patterns. They also are versatile and can be applied in brief sessions, making them feasible for young subjects from clinical populations. Overall, eye-tracking systems have the potential to help clinicians discriminate between DBDs subjects with high vs. low CU traits and identify subgroups of patients. However, further studies are needed. Moreover, doing a step forward, it is possible to assume that eye-tracking technology would increasingly benefit from more sophisticated techniques, such as artificial intelligence and machine learning. These solutions would guarantee an even more accurate and objective detection of what subjects are looking at and how they look, revealing patterns not easily retrievable with more traditional software techniques. The technological upgrading would further facilitate research on automatic recognition and interpretation of human social cues, improving our understanding of CU traits' clinical characteristics and ability to detect children at greater risk (Hoppe et al., 2018).

The present study's findings may also have significant implications for the treatment of children with DBDs and CU traits. Given the severe negative outcomes associated with high CU traits, finding effective and more tailored interventions is a priority for researchers and clinicians. As already mentioned, children with DBDs and CU traits usually show a diminished response to traditional interventions for DBDs, such as parent training interventions and behavioral interventions delivered to the child (Wilkinson et al., 2016; Hawes & Dadds, 2005). Bansal et al. (2019) found that CU traits moderated treatment effects for children with DBDs. Participants with high CU traits showed an improvement after an intensive intervention, though they had worse treatment outcomes and a lower likelihood of normalization after the intervention. These results suggest that intensive treatment may be necessary but not sufficient for children with DBDs and CU traits.

Some interventions have demonstrated success in reducing the behavior problems in children and adolescents with CU traits (see, for instance, Kolko & Pardini, 2010; White et al., 2013). However, only a few studies have endeavored to target a reduction in CU traits themselves directly. In this regard, targeting factors proven to boost conscience development in typically developing may enhance the treatment of children with severe DBDs and CU traits. A noteworthy example is a controlled treatment study by Dadds et al. (2012). The authors tested the efficacy of an Emotion-recognition-training (ERT) vs. treatment-as-usual (parent training intervention) with a large sample of mixed diagnostic children (mean age 10.52 years) referred for behavioral and emotional problems. Findings revealed that levels of CU traits moderated the outcomes such that children with high CU traits had a weaker response to the treatment-as-usual, while the ERT produced significant improvements in affective empathy and conduct problems in these children. It is important to underline that the change observed due to the parent training intervention and ERT in this sample was small, and even where the authors found significant changes, children with CU remained largely in the clinical range. Regardless of that, emotion recognition training may have potential as an adjunctive intervention specifically for children with DBDs and high CU traits. Another notable example has been recently attempted by Dadds et al. (2019), who tested the efficacy of emotional engagement strategies in the context of a parent training program. Findings showed that emotional engagement produced improvements in parent-child emotional engagement (shared eye gaze); though, these reverted to baseline levels after treatment. The putative mechanism of emotional engagement through reciprocated eye gaze proved to be resistant to sustained change and failed to have a specific impact on conduct problems or levels of CU traits.

Overall, studies suggested the emotional deficits shown by children with high CU traits can be addressed, though methods for producing long-lasting effects are still needed. More intensive and structured intervention may help to reach lasting results. In this regard, computer-based training (e.g., attention modification training) may guarantee a wider degree of control during the intervention and help to specifically target and shape the attentional processes impaired in children with CU traits.

Attention plays an early and substantial role in shaping behavior, and more broadly, cognitive and emotional development from infancy (Morales et al., 2016). For this reason, the influence of affect-biased attention on psychopathology is being increasingly studied. Affect-biased attention is defined as "attentional biases that cause the preferential perception of particular category of stimulus [at the expense of other potentially relevant stimuli] based on its relative affective salience" (Todd et al., 2012).

Studies suggested that when affect-biased attention is stable and entrenched, it can sustain early socioemotional and behavioral profiles over time. Most of the evidence is found in the anxiety literature and suggests that a threat-related attentional bias might contribute to anxiety disorders. This line of research led to the development of a new theory-driven intervention model for anxiety, namely attention bias modification training (ABM) (Bar-Haim, 2010), currently widely used also with children and adolescents (for a review, see Lowther & Newman, 2014). ABM training for anxiety disorders usually uses modified versions of the dot-probe task. It aims to take subjects' attention away from threat stimuli by creating attentional competition between a threat and a non-threat stimulus and repeatedly directing participants' attention toward the non-threat stimulus.

Implementing a procedure similar to ABM training, Wieckowski & White (2019) developed and tested the preliminary efficacy of an attention modification intervention designed to attenuate facial ER deficits in a small sample (*N* = 8) of children with Autism Spectrum Disorder. During the 10-session treatment, children watched dynamic videos of people expressing different emotions with the facial features highlighted to guide children's attention toward emotionally relevant cues. Children and their parents generally rated the treatment as acceptable and helpful, and parents reported an improvement in children's socioemotional problems following treatment.

Wieckowski and White's study suggests that ABM-like procedures may represent a novel intervention to implement ER and emotional processing in children with different psychiatric disorders. We can hypothesize that ABM may represent an innovative and promising tool to attenuate emotional processing impairments exhibited by children with DBDs and CU traits, directing their attention to emotionally salient cues (i.e., eye region of other people). This, in turn, should help them improve their ER ability and promote the development of empathic skills.

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APPENDIX A

1) Independent samples *t*-tests.

Emotion recognition (ER) scores differences in children with low vs. high CU traits.

	Low CU	High CU			
	Mean (*SD*)	Mean (*SD*)	*t*	*p*	*d*
ER Anger	**2.96 (.808)**	**2.62 (.954)**	**1.988**	**.049**	**0.405**
ER Fear	2.13(1.387)	1.97 (1.425)	.557	579	0.114
ER Sadness	**2.61(1.039)**	**1.29 (.906)**	**6.425**	**< .001**	**1.311**
ER Disgust	2.57 (1.241)	2.15 (1.351)	1.612	.110	0.329
ER Happiness	3.64 (.636)	3.38 (.954)	1.428	.160	.342
ER Neutral	1.80 (1.330)	1.91 (1.505)	-.388	.699	-.079
ER Positive Emotions	5.43 (1.423)	5.29 (1.749)	.466	.642	.094
ER Negative Emotions	**10.27 (2.398)**	**8.03 (2.834)**	**4.330**	**< .001**	**.883**
ER Total	**15.70 (2.813)**	**13.32 (3.673)**	**3.786**	**< .001**	**.772**

Skin Conductance Response (SCR) differences in children with low vs. high CU traits.

	Low CU	High CU			
	Mean (*SD*)	Mean (*SD*)	*t*	*p*	*d*
SCR Anger	.000543 (.0244)	.001470 (.0182)	-.199	.843	-.041
SCR Fear	.004959 (.0243)	.008615 (.0192)	-.779	.437	-.159
SCR Sadness	.002179 (.0159)	-.005122 (.0240)	1.919	.057	.0391
SCR Disgust	-.004229 (.0240)	-.001060 (.0130)	-.715	.476	-.146
SCR Happiness	.004286 (.0144)	.003886 (.0179)	.126	.900	.026
SCR Neutral	.003185 (.0151)	-.000367 (.0244)	.950	.344	.0194
SCR Positive Emotions	.003736 (.0111)	.001759 (.0152)	.777	.439	.159
SCR Negative Emotions	.000863 (.0082)	.000975 (.0092)	.934	.949	-.013

Global Emotion Processing Differences in children with low vs high CU traits.

	Low CU	High CU			
	Mean (*SD*)	Mean (*SD*)	*t*	*p*	*d*
FC_F Total	96.09 (5.22)	95.57 (5.56)	.474	.636	.097
FC_E Total	48.14 (17.10)	47.48 (20.82)	.177	.860	.036
FC_M Total	25.26 (12.72)	23.51 (13.17)	.665	.507	.136
FC_N Total	14.24 (8.07)	15.68 (10.85)	-.697	.489	-.160
FFD_F Total	170.68 (39.08)	167.55 (38.49)	.395	.694	.080
FFD_E Total	**154.14 (46.56)**	**128.22 (53.83)**	**2.506**	**.014**	**.511**
FFD_M Total	**116.84 (44.03)**	**90.20 (41.92)**	**3.007**	**.003**	**.613**
FFD_N Total	83.20 (41.36)	70.56 (43.21)	1.479	.161	.302
FD_F Total	95.29 (10.14)	95.43 (6.17)	-.075	.940	-.015
FD_E Total	49.169 (18.16)	48.06 (20.88)	.285	.776	.058
FD_M Total	25.63 (13.19)	23.20 (13.36)	.900	.370	.184
FD_N Total	14.13 (8.08)	15.79 (11.11)	-.789	.434	-.183

Note. FC_F: Fixation Count Face; FC_E: Fixation Count Eyes; FC_M: Fixation Count Mouth; FC_N: Fixation Count Nose.

Negative Emotions Processing Differences in children with low vs high CU traits.

	Low CU	High CU			
	Mean (*SD*)	Mean (*SD*)	*t*	*p*	*d*
FC_F Negative Emotions	96.37 (5.58)	94.82 (6.95)	1.262	.210	.257
FC_E Negative Emotions	48.40 (17.30)	45.76 (20.81)	.703	.483	.143
FC_M Negative Emotions	25.23 (13.24)	23.69 (12.53)	.579	.564	.118
FC_N Negative Emotions	13.81 (7.94)	15.79 (11.21)	-.934	.355	-.219
FFD_F Negative Emotions	170.22 (40.55)	167.09 (38.15)	.384	.702	.078
FFD_E Negative Emotions	**156.51 (46.33)**	**128.23 (51.84)**	**2.888**	**.005**	**.589**
FFD_M Negative Emotions	**117.59 (45.97)**	**91.24 (44.10)**	**2.843**	**.005**	**.580**
FFD_N Negative Emotions	82.70 (41.97)	70.62 (42.07)	1.409	.161	.287
FD_F Negative Emotions	95.52 (10.09)	94.76 (7.58)	.397	.692	.081
FD_E Negative Emotions	49.52 (18.45)	48.06 (20.69)	.753	.453	.154
FD_M Negative Emotions	25.87 (13.72)	23.20 (13.36)	.909	.370	.185
FD_N Negative Emotions	13.70 (8.04)	15.98 (11.29)	-1.067	.292	-.250

Note. FFD_F: First Fixation Duration Face; FFD_E: First Fixation Duration Eyes; FFD_M: First Fixation Duration Mouth; FFD_N: First Fixation Duration Nose.

Positive Emotions Processing Differences in children with low vs high CU traits.

	Low CU	High CU			
	Mean (*SD*)	Mean (*SD*)	*t*	*p*	*d*
FC_F Positive Emotions	95.52 (5.72)	97.07 (4.45)	-1.407	.162	-.287
FC_E Positive Emotions	43.15 (21.78)	51.89 (24.32)	-1.900	.060	-.388
FC_M Positive Emotions	**30.72 (18.81)**	**23.12 (18.53)**	**1.989**	**.049**	**.406**
FC_N Positive Emotions	16.09 (12.70)	16.59 (15.81)	-.192	.848	-.039
FFD_F Positive Emotions	171.61 (42.86)	168.46 (45.17)	.355	.723	.072
FFD_E Positive Emotions	149.43 (53.66)	131.18 (65.33)	1.562	.121	.319
FFD_M Positive Emotions	**115.34 (48.32)**	**88.12 (46.43)**	**2.793**	**.006**	**.570**
FFD_N Positive Emotions	84.22 (48.84)	70.45 (50.09)	1.372	.173	.280
FD_F Positive Emotions	94.83 (11.00)	96.78 (5.25)	-.985	.327	.201
FD_E Positive Emotions	48.46 (19.76)	51.03 (23.29)	-.604	.547	-.123
FD_M Positive Emotions	25.15 (14.68)	22.83 (17.05)	.738	.462	.151
FD_N Positive Emotions	14.97 (9.86)	15.41 (12.45)	-.183	.856	-.041

Note. FFD_F: First Fixation Duration Face; FFD_E: First Fixation Duration Eyes; FFD_M: First Fixation Duration Mouth; FFD_N: First Fixation Duration Nose.

Anger (AN) processing differences in children with low vs. high CU traits.

	Low CU	High CU			
	Mean (*SD*)	Mean (*SD*)	*t*	*p*	*d*
FC_F_AN	**97.89 (4.99)**	**92.90 (13.56)**	**2.903**	**.044**	**.592**
FC_E_AN	49.84 (21.83)	52.08 (26.90)	-.469	.640	-.096
FC_M_AN	20.74 (15.37)	17.58 (16.61)	.983	.328	.201
FC_N_AN	16.67 (11.78)	14.55 (14.25)	.127	.409	.169
FFD_F_AN	165.03 (41.97)	152.62 (40.84)	1.460	.147	.298
FFD_E_AN	147.28 (50.27)	127.94 (53.38)	1.852	.067	.378
FFD_M_AN	**116.47 (61.63)**	**75.70 (60.85)**	**3.255**	**.001**	**.664**
FFD_N_AN	86.79 (53.36)	67.79 (55.22)	1.728	.087	.352
FD_F_AN	97.29 (6.83)	93.24 (13.57)	1.625	.106	.435
FD_E_AN	49.71 (22.45)	52.99 (26.31)	-.681	.497	-.139
FD_M_AN	21.79 (15.72)	16.98 (15.05)	1.520	.131	.310
FD_N_AN	16.94 (12.03)	15.08 (14.94)	.645	.522	.144

Note. FC_F: Fixation Count Face; FC_E: Fixation Count Eyes; FC_M: Fixation Count Mouth; FC_N: Fixation Count Nose; FFD_F: First Fixation Duration Face; FFD_E: First Fixation Duration Eyes; FFD_M: First Fixation Duration Mouth; FFD_N: First Fixation Duration Nose; FD_F: Fixation Duration Face; FD_E: Fixation Duration Eyes; FD_M: Fixation Duration Mouth; FD_N: Fixation Duration Nose.

Fear (FE) processing differences in children with low vs. high CU traits.

	Low CU	High CU			
	Mean (*SD*)	Mean (*SD*)	*t*	*p*	*d*
FC_F_FE	95.77 (7.40)	94.68 (13.06)	.568	.571	.116
FC_E_FE	52.21 (21.47)	53.52 (25.73)	-.282	.778	-.058
FC_M_FE	21.12 (15.26)	19.05 (15.49)	.661	.510	.135
FC_N_FE	11.78 (10.13)	16.86 (14.87)	-1.824	.075	-.434
FFD_F_FE	169.01 (55.85)	175.83 (53.41)	-.607	.545	-.124
FFD_E_FE	154.90 (66.92)	142.01 (60.70)	.970	.334	.198
FFD_M_FE	109.28 (61.51)	87.58 (52.60)	1.801	.074	.367
FFD_N_FE	79.04 (53.56)	80.63 (51.99)	-.146	.884	-.030
FD_F_FE	94.74 (12.15)	94.58 (13.91)	.056	.956	.011
FD_E_FE	53.36 (22.60)	54.77 (25.32)	-.296	.768	-.060
FD_M_FE	21.55 (16.22)	19.34 (16.23)	.668	.506	.136
FD_N_FE	11.67 (10.32)	15.36 (13.16)	-1.612	.110	-.329

Note. FC_F: Fixation Count Face; FC_E: Fixation Count Eyes; FC_M: Fixation Count Mouth; FC_N: Fixation Count Nose; FFD_F: First Fixation Duration Face; FFD_E: First Fixation Duration Eyes; FFD_M: First Fixation Duration Mouth; FFD_N: First Fixation Duration Nose; FD_F: Fixation Duration Face; FD_E: Fixation Duration Eyes; FD_M: Fixation Duration Mouth; FD_N: Fixation Duration Nose.

Sadness (SA) processing differences in children with low vs. high CU traits.

	Low CU	High CU			
	Mean (*SD*)	Mean (*SD*)	*t*	*p*	*d*
FC_F_SA	95.36 (7.85)	96.14 (7.57)	-.493	.623	-.101
FC_E_SA	**52.02 (21.66)**	**41.95 (25.36)**	**2.166**	**.032**	**.442**
FC_M_SA	23.27 (16.39)	19.87 (16.18)	1.019	.310	.208
FC_N_SA	14.12 (11.73)	18.16 (18.57)	-1.175	.246	-.287
FFD_F_SA	173.44 (54.48)	168.53 (45.68)	.462	.645	.094
FFD_E_SA	**170.45 (62.73)**	**123.89 (62.89)**	**3.363**	**< .001**	**.742**
FFD_M_SA	**115.32 (61.83)**	**85.57 (53.96)**	**2.444**	**.016**	**.499**
FFD_N_SA	84.16 (54.02)	72.41 (53.31)	1.070	.287	.218
FD_F_SA	94.52 (12.62)	96.33 (7.55)	-.775	.440	-.158
FD_E_SA	**54.09 (22.75)**	**43.01 (25.37)**	**2.307**	**.023**	**.471**
FD_M_SA	23.80 (16.92)	20.04 (15.46)	1.117	.266	.228
FD_N_SA	13.42 (11.32)	18.42 (18.18)	-1.794	.075	-.366

Note. FC_F: Fixation Count Face; FC_E: Fixation Count Eyes; FC_M: Fixation Count Mouth; FC_N: Fixation Count Nose; FFD_F: First Fixation Duration Face; FFD_E: First Fixation Duration Eyes; FFD_M: First Fixation Duration Mouth; FFD_N: First Fixation Duration Nose; FD_F: Fixation Duration Face; FD_E: Fixation Duration Eyes; FD_M: Fixation Duration Mouth; FD_N: Fixation Duration Nose.

Disgust (DI) processing differences in children with low vs. high CU traits.

	Low CU	High CU			
	Mean (*SD*)	Mean (*SD*)	*t*	*p*	*d*
FC_F_DI	96.47 (7.25)	95.57 (6.39)	.626	.533	.128
FC_E_DI	39.54 (18.92)	35.50 (23.24)	.978	.330	.199
FC_M_DI	35.81 (17.05)	38.27 (22.50)	-.640	.523	-.137
FC_N_DI	12.67 (9.62)	13.57 (18.42)	-.343	.732	-.070
FFD_F_DI	173.39 (48.28)	171.38 (51.78)	.200	.842	.041
FFD_E_DI	**153.41 (62.92)**	**119.10 (77.76)**	**2.282**	**.027**	**.508**
FFD_M_DI	129.29 (47.77)	116.10 (58.21)	1.267	.208	.258
FFD_N_DI	80.78 /51.10)	61.64 (51.29)	1.834	.069	.374
FD_F_DI	95.55 (12.03)	94.89 (7.86)	.298	.766	.061
FD_E_DI	40.91 (20.23)	35.54 (22.87)	1.252	.213	.255
FD_M_DI	36.34 (18.18)	37.18 (22.39)	-.210	.834	-.043
FD_N_DI	12.79 (10.63)	15.05 (19.83)	-.629	.533	-.162

Note. FC_F: Fixation Count Face; FC_E: Fixation Count Eyes; FC_M: Fixation Count Mouth; FC_N: Fixation Count Nose; FFD_F: First Fixation Duration Face; FFD_E: First Fixation Duration Eyes; FFD_M: First Fixation Duration Mouth; FFD_N: First Fixation Duration Nose; FD_F: Fixation Duration Face; FD_E: Fixation Duration Eyes; FD_M: Fixation Duration Mouth; FD_N: Fixation Duration Nose.

Happiness (HA) processing differences in children with low vs. high CU traits.

	Low CU	High CU			
	Mean (*SD*)	Mean (*SD*)	*t*	*p*	*d*
FC_F_HA	94.95 (7.83)	96.93 (6.34)	-1.305	.195	-.266
FC_E_HA	43.15 (21.78)	51.89 (24.32)	-1.900	.060	-.388
FC_M_HA	**30.72 (18.81)**	**23.12 (18.53)**	**1.989**	**0.49**	**.406**
FC_N_HA	16.06 (12.70)	16.59 (15.81)	-.192	.848	-.039
FFD_F_HA	172.76 (51.62)	172.40 (51.89)	.034	.973	.007
FFD_E_HA	147.48 (67.80)	128.34 (66.42)	1.392	.167	.284
FFD_M_HA	**123.39 (56.82)**	**86.91 (46.96)**	**3.303**	**.001**	**.674**
FFD_N_HA	88.37 (61.29)	79.78 (65.65)	.673	.502	.137
FD_F_HA	93.99 (12.23)	96.54 (24.08)	-1.152	.252	-.235
FD_E_HA	44.07 (22.78)	52.34 (24.08)	-1.750	.083	-.357
FD_M_HA	**30.16 (17.99)**	**22.35 (18.30)**	**2.117**	**.036**	**.432**
FD_N_HA	15.85 (12.53)	16.83 (16.24)	-.314	.755	-.071

Note. FC_F: Fixation Count Face; FC_E: Fixation Count Eyes; FC_M: Fixation Count Mouth; FC_N: Fixation Count Nose; FFD_F: First Fixation Duration Face; FFD_E: First Fixation Duration Eyes; FFD_M: First Fixation Duration Mouth; FFD_N: First Fixation Duration Nose; FD_F: Fixation Duration Face; FD_E: Fixation Duration Eyes; FD_M: Fixation Duration Mouth; FD_N: Fixation Duration Nose.

Neutral (NE) stimuli processing differences in children with low vs. high CU traits.

	Low CU	High CU			
	Mean (*SD*)	Mean (*SD*)	*t*	*p*	*d*
FC_F_NE	96.06 (6.41)	97.22 (5.03)	-.912	.364	-.186
FC_E_NE	52.08 (20.54)	49.95 (27.22)	.411	.683	.094
FC_M_NE	19.89 (13.50)	23.18 (18.17)	-.953	.345	-.219
FC_N_NE	14.14 (11.97)	14.32 (15.62)	-.063	.950	-.014
FFD_F_NE	170.47 (45.67)	164.52 (49.29)	.623	.534	.127
FFD_E_NE	151.39 (51.70)	134.02 (75.52)	1.227	.226	.291
FFD_M_NE	107.30 (58.73)	89.33 (63.03)	1.468	.145	.299
FFD_N_NE	80.07 (52.21)	61.12 (54.95)	1.752	.082	.357
FD_F_NE	95.67 (10.96)	96.98 (5.33)	-.665	.508	-.136
FD_E_NE	52.85 (20.89)	49.72 (27.60)	.596	.554	.136
FD_M_NE	20.14 (14.27)	23.31 (18.87)	-.881	.383	-.201
FD_N_NE	14.09 (11.63)	13.99 (15.10)	.034	.973	.008

Note. FC_F: Fixation Count Face; FC_E: Fixation Count Eyes; FC_M: Fixation Count Mouth; FC_N: Fixation Count Nose; FFD_F: First Fixation Duration Face; FFD_E: First Fixation Duration Eyes; FFD_M: First Fixation Duration Mouth; FFD_N: First Fixation Duration Nose; FD_F: Fixation Duration Face; FD_E: Fixation Duration Eyes; FD_M: Fixation Duration Mouth; FD_N: Fixation Duration Nose.

2) Partial Correlations

Partial correlations between CU traits and emotion recognition (ER) scores, controlling for externalizing problems.

	1	2	3	4	5	6	7	8	9	10
1. CU traits	1									
2. ER Anger	-.087	1								
3. ER Fear	-.054	-.009	1							
4. ER Sadness	**-.348****	.206*	.043	1						
5. ER Disgust	-.054	.177	.073	.041	1					
6. ER Happiness	-.086	.192*	-.185*	.017	.123	1				
7. ER Neutral	.131	-.024	-.118	.168	.142	-.078	1			
8. ER Positive Emotions	.077	.073	-.199*	.161	.190*	.424**	.870**	1		
9. ER Negative Emotions	**-.231***	.500**	.584**	.535**	.606**	.032	.070	.080	1	
10 ER Total	-.156	.453**	.391**	.525**	.599**	.233*	.482**	.553**	.875**	1

Note. False discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values was applied across all correlations. *$p \leq .05$ ** $p \leq .01$ *** $p \leq .001$

Partial correlations between CU traits and Galvanic Skin Conductance Response (SCR), controlling for externalizing problems.

	1	2	3	4	4	5	6	7	8
1. CU traits	1								
2. SCR Anger	-.028	1							
3. SCR Fear	.052	-.175	1						
4. SCR Sadness	-.151	.396**	-.185*	1					
5. SCR Disgust	.133	-.324**	-.301**	-.104	1				
6. SCR Happiness	.027	.512**	.052	.112	-.132	1			
7. SCR Neutral	-.117	-.053	-.051	-.078	-.014	.088	1		
8. SCR Positive Emotions	-.070	.275**	-.006	.011	-.091	.679**	.791**	1	
9. SCR Negative Emotions	.017	.563**	.261**	.628**	.159	.354**	-.122	.128	1

Note. False discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values was applied across all correlations. $*p \leq .05$ $**\ p \leq .01$ $***\ p \leq .001$

Partial correlations between CU traits ang Global Emotion Processing variables, controlling for externalizing problems.

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. CU traits	1												
2. FC_F Total	.006	1											
3. FC_E Total	-.117	-.136	1										
4. FC_M Total	.073	.086	-.670**	1									
5. FC_N Total	.076	.123	-.511**	.075	1								
6. FFD_F Total	-.021	.057	.138	-.028	.086	1							
7. FFD_E Total	**-.184***	.080	.494**	-.259**	-.169	.739**	1						
8. FFD_M Total	-.131	.162	-.334**	.633**	.016	.368**	.340**	1					
9. FFD_N Total	-.147	.201*	-.418**	.109	.711**	.333**	.237*	.434**	1				
10. FD_F Total	-.015	.552**	-.115	.082	.114	.197*	-.108	-.131	-.044	1			
11. FD_E Total	-.094	-.125	.970**	-.660**	-.510**	.117	.541**	-.261**	-.368**	-.283**	1		
12. FD_M Total	.056	.084	-.658**	.963**	.063	-.110	-.240**	.682**	.161	-.119	-.602**	1	
13. FD_N Total	.083	.086	-.498**	.064	.981**	.061	-.157	.027	.724**	-.015	-.469**	.080	1

Note. FC_F: Fixation Count Face; FC_E: Fixation Count Eyes; FC_M: Fixation Count Mouth; FC_N: Fixation Count Nose. False discovery rate (FDR; Benjamini and Hochberg. 1995) correction of the *p*-values was applied across all correlations. $*p \leq .05$ $**\ p \leq .01$ $***\ p \leq .001$

Partial correlations between CU traits ang Negative Emotion Processing variables, controlling for externalizing problems.

		1	2	3	4	5	6	7	8	9	10	11	12	13
1.	CU traits	1												
2.	FC_F Negative	-.021	1											
3.	FC_E Negative	-.153	-.102	1										
4.	FC_M Negative	.072	.118	-.645**	1									
5.	FC_N Negative	.110	.111	-.490**	.032	1								
6.	FFD_F Negative	-.014	.118	.093	-.034	.082	1							
7.	FFD_E Negative	**-.211***	.154	.473**	-.245**	-.135	.749**	1						
8.	FFD_M Negative	-.129	.207*	-.318**	.609**	.000	.386**	.343**	1					
9.	FFD_N Negative	-.118	.220*	-.362**	.078	.668**	.311**	.283**	.435**	1				
10.	FD_F Negative	-.027	.640**	-.103	.115	.106	.261**	-.020	-.036	-.056	1			
11.	FD_E Negative	-.135	-.097	.965**	-.636**	-.486**	.079	.514**	-.253**	-.305**	-.256**	1		
12.	FD_M Negative	.051	.090	-.626**	.957**	.020	-.125	-.236*	.652**	.142	-.094	-.573**	1	
13.	FD_N Negative	.125	.065	-.488**	.026	.973**	.052	-.129	.009	.690**	-.025	-.451**	.043	1

Note. FC_F: Fixation Count Face; FC_E: Fixation Count Eyes; FC_M: Fixation Count Mouth; FC_N: Fixation Count Nose. False discovery rate (FDR; Benjamini and Hochberg. 1995) correction of the *p*-values was applied across all correlations. *$p \le .05$ ** $p \le .01$ *** $p \le .001$

Partial correlations between CU traits ang Positive Emotion Processing variables, controlling for externalizing problems.

		1	2	3	4	5	6	7	8	9	10	11	12	13
1.	CU traits	1												
2.	FC_F Positive	.064	1											
3.	FC_E Positive	.048	-.186*	1										
4.	FC_M Positive	-.006	.033	-.609**	1									
5.	FC_N Positive	-.057	.091	-.371**	-.054	1								
6.	FFD_F Positive	-.030	-.082	.077	.070	.049	1							
7.	FFD_E Positive	-.114	-.087	.398**	-.219*	-.156	.664**	1						
8.	FFD_M Positive	-.112	.061	-.362**	.541**	.018	.280**	.275**	1					
9.	FFD_N Positive	-.174	.106	-.371**	.109	.541**	.305**	.125	.337**	1				
10.	FD_F Positive	.010	.483**	-.150	.030	.078	.031	-.236*	-.240**	.024	1			
11.	FD_E Positive	-.008	-.176	.871**	-.568**	-.336**	.110	.537**	-.278**	-.433**	-.298**	1		
12.	FD_M Positive	.055	.074	-.586**	.877**	.009	-.045	-.236*	.689**	.137	-.119	-.589**	1	
13.	FD_N Positive	-.001	.073	-.385**	.080	.800**	.088	-.187*	.025	.715**	-.008	-.462**	.089	1

Note. FC_F: Fixation Count Face; FC_E: Fixation Count Eyes; FC_M: Fixation Count Mouth; FC_N: Fixation Count Nose. False discovery rate (FDR; Benjamini and Hochberg. 1995) correction of the *p*-values was applied across all correlations. *$p \le .05$ ** $p \le .01$ *** $p \le .001$

Partial correlations between CU traits and anger (AN) processing variables, controlling for externalizing problems.

		1	2	3	4	5	6	7	8	9	10	11	12	13
1.	CU traits	1												
2.	FC_F_AN	**-.190***	1											
3.	FC_E_AN	-.046	.018	1										
4.	FC_M_AN	.026	.091	-.595**	1									
5.	FC_N_AN	-.006	.048	-.539**	.038	1								
6.	FFD_F_AN	-.039	.200*	.063	.082	.011	1							
7.	FFD_E_AN	-.120	.143	.436**	-.190*	-.185*	.648**	1						
8.	FFD_M_AN	-.181	.130	-.316**	.532**	.096	.274**	.224*	1					
9.	FFD_N_AN	-.108	.143	-.434**	.114	.698**	.106	.117	.350**	1				
10.	FD_F_AN	-.153	.935**	.031	.076	.057	.286**	.079	.049	.057	1			
11.	FD_E_AN	-.009	.042	.973**	-.576**	-.547**	.043	.469**	-.299**	-.423**	-.004	1		
12.	FD_M_AN	-.002	.031	-.565**	.900**	.056	-.021	-.158	.645**	.217*	-.079	-.524**	1	
13.	FD_N_AN	-.027	-.010	-.527**	.047	.965**	-.024	-.229*	.120	.692**	-.015	-.542**	.092	1

Note. FC_F: Fixation Count Face; FC_E: Fixation Count Eyes; FC_M: Fixation Count Mouth; FC_N: Fixation Count Nose; FFD_F: First Fixation Duration Face; FFD_E: First Fixation Duration Eyes; FFD_M: First Fixation Duration Mouth; FFD_N: First Fixation Duration Nose; FD_F: Fixation Duration Face; FD_E: Fixation Duration Eyes; FD_M: Fixation Duration Mouth; FD_N: Fixation Duration Nose. Note. False discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values was applied across all correlations. **p* ≤ .05 ** *p* ≤ .01 *** *p* ≤ .001

Partial correlations between CU traits and fear (FE) processing variables, controlling for externalizing problems.

		1	2	3	4	5	6	7	8	9	10	11	12	13
1.	CU traits	1												
2.	FC_F_FE	.058	1											
3.	FC_E_FE	-.092	-.123	1										
4.	FC_M_FE	.014	.096	-.541**	1									
5.	FC_N_FE	.160	-.064	-.445**	-.015	1								
6.	FFD_F_FE	.035	.084	.085	.013	.120	1							
7.	FFD_E_FE	-.095	.038	.438**	-.140	-.082	.805**	1						
8.	FFD_M_FE	-.098	.080	-.319**	.580**	.014	.384**	.316**	1					
9.	FFD_N_FE	-.012	.018	-.358**	.032	.656**	.130	.055	.261**	1				
10.	FD_F_FE	.007	.722**	-.106	.065	-.006	.165	-.020	-.049	-.057	1			
11.	FD_E_FE	-.071	-.123	.979**	-.527**	-.435**	.111	.480**	-.275**	-.332**	-.213*	1		
12.	FD_M_FE	.005	.083	-.526**	.963**	-.005	-.028	-.132	.614**	.054	-.088	-.485**	1	
13.	FD_N_FE	.179	-.044	-.436**	-.063	.905**	.006	-.191*	-.033	.695**	-.078	-.427**	-.027	1

Note. FC_F: Fixation Count Face; FC_E: Fixation Count Eyes; FC_M: Fixation Count Mouth; FC_N: Fixation Count Nose; FFD_F: First Fixation Duration Face; FFD_E: First Fixation Duration Eyes; FFD_M: First Fixation Duration Mouth; FFD_N: First Fixation Duration Nose; FD_F: Fixation Duration Face; FD_E: Fixation Duration Eyes; FD_M: Fixation Duration Mouth; FD_N: Fixation Duration Nose. False discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values was applied across all correlations. **p* ≤ .05 ** *p* ≤ .01 *** *p* ≤ .001

Partial correlations between CU traits and sadness (SA) processing variables, controlling for externalizing problems.

		1	2	3	4	5	6	7	8	9	10	11	12	13
1.	CU traits	1												
2.	FC_F_SA	.109	1											
3.	FC_E_SA	**-.235***	.084	1										
4.	FC_M_SA	.061	.045	-.401**	1									
5.	FC_N_SA	.130	.161	-.382**	-.202*	1								
6.	FFD_F_SA	-.009	.100	-.013	.059	.141	1							
7.	FFD_E_SA	**-.234***	.210*	.356**	-.034	-.063	.698**	1						
8.	FFD_M_SA	-.098	.143	-.211*	.613**	-.167	.265**	.179	1					
9.	FFD_N_SA	-.064	.123	-.262**	-.018	.570**	.446**	.352**	.321**	1				
10.	FD_F_SA	.075	.576**	.007	.102	.109	.180	.035	-.043	-.155	1			
11.	FD_E_SA	**-.229***	.059	.944**	-.430**	-.374**	-.028	.399**	-.194*	-.204*	-.126	1		
12.	FD_M_SA	.080	.057	-.421**	.954**	-.209*	-.003	-.023	.676**	.063	-.075	-.412**	1	
13.	FD_N_SA	.145	.180	-.398**	-.214*	.972**	.122	-.061	-.165	.554**	.090	-.378**	-.203*	1

Note. FC_F: Fixation Count Face; FC_E: Fixation Count Eyes; FC_M: Fixation Count Mouth; FC_N: Fixation Count Nose; FFD_F: First Fixation Duration Face; FFD_E: First Fixation Duration Eyes; FFD_M: First Fixation Duration Mouth; FFD_N: First Fixation Duration Nose; FD_F: Fixation Duration Face; FD_E: Fixation Duration Eyes; FD_M: Fixation Duration Mouth; FD_N: Fixation Duration Nose. False discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values was applied across all correlations.
$^{*}p \leq .05$ $^{**}p \leq .01$ $^{***}p \leq .001$

Partial correlations between CU traits and disgust (DI) processing variables, controlling for externalizing problems.

		1	2	3	4	5	6	7	8	9	10	11	12	13
1.	CU traits	1												
2.	FC_F_DI	-,034	1											
3.	FC_E_DI	-,133	-,044	1										
4.	FC_M_DI	,114	,072	-,518**	1									
5.	FC_N_DI	,023	,073	-,403**	-,218*	1								
6.	FFD_F_DI	-,044	,135	,082	-,144	,094	1							
7.	FFD_E_DI	**-,202***	,155	,482**	-,311**	-,108	,729**	1						
8.	FFD_M_DI	-,016	,169	-,212*	,532**	-,205*	,251**	,266**	1					
9.	FFD_N_DI	**-,193***	,258**	-,242**	-,116	,506**	,362**	,280**	,233*	1				
10.	FD_F_DI	-,044	,633**	-,078	,081	,069	,210*	,034	,009	,019	1			
11.	FD_E_DI	-,140	-,067	,951**	-,517**	-,390**	,116	,530**	-,151	-,198*	-,247**	1		
12.	FD_M_DI	,071	,087	-,490**	,962**	-,230*	-,233*	-,329**	,509**	-,101	,028	-,495**	1	
13.	FD_N_DI	,064	,025	-,368**	-,239*	,953**	,096	-,107	-,191*	,519**	-,122	-,319**	-,260**	1

Note. FC_F: Fixation Count Face; FC_E: Fixation Count Eyes; FC_M: Fixation Count Mouth; FC_N: Fixation Count Nose; FFD_F: First Fixation Duration Face; FFD_E: First Fixation Duration Eyes; FFD_M: First Fixation Duration Mouth; FFD_N: First Fixation Duration Nose; FD_F: Fixation Duration Face; FD_E: Fixation Duration Eyes; FD_M: Fixation Duration Mouth; FD_N: Fixation Duration Nose. False discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values was applied across all correlations.
$^{*}p \leq .05$ $^{**}p \leq .01$ $^{***}p \leq .001$

Partial correlations between CU traits and happiness (HA) processing variables, controlling for externalizing problems.

		1	2	3	4	5	6	7	8	9	10	11	12	13
1.	CU traits	1												
2.	FC_F_HA	.108	1											
3.	FC_E_HA	.048	-.161	1										
4.	FC_M_HA	-.006	.060	-.609**	1									
5.	FC_N_HA	-.057	.056	-.371**	-.054	1								
6.	FFD_F_HA	.003	-.072	.147	-.011	.042	1							
7.	FFD_E_HA	-.099	-.141	.404**	-.247**	-.185*	.683**	1						
8.	FFD_M_HA	-.172	.093	-.338**	.468**	-.028	.277**	.280**	1					
9.	FFD_N_HA	**-.218***	.055	-.268**	-.016	.625**	.280**	.110	.226*	1				
10.	FD_F_HA	.051	.615**	-.140	.052	.069	-.031	-.206*	-.142	.094	1			
11.	FD_E_HA	.076	-.141	.966**	-.598**	-.367**	.190*	.477**	-.289**	-.295**	-.271**	1		
12.	FD_M_HA	-.017	.087	-.636**	.965**	-.052	-.057	-.222*	.538**	-.010	-.053	-.595**	1	
13.	FD_N_HA	-.061	.041	-.327**	-.081	.983**	.013	-.181	-.044	.638**	-.018	-.323**	-.067	1

Note. FC_F: Fixation Count Face; FC_E: Fixation Count Eyes; FC_M: Fixation Count Mouth; FC_N: Fixation Count Nose; FFD_F: First Fixation Duration Face; FFD_E: First Fixation Duration Eyes; FFD_M: First Fixation Duration Mouth; FFD_N: First Fixation Duration Nose; FD_F: Fixation Duration Face; FD_E: Fixation Duration Eyes; FD_M: Fixation Duration Mouth; FD_N: Fixation Duration Nose. False discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values was applied across all correlations.
*$p \leq .05$ ** $p \leq .01$ *** $p \leq .001$

Partial correlations between CU traits and neutral (NE) stimuli processing variables, controlling for externalizing problems.

		1	2	3	4	5	6	7	8	9	10	11	12	13
1.	CU traits	1												
2.	FC_F_NE	-.019	1											
3.	FC_E_NE	-.112	-.009	1										
4.	FC_M_NE	.133	-.001	-.558**	1									
5.	FC_N_NE	.069	.038	-.537**	.051	1								
6.	FFD_F_NE	-.058	.003	.028	.017	.175	1							
7.	FFD_E_NE	-.108	-.002	.442**	-.176	-.146	.605**	1						
8.	FFD_M_NE	-.023	-.039	-.310**	.693**	-.031	.212*	.228*	1					
9.	FFD_N_NE	-.068	.131	-.470**	.131	.656**	.207*	.014	.324**	1				
10.	FD_F_NE	-.039	.467**	-.030	-.008	.056	.115	-.219*	-.263**	-.064	1			
11.	FD_E_NE	-.092	-.030	.970**	-.548**	-.523**	.034	.506**	-.243**	-.437**	-.185*	1		
12.	FD_M_NE	.128	.014	-.556**	.969**	.033	-.038	-.148	.747**	.184*	-.159	-.527**	1	
13.	FD_N_NE	.063	.042	-.532**	.049	.981**	.160	-.162	-.028	.685**	-.002	-.513**	.038	1

Note. FC_F: Fixation Count Face; FC_E: Fixation Count Eyes; FC_M: Fixation Count Mouth; FC_N: Fixation Count Nose; FFD_F: First Fixation Duration Face; FFD_E: First Fixation Duration Eyes; FFD_M: First Fixation Duration Mouth; FFD_N: First Fixation Duration Nose; FD_F: Fixation Duration Face; FD_E: Fixation Duration Eyes; FD_M: Fixation Duration Mouth; FD_N: Fixation Duration Nose. False discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values was applied across all correlations.
*$p \leq .05$ ** $p \leq .01$ *** $p \leq .001$

3) Linear regression models.

Regressions models predicting CU traits via Emotion Recognition (ER)		
	Beta	*p*
Age	.071	.372
IQ	-.092	.266
SES	.086	.336
Externalizing Problems	**.522**	**< .001[a]**
ER Total	-.142	.091

Note. IQ: Intelligence Quotient; SES: Socioeconomic Status; ER: Emotion Recognition. [a] p < .001 after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the p-values; [b] p < .05 after FDR correction of the p-values.

Regressions models predicting CU traits via Positive and Negative Emotion Recognition (ER)		
	Beta	*p*
Age	.052	.504
IQ	-.065	.431
SES	.110	.218
Externalizing Problems	**.520**	**< .001[a]**
ER Positive Emotions	.076	.342
ER Negative Emotions	**-.218**	**.011[b]**

Note. IQ: Intelligence Quotient; SES: Socioeconomic Status; ER: Emotion Recognition. [a] p < .001 after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the p-values; [b] p < .05 after FDR correction of the p-values.

Regressions models predicting CU traits via Emotion Recognition (ER).

	Anger		Fear		Sadness		Disgust		Happiness		Neutral	
	Beta	*p*	*Beta*	*p*	*Beta*	*p*	*Beta*	*p*	*Beta*	*p*	*Beta*	*p*
Age	.059	.460	.060	.459	.061	.416	.076	.351	.060	.451	.049	.541
IQ	-.099	.232	-.096	.251	-.097	.216	-.091	.278	-.102	.219	-.091	.275
SES	.067	.458	.077	.401	.069	.416	.081	.375	.060	.511	.068	.450
Externalizing	**.550**	**< .001[a]**	**.558**	**< .001[a]**	**.457**	**< .001[a]**	**.558**	**< .001[a]**	**.550**	**< .001[a]**	**.568**	**< .001[a]**
ER	-.067	.409	-.036	.665	**-.309**	**< .001[a]**	-.058	.495	-.068	.401	.095	.243

Note. IQ: Intelligence Quotient; SES: Socioeconomic Status; Externalizing: Externalizing Problems; ER: Emotion Recognition. [a] p < .001 after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the p-values; [b] p < .05 after FDR correction of the p-values.

Regressions models predicting CU traits via Skin Conductance Response (SCR).

	Anger		Fear		Sadness		Disgust		Happiness		Neutral	
	Beta	*p*	*Beta*	*p*	*Beta*	*p*	*Beta*	*p*	*Beta*	*p*	*Beta*	*p*
Age	,064	,428	,065	,418	,069	,383	,058	,463	,070	,385	,066	,404
IQ	-,099	,235	-,098	,238	-,105	,202	-,090	,278	-,101	,224	-,092	,267
SES	,070	,440	,074	,415	,079	,379	,073	,415	,074	,411	,069	,440
Externalizing	**,560**	**< .001[a]**	**,557**	**< .001[a]**	**,565**	**< .001[a]**	**,566**	**< .001[a]**	**,568**	**< .001[a]**	**,564**	**< .001[a]**
SCR	-,005	,946	,043	,588	-,135	,088	,103	,199	,040	,629	-,093	,242

Note. IQ: Intelligence Quotient; SES: Socioeconomic Status; Externalizing: Externalizing Problems; SCR: Skin Conductance Response. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

Regressions models predicting CU traits via Fixation Count (FC) global scores.

	Face		Eyes		Mouth		Nose	
	Beta	*p*	*Beta*	*p*	*Beta*	*p*	*Beta*	*p*
Age	.067	.405	.058	.469	.070	.383	.050	.547
IQ	-.100	.231	-.102	.218	-.094	.261	-.102	.222
SES	.072	.429	.074	.410	.075	.403	.068	.447
Externalizing Problems	**.560**	**< .001[a]**	**.561**	**< .001[a]**	**.564**	**< .001[a]**	**.558**	**< .001[a]**
FC Total	.017	.831	-.097	.222	.063	.434	.052	.533

Note. IQ: Intelligence Quotient; SES: Socioeconomic Status; FC: Fixation Count. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

Regressions models predicting CU traits via First Fixation Duration (FFD) global scores.

	Face		Eyes		Mouth		Nose	
	Beta	*p*	*Beta*	*p*	*Beta*	*p*	*Beta*	*p*
Age	.064	.421	.054	.493	.048	.545	.086	.282
IQ	-.101	.228	-.110	.179	-.131	.123	-.106	.196
SES	.073	.423	.083	.353	.056	.535	.080	.372
Externalizing Problems	**.561**	**< .001[a]**	**.546**	**< .001[a]**	**.540**	**< .001[a]**	**.564**	**< .001[a]**
FFD Total	-.023	.772	-.161	**.044**	-.132	.116	-.143	.074

Note. IQ: Intelligence Quotient; SES: Socioeconomic Status; FFD: First Fixation Duration. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

Regressions models predicting CU traits via Fixation Duration (FD) global scores.

	Face		Eyes		Mouth		Nose	
	Beta	*p*	*Beta*	*p*	*Beta*	*p*	*Beta*	*p*
Age	.066	.412	.059	.464	.069	.389	.049	.563
IQ	-.101	.230	-.104	.210	-.093	.268	-.100	.229
SES	.071	.431	.074	.411	.073	.418	.067	.461
Externalizing Problems	**.560**	**< .001[a]**	**.562**	**< .001[a]**	**.562**	**< .001[a]**	**.556**	**< .001[a]**
FD Total	.011	.896	-.081	.313	.045	.580	.054	.521

Note. IQ: Intelligence Quotient; SES: Socioeconomic Status; FD: Fixation Duration. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

Regressions models predicting CU traits via Fixation Count (FC) Positive and Negative Emotions.

	Face		Eyes		Mouth		Nose	
	Beta	*p*	*Beta*	*p*	*Beta*	*p*	*Beta*	*p*
Age	.074	.359	.046	.558	.069	.389	.060	.466
IQ	-.101	.225	-.067	.419	-.090	.281	-.111	.177
SES	.081	.371	.073	.409	.081	.373	.059	.505
Externalizing Problems	**.544**	**< .001[a]**	**.521**	**< .001[a]**	**.564**	**< .001[a]**	**.550**	**< .001[a]**
FC Positive Emotions	.121	.236	**.214**	**.049**	-.074	.479	-.173	.082
FC Negative Emotions	-.081	.419	**-.267**	**.013[b]**	.111	.296	.182	.068

Note. IQ: Intelligence Quotient; SES: Socioeconomic Status; FC: Fixation Count. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

Regressions models predicting CU traits via First Fixation Duration (FFD) Positive and Negative Emotions.

	Face		Eyes		Mouth		Nose	
	Beta	*p*	*Beta*	*p*	*Beta*	*p*	*Beta*	*p*
Age	.066	.413	.039	.621	.049	.545	.095	.237
IQ	-.102	.223	-.108	.184	-.131	.124	-.100	.224
SES	.074	.416	.096	.281	.055	.545	.059	.517
Externalizing Problems	**.559**	**< .001[a]**	**.541**	**< .001[a]**	**.541**	**< .001[a]**	**.559**	**< .001[a]**
FFD Positive Emotions	-.055	.664	.138	.307	-.035	.776	-.178	.164
FFD Negative Emotions	.027	.829	**-.299**	**.031**	-.104	.403	.018	.887

Note. IQ: Intelligence Quotient; SES: Socioeconomic Status; FFD: First Fixation Duration. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

Regressions models predicting CU traits via Fixation Duration (FD) Positive and Negative Emotions.

	Face		Eyes		Mouth		Nose	
	Beta	*p*	*Beta*	*p*	*Beta*	*p*	*Beta*	*p*
Age	.068	.399	.028	.726	.068	.398	.040	.632
IQ	-.106	.211	-.071	.396	-.094	.266	-.102	.213
SES	.077	.396	.071	.424	.073	.422	.057	.527
Externalizing Problems	**.554**	**< .001[a]**	**.541**	**< .001[a]**	**.562**	**< .001[a]**	**.547**	**< .001[a]**
FD Positive Emotions	.119	.418	.270	.073	.035	.772	-.189	.118
FD Negative Emotions	-.100	.491	**-.340**	**.025**	.013	.914	.234	.058

Note. IQ: Intelligence Quotient; SES: Socioeconomic Status; FD: Fixation Duration. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

Regressions models predicting CU traits via anger (AN) processing.

	Face		Eyes		Mouth		Nose	
	Beta	*p*	*Beta*	*p*	*Beta*	*p*	*Beta*	*p*
Age	.055	.486	.063	.434	.064	.421	.065	.416
IQ	-.099	.229	-.103	.216	-.100	.229	-.099	.233
SES	.047	.600	.073	.420	.071	.429	.070	.437
Externalizing Problems	**.540**	**< .001[a]**	**.558**	**< .001[a]**	**.559**	**< .001[a]**	**.560**	**< .001[a]**
FC_AN	-.154	.054	-.044	.580	.024	.765	-.003	.970

Note. IQ: Intelligence Quotient; SES: Socioeconomic Status; FC: Fixation Count.[a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

	Face		Eyes		Mouth		Nose	
	Beta	*p*	*Beta*	*p*	*Beta*	*p*	*Beta*	*p*
Age	.063	.433	.056	.485	.059	.451	.067	.402
IQ	-.098	.238	-.107	.196	-.118	.151	-.106	.201
SES	.068	.452	.068	.449	.051	.566	.079	.381
Externalizing Problems	**.558**	**< .001[a]**	**.549**	**< .001[a]**	**.551**	**< .001[a]**	**.559**	**< .001[a]**
FFD_AN	-.014	.862	-.102	.202	**-.162**	**.044**	-.101	.206

Note. IQ: Intelligence Quotient; SES: Socioeconomic Status; FFD: First Fixation Duration. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

	Face		Eyes		Mouth		Nose	
	Beta	*p*	*Beta*	*p*	*Beta*	*p*	*Beta*	*p*
Age	.060	.450	.064	.423	.065	.414	.066	.412
IQ	-.091	.271	-.101	.227	-.101	.229	-.099	.236
SES	.051	.574	.071	.432	.070	.437	.071	.434
Externalizing Problems	**.545**	**< .001[a]**	**.559**	**< .001[a]**	**.561**	**< .001[a]**	**.559**	**< .001[a]**
FD_AN	-.118	.143	-.015	.852	-.012	.883	-.022	.781

Note. IQ: Intelligence Quotient; SES: Socioeconomic Status; FD: Fixation Duration. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

Regressions models predicting CU traits via fear (FE) processing.

	Face		Eyes		Mouth		Nose	
	Beta	*p*	*Beta*	*p*	*Beta*	*p*	*Beta*	*p*
Age	.069	.389	.060	.452	.066	.413	.030	.718
IQ	-.101	.226	-.100	.226	-.099	.240	-.098	.235
SES	.069	.441	.079	.384	.071	.435	.070	.434
Externalizing Problems	.566	**< .001**[a]	.568	**< .001**[a]	.560	**< .001**[a]	.553	**< .001**[a]
FC_FE	.056	.489	-.079	.325	.009	.913	.125	.130

Note. IQ: Intelligence Quotient; SES: Socioeconomic Status; FC: Fixation Count. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

	Face		Eyes		Mouth		Nose	
	Beta	*p*	*Beta*	*p*	*Beta*	*p*	*Beta*	*p*
Age	.065	.418	.063	.431	.063	.427	.070	.392
IQ	-.099	.234	-.103	.216	-.116	.168	-.099	.235
SES	.068	.454	.077	.392	.063	.482	.072	.428
Externalizing Problems	**.559**	**< .001**[a]	**.557**	**< .001**[a]	**.554**	**< .001**[a]	**.563**	**< .001**[a]
FFD_FE	.024	.764	-.085	.288	-.097	.233	-.025	.764

Note. IQ: Intelligence Quotient; SES: Socioeconomic Status; FFD: First Fixation Duration. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

	Face		Eyes		Mouth		Nose	
	Beta	*p*	*Beta*	*p*	*Beta*	*p*	*Beta*	*p*
Age	.067	.406	.060	.450	.065	.420	.022	.793
IQ	-.103	.221	-.102	.220	-.100	.235	-.095	.247
SES	.072	.429	.078	.392	.070	.437	.061	.491
Externalizing Problems	**.562**	**< .001**[a]	**.566**	**< .001**[a]	**.560**	**< .001**[a]	**.551**	**< .001**[a]
FD_FE	.024	.764	-.063	.435	-.005	.954	.140	.094

Note. IQ: Intelligence Quotient; SES: Socioeconomic Status; FD: Fixation Duration. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

Regressions models predicting CU traits via sadness (SA) processing.

	Face		Eyes		Mouth		Nose	
	Beta	*p*	*Beta*	*p*	*Beta*	*p*	*Beta*	*p*
Age	.064	.420	.039	.625	.074	.361	.032	.705
IQ	-.105	.203	-.076	.350	-.092	.275	-.103	.213
SES	.069	.442	.076	.390	.077	.398	.069	.444
Externalizing Problems	**.560**	**< .001[a]**	**.541**	**< .001[a]**	**.566**	**< .001[a]**	**.558**	**< .001[a]**
FC_SA	.096	.228	**-.188**	**.020[b]**	.057	.487	.102	.227

Note. IQ: Intelligence Quotient; SES: Socioeconomic Status; FC: Fixation Count. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

	Face		Eyes		Mouth		Nose	
	Beta	*p*	*Beta*	*p*	*Beta*	*p*	*Beta*	*p*
Age	.068	.397	.067	.388	.049	.542	.072	.369
IQ	-.101	.225	-.108	.181	-.119	.159	-.114	.177
SES	.073	.420	.113	.204	.058	.521	.084	.356
Externalizing Problems	**.561**	**< .001[a]**	**.533**	**< .001[a]**	**.545**	**< .001[a]**	**.567**	**< .001[a]**
FFD_SA	-.026	.751	**-.219**	**.007[b]**	-.095	.259	-.083	.311

Note. IQ: Intelligence Quotient; SES: Socioeconomic Status; FFD: First Fixation Duration. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

	Face		Eyes		Mouth		Nose	
	Beta	*p*	*Beta*	*p*	*Beta*	*p*	*Beta*	*p*
Age	.064	.419	.043	.583	.077	.340	.024	.773
IQ	-.117	.167	-.078	.340	-.087	.304	-.102	.217
SES	.074	.413	.074	.404	.076	.398	.069	.441
Externalizing Problems	**.564**	**< .001[a]**	**.549**	**< .001[a]**	**.567**	**< .001[a]**	**.557**	**< .001[a]**
FD_SA	.084	.298	**-.182**	**.023**	.071	.389	.115	.176

Note. IQ: Intelligence Quotient; SES: Socioeconomic Status; FD: Fixation Duration. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

Regressions models predicting CU traits via disgust (DI) processing.

	Face		Eyes		Mouth		Nose	
	Beta	*p*	*Beta*	*p*	*Beta*	*p*	*Beta*	*p*
Age	.062	.444	.055	.490	.071	.373	.063	.439
IQ	-.100	.228	-.099	.233	-.089	.283	-.101	.227
SES	.070	.439	.064	.478	.079	.380	.069	.444
Externalizing Problems	**.560**	**< .001[a]**	**.554**	**< .001[a]**	**.570**	**< .001[a]**	**.558**	**< .001[a]**
FC_DI	-.023	.778	-.104	.192	.097	.229	.016	.845

Note. IQ: Intelligence Quotient; SES: Socioeconomic Status; FC: Fixation Count. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

	Face		Eyes		Mouth		Nose	
	Beta	*p*	*Beta*	*p*	*Beta*	*p*	*Beta*	*p*
Age	.059	.470	.034	.672	.061	.450	.077	.330
IQ	-.103	.219	-.107	.189	-.106	.218	-.098	.231
SES	.077	.398	.077	.387	.068	.455	.086	.330
Externalizing Problems	**.565**	**< .001[a]**	**.552**	**< .001[a]**	**.556**	**< .001[a]**	**.548**	**< .001[a]**
FFD_DI	-.040	.624	**-.169**	**.035**	-.025	.767	**-.172**	**.030**

Note. IQ: Intelligence Quotient; SES: Socioeconomic Status; FFD: First Fixation Duration. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

	Face		Eyes		Mouth		Nose	
	Beta	*p*	*Beta*	*p*	*Beta*	*p*	*Beta*	*p*
Age	.063	.432	.049	.538	.072	.368	.058	.479
IQ	-.097	.244	-.103	.213	-.094	.261	-.100	.231
SES	.069	.447	.064	.473	.078	.391	.065	.478
Externalizing Problems	**.559**	**< .001[a]**	**.556**	**< .001[a]**	**.569**	**< .001[a]**	**.553**	**< .001[a]**
FD_DI	-.020	.799	-.112	.163	.066	.416	.040	.629

Note. IQ: Intelligence Quotient; SES: Socioeconomic Status; FD: Fixation Duration. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

Regressions models predicting CU traits via happiness (HA) processing.

	Face		Eyes		Mouth		Nose	
	Beta	*p*	*Beta*	*p*	*Beta*	*p*	*Beta*	*p*
Age	.078	.329	.067	.406	.065	.419	.084	.310
IQ	-.093	.259	-.095	.257	-.100	.232	-.100	.228
SES	.079	.377	.069	.445	.070	.437	.068	.449
Externalizing Problems	**.558**	**< .001**[a]	**.555**	**< .001**[a]	**.560**	**< .001**[a]	**.558**	**< .001**[a]
FC_HA	.101	.212	.031	.702	-.003	.967	-.071	.391

Note. IQ: Intelligence Quotient; SES: Socioeconomic Status; FC: Fixation Count. [a] p < .001 after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] p < .05 after FDR correction of the *p*-values.

	Face		Eyes		Mouth		Nose	
	Beta	*p*	*Beta*	*p*	*Beta*	*p*	*Beta*	*p*
Age	.066	.411	.063	.428	.035	.661	.112	.163
IQ	-.100	.230	-.104	.210	-.125	.133	-.096	.236
SES	.072	.430	.071	.429	.080	.368	.072	.413
Externalizing Problems	**.560**	**< .001**[a]	**.552**	**< .001**[a]	**.536**	**< .001**[a]	**.582**	**< .001**[a]
FFD_HA	-.012	.882	-.087	.274	-.160	.054	-.163	.061

Note. IQ: Intelligence Quotient; SES: Socioeconomic Status; FFD: First Fixation Duration. [a] p < .001 after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] p < .05 after FDR correction of the *p*-values.

	Face		Eyes		Mouth		Nose	
	Beta	*p*	*Beta*	*p*	*Beta*	*p*	*Beta*	*p*
Age	.069	.389	.066	.406	.064	.426	.086	.300
IQ	-.107	.202	-.091	.281	-.100	.229	-.101	.223
SES	.079	.387	.067	.454	.070	.437	.070	.439
Externalizing Problems	.561	**< .001**[a]	**.553**	**< .001**[a]	**.559**	**< .001**[a]	**.561**	**< .001**[a]
FD_HA	.062	.438	.052	.526	-.014	.857	-.077	.353

Note. IQ: Intelligence Quotient; SES: Socioeconomic Status; FD: Fixation Duration. [a] p < .001 after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] p < .05 after FDR correction of the *p*-values.

Regressions models predicting CU traits via neutral (NE) stimuli processing.

	Face		Eyes		Mouth		Nose	
	Beta	*p*	*Beta*	*p*	*Beta*	*p*	*Beta*	*p*
Age	.065	.416	.069	.389	.066	.408	.058	.468
IQ	-.100	.234	-.102	.219	-.093	.261	-.101	.225
SES	.071	.437	.070	.434	.081	.366	.066	.463
Externalizing Problems	**.559**	**< .001**[a]	**.558**	**< .001**[a]	**.557**	**< .001**[a]	**.557**	**< .001**[a]
FC_NE	.003	.972	-.099	.213	.112	.161	.051	.530

Note. IQ: Intelligence Quotient; SES: Socioeconomic Status; FC: Fixation Count. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

	Face		Eyes		Mouth		Nose	
	Beta	*p*	*Beta*	*p*	*Beta*	*p*	*Beta*	*p*
Age	.060	.453	.064	.417	.064	.425	.070	.384
IQ	-.102	.220	-.107	.198	-.106	.213	-.102	.219
SES	.074	.412	.075	.405	.066	.470	.064	.480
Externalizing Problems	**.560**	**< .001**[a]	**.557**	**< .001**[a]	**.556**	**< .001**[a]	**.552**	**< .001**[a]
FFD_NE	-.050	.529	-.099	.214	-.032	.703	-.064	.429

Note. IQ: Intelligence Quotient; SES: Socioeconomic Status; FFD: First Fixation Duration. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

	Face		Eyes		Mouth		Nose	
	Beta	*p*	*Beta*	*p*	*Beta*	*p*	*Beta*	*p*
Age	.065	.419	.066	.408	.066	.407	.059	.463
IQ	-.099	.250	-.104	.210	-.090	.276	-.101	.226
SES	.070	.442	.073	.414	.081	.370	.067	.455
Externalizing Problems	.560	**< .001**[a]	.558	**< .001**[a]	.559	**< .001**[a]	.558	**< .001**[a]
FD_NE	-.003	.973	-.084	.291	.106	.186	.046	.567

Note. IQ: Intelligence Quotient; SES: Socioeconomic Status; FD: Fixation Duration. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

4) Moderation models with Positive Parenting moderating the link between attention to the eyes and CU traits

	b	*p*		*b*	*p*		*b*	*p*
Age	.092	.627	Age	.146	.410	Age	.097	.605
IQ	-.021	.499	IQ	-.022	.426	IQ	-.018	.548
SES	.618	.146	SES	.808	.045	SES	.624	.141
Externalizing	**.139**	**.002[b]**	Externalizing	**.132**	**.002[b]**	Externalizing	**.140**	**.002[b]**
NP	.043	.468	NP	.039	.474	NP	.043	.467
FC_E Total	-.003	.816	FFD_E Total	-.012	.012	FD_E Total	-.002	.887
PP	-.047	.204	PP	-.068	.051	PP	-.048	.190
PP× FC_E Total	-.001	.592	PP×FFD_E Total	**-.002**	**.009[b]**	PP× FD_E Total	-.002	.418

Note. IQ: Intelligence Quotient, SES: Socioeconomic Status; FC_E: Fixation Count Eyes; FFD_E: First Fixation Duration Eyes; FD_E: Fixation Duration Eyes; NP: Negative Parenting; PP: Positive Parenting. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

	b	*p*		*b*	*p*		*b*	*p*
Age	.071	.699	Age	.194	.270	Age	.071	.704
IQ	-.019	.524	IQ	-.017	.531	IQ	-.016	.598
SES	.590	.161	SES	**.865**	**.031**	SES	.611	.147
Externalizing	**.131**	**.003[b]**	Externalizing	**.135**	**.001[b]**	Externalizing	**.137**	**.002[b]**
NP	.056	.326	NP	.030	.571	NP	.057	.334
FC_E PosEm	.014	.178	FFD_E PosEm	-.006	.110	FD_E PosEm	.009	.419
PP	-.057	.123	PP	-.063	.066	PP	-.053	.151
PP× FC_E PosEm	.000	.808	PP×FFD_E PosEm	**-.002**	**.001[b]**	PP× FD_E PosEm	-.002	.368

Note. IQ: Intelligence Quotient, SES: Socioeconomic Status; FC_E: Fixation Count Eyes; FFD_E: First Fixation Duration Eyes; FD_E: Fixation Duration Eyes; NP: Negative Parenting; PP: Positive Parenting; PosEm: Positive Emotions. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

	b	*p*		*b*	*p*		*b*	*p*
Age	.084	.654	Age	.096	.589	Age	.092	.625
IQ	-.021	.490	IQ	-.025	.364	IQ	-.019	.527
SES	.628	.139	SES	**.809**	**.045**	SES	.636	.134
Externalizing	**.138**	**.002[b]**	Externalizing	**.133**	**.001[b]**	Externalizing	**.140**	**.002[b]**
NP	.037	.535	NP	.042	.431	NP	.037	.527
FC_E NegEm	-.011	.425	FFD_E NegEm	**-.015**	**.003[b]**	FD_E NegEm	-.009	.507
PP	-.043	.242	PP	**-.069**	**.049**	PP	-.045	.223
PP× FC_E NegEm	-.001	.730	PP×FFD_E NegEm	**-.002**	**.026**	PP× FD_E NegEm	-.001	.510

Note. IQ: Intelligence Quotient, SES: Socioeconomic Status; FC_E: Fixation Count Eyes; FFD_E: First Fixation Duration Eyes; FD_E: Fixation Duration Eyes; NP: Negative Parenting; PP: Positive Parenting; NegEm: Negative Emotions. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

	b	*p*		*b*	*p*		*b*	*p*
Age	.084	.658	Age	.093	.621	Age	.093	.621
IQ	-.023	.447	IQ	-.023	.426	IQ	-.020	.509
SES	.594	.164	SES	.616	.140	SES	.607	.155
Externalizing	**.137**	**.002[b]**	Externalizing	**.126**	**.004[b]**	Externalizing	**.137**	**.002[b]**
NP	.051	.382	NP	.043	.447	NP	.052	.370
FC_E AN	.003	.749	FFD_E AN	-.006	.161	FD_E AN	.008	.447
PP	-.051	.169	PP	-.057	.115	PP	-.052	.159
PP× FC_E AN	.000	.792	PP×FFD_E AN	-.001	.365	PP× FD_E AN	-.001	.548

Note. IQ: Intelligence Quotient, SES: Socioeconomic Status; FC_E: Fixation Count Eyes; FFD_E: First Fixation Duration Eyes; FD_E: Fixation Duration Eyes; NP: Negative Parenting; PP: Positive Parenting; AN: Anger. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

	b	*p*		*b*	*p*		*b*	*p*
Age	.072	.704	Age	.081	.664	Age	.080	.670
IQ	-.025	.417	IQ	-.025	.401	IQ	-.023	.461
SES	.604	.158	SES	.700	.105	SES	.599	.163
Externalizing	**.136**	**.003[b]**	Externalizing	**.136**	**.002[b]**	Externalizing	**.137**	**.002[b]**
NP	.047	.422	NP	.050	.381	NP	.047	.420
FC_E FE	-.003	.813	FFD_E FE	-.004	.325	FD_E FE	-.001	.954
PP	-.049	.188	PP	-.051	.160	PP	-.049	.186
PP× FC_E FE	.000	.916	PP×FFD_E FE	.000	.560	PP× FD_E FE	.000	.847

Note. IQ: Intelligence Quotient, SES: Socioeconomic Status; FC_E: Fixation Count Eyes; FFD_E: First Fixation Duration Eyes; FD_E: Fixation Duration Eyes; NP: Negative Parenting; PP: Positive Parenting; FE: Fear. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

	b	*p*		*b*	*p*		*b*	*p*
Age	.072	.697	Age	.116	.524	Age	.083	.652
IQ	-.018	.533	IQ	-.026	.363	IQ	-.018	.544
SES	.569	.174	SES	.676	.101	SES	.560	.179
Externalizing	**.135**	**.002**	Externalizing	**.140**	**.001[b]**	Externalizing	**.139**	**.002[b]**
NP	.028	.631	NP	.030	.594	NP	.026	.654
FC_E SA	-.018	.103	FFD_E SA	**-.010**	**.014**	FD_E SA	-.017	.100
PP	-.039	.287	PP	-.063	.087	PP	-.040	.278
PP× FC_E SA	.000	.936	PP×FFD_E SA	-.001	.287	PP× FD_E SA	.000	.909

Note. IQ: Intelligence Quotient, SES: Socioeconomic Status; FC_E: Fixation Count Eyes; FFD_E: First Fixation Duration Eyes; FD_E: Fixation Duration Eyes; NP: Negative Parenting; PP: Positive Parenting; SA: Sadness. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

	b	*p*		*b*	*p*		*b*	*p*
Age	.088	.629	Age	.015	.932	Age	.075	.680
IQ	-.015	.602	IQ	-.030	.268	IQ	-.015	.608
SES	.648	.120	SES	**.813**	**.037**	SES	.679	.101
Externalizing	**.141**	**.001[b]**	Externalizing	**.141**	**.001[b]**	Externalizing	**.141**	**.001[b]**
NP	.035	.540	NP	.060	.255	NP	.035	.535
FC_E DI	-.014	.207	FFD_E DI	**-.011**	**.001[b]**	FD_E DI	-.017	.127
PP	-.044	.229	PP	**-.067**	**.045**	PP	-.047	.193
PP× FC_E DI	-.003	.170	PP×FFD_E DI	**-.001**	**.038**	PP× FD_E DI	-.003	.080

Note. IQ: Intelligence Quotient, SES: Socioeconomic Status; FC_E: Fixation Count Eyes; FFD_E: First Fixation Duration Eyes; FD_E: Fixation Duration Eyes; NP: Negative Parenting; PP: Positive Parenting; DI: Disgust. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

	b	*p*		*b*	*p*		*b*	*p*
Age	.071	.699	Age	.144	.425	Age	.064	.729
IQ	-.019	.524	IQ	-.021	.469	IQ	-.015	.611
SES	.59	.161	SES	.797	.055	SES	.590	.160
Externalizing	**.131**	**.003**[b]	Externalizing	**.132**	**.002**[b]	Externalizing	**.134**	**.002**[b]
NP	.056	.326	NP	.038	.487	NP	.055	.333
FC_E HA	.014	.178	FFD_E HA	-.005	.125	FD_E HA	.014	.166
PP	-.057	.123	PP	-.057	.107	PP	-.054	.143
PP× FC_E HA	.000	.808	PP×FFD_E HA	**-.002**	**.019**	PP× FD_E HA	-.001	.553

Note. IQ: Intelligence Quotient, SES: Socioeconomic Status; FC_E: Fixation Count Eyes; FFD_E: First Fixation Duration Eyes; FD_E: Fixation Duration Eyes; NP: Negative Parenting; PP: Positive Parenting; HA: Happiness. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

	b	*p*		*b*	*p*		*b*	*p*
Age	.096	.615	Age	.209	.228	Age	.104	.583
IQ	-.018	.557	IQ	-.016	.560	IQ	-.018	.556
SES	.610	.148	SES	.831	.034	SES	.603	.152
Externalizing	**.140**	**.002**[b]	Externalizing	**.138**	**.001**[b]	Externalizing	**.140**	**.002**[b]
NP	.043	.479	NP	.028	.599	NP	.043	.481
FC_E NE	.000	.978	FFD_E NE	-.005	.172	FD_E NE	.000	.978
PP	-.050	.173	PP	-.063	.061	PP	-.051	.161
PP× FC_E NE	-.002	.289	PP×FFD_E NE	**-.006**	**.015**	PP× FD_E NE	-.002	.280

Note. IQ: Intelligence Quotient, SES: Socioeconomic Status; FC_E: Fixation Count Eyes; FFD_E: First Fixation Duration Eyes; FD_E: Fixation Duration Eyes; NP: Negative Parenting; PP: Positive Parenting. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

5) Moderation models linking attention to the eyes and CU traits via Negative Parenting.

	b	*p*		*b*	*p*		*b*	*p*
Age	.081	.651	Age	.053	.771	Age	.08	.653
IQ	-.020	.492	IQ	-.03	.306	IQ	-.017	.540
SES	.613	.131	SES	.706	.089	SES	.603	.137
Externalizing	**.135**	**.001**[b]	Externalizing	**.129**	**.003**[b]	Externalizing	**.133**	**.002**[b]
PP	-.050	.164	PP	-.057	.109	PP	-.052	.143
FC_E Total	-.004	.736	FFD_E Total	**-.011**	**.032**	FD_E Total	-.003	.802
NP	.043	.448	NP	.043	.441	NP	.044	.441
NP×FC_E Total	**-.008**	**.007**	NP×FFD_E Total	-.001	.549	NP× FD_E Total	**-.008**	**.007**[b]

Note. IQ: Intelligence Quotient, SES: Socioeconomic Status; FC_E: Fixation Count Eyes; FFD_E: First Fixation Duration Eyes; FD_E: Fixation Duration Eyes; NP: Negative Parenting; PP: Positive Parenting. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

	b	*p*		*b*	*p*		*b*	*p*
Age	.088	.629	Age	.083	.654	Age	.081	.656
IQ	-.023	.429	IQ	-.026	.380	IQ	-.018	.521
SES	.626	.129	SES	.635	.130	SES	.569	.164
Externalizing	**.135**	**.002**[b]	Externalizing	**.126**	**.004**[b]	Externalizing	**.133**	**.002**[b]
PP	-.057	.113	PP	-.056	.124	PP	-.056	.116
FC_E PosEm	.015	.140	FFD_E PosEm	-.005	.193	FD_E PosEm	.008	.481
NP	.051	.369	NP	.046	.419	NP	.058	.313
NP×FC_E PosEm	-.004	.078	NP×FFD_E PosEm	-.001	.439	NP×FD_E PosEm	**-.006**	**.020**

Note. IQ: Intelligence Quotient, SES: Socioeconomic Status; FC_E: Fixation Count Eyes; FFD_E: First Fixation Duration Eyes; FD_E: Fixation Duration Eyes; NP: Negative Parenting; PP: Positive Parenting; PosEm: Positive Emotions. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

	b	*p*		*b*	*p*		*b*	*p*
Age	.058	.746	Age	.024	.895	Age	.062	.727
IQ	-.018	.534	IQ	-.031	.275	IQ	-.016	.573
SES	.628	.121	SES	.751	.070	SES	.634	.117
Externalizing	**.133**	**.002[b]**	Externalizing	**.132**	**.002[b]**	Externalizing	**.132**	**.002[b]**
PP	-.046	.199	PP	-.058	.104	PP	-.049	.170
FC_E NegEm	-.011	.395	FFD_E NegEm	**-.013**	**.012**	FD_E NegEm	-.009	.447
NP	.039	.484	NP	.043	.443	NP	.037	.505
NP× FC_E NegEm	**-.008**	**.006[b]**	NP×FFD_E NegEm	.000	.686	NP×FD_E NegEm	**-.008**	**.006[b]**

Note. IQ: Intelligence Quotient, SES: Socioeconomic Status; FC_E: Fixation Count Eyes; FFD_E: First Fixation Duration Eyes; FD_E: Fixation Duration Eyes; NP: Negative Parenting; PP: Positive Parenting; NegEm: Negative Emotions. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

	b	*p*		*b*	*p*		*b*	*p*
Age	.072	.692	Age	.070	.705	Age	.076	.675
IQ	-.026	.364	IQ	-.027	.355	IQ	-.026	.363
SES	.607	.142	SES	.600	.153	SES	.677	.102
Externalizing	**.126**	**.004[b]**	Externalizing	**.128**	**.004[b]**	Externalizing	**.125**	**.004[b]**
PP	-.055	.132	PP	-.057	.121	PP	-.058	.108
FC_E AN	.005	.618	FFD_E AN	-.006	.165	FD_E AN	.008	.436
NP	.065	.252	NP	.046	.422	NP	.061	.281
NP× FC_E AN	**-.005**	**.031**	NP×FFD_E AN	.000	.682	NP× FD_E AN	**-.005**	**.026**

Note. IQ: Intelligence Quotient, SES: Socioeconomic Status; FC_E: Fixation Count Eyes; FFD_E: First Fixation Duration Eyes; FD_E: Fixation Duration Eyes; NP: Negative Parenting; PP: Positive Parenting; AN: Anger. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

	b	*p*		*b*	*p*		*b*	*p*
Age	.062	.729	Age	.066	.719	Age	.060	.741
IQ	-.018	.533	IQ	-.026	.384	IQ	-.018	.540
SES	.582	.159	SES	.676	.117	SES	.581	.163
Externalizing	**.143**	**.001[b]**	Externalizing	**.138**	**.002[b]**	Externalizing	**.142**	**.001[b]**
PP	-.047	.192	PP	-.051	.161	PP	-.048	.179
FC_E FE	-.002	.863	FFD_E FE	-.004	.357	FD_E FE	-.001	.893
NP	.044	.436	NP	.051	.374	NP	.041	.472
NP× FC_E FE	**-.006**	**.019**	NP×FFD_E FE	-.001	.451	NP× FD_E FE	**-.005**	**.024**

Note. IQ: Intelligence Quotient, SES: Socioeconomic Status; FC_E: Fixation Count Eyes; FFD_E: First Fixation Duration Eyes; FD_E: Fixation Duration Eyes; NP: Negative Parenting; PP: Positive Parenting; FE: Fear. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

	b	*p*		*b*	*p*		*b*	*p*
Age	.056	.755	Age	.082	.649	Age	.069	.699
IQ	-.011	.696	IQ	-.030	.304	IQ	-.007	.808
SES	.525	.198	SES	.714	.086	SES	.488	.230
Externalizing	**.126**	**.003[b]**	Externalizing	**.141**	**.001[b]**	Externalizing	**.128**	**.003[b]**
PP	-.050	.168	PP	-.052	.143	PP	-.052	.147
FC_E SA	-.017	.099	FFD_E SA	**-.009**	**.021**	FD_E SA	-.015	.142
NP	.028	.627	NP	.030	.597	NP	.035	.540
NP× FC_E SA	-.004	.052	NP×FFD_E SA	.000	.897	NP× FD_E SA	**-.004**	**.037**

Note. IQ: Intelligence Quotient, SES: Socioeconomic Status; FC_E: Fixation Count Eyes; FFD_E: First Fixation Duration Eyes; FD_E: Fixation Duration Eyes; NP: Negative Parenting; PP: Positive Parenting; SA: Sadness. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

	b	*p*		*b*	*p*		*b*	*p*
Age	.064	.724	Age	-.055	.766	Age	.046	.797
IQ	-.02	.485	IQ	-.031	.276	IQ	-.020	.479
SES	.656	.112	SES	.687	.092	SES	.660	.107
Externalizing	**.140**	**.001[b]**	Externalizing	**.132**	**.002[b]**	Externalizing	**.139**	**.001[b]**
PP	-.037	.309	PP	-.059	.097	PP	-.036	.308
FC_E DI	-.015	.171	FFD_E DI	**-.009**	**.008[b]**	FD_E DI	-.018	.100
NP	.027	.640	NP	.051	.357	NP	.019	.738
NP× FC_E DI	-.004	.058	NP×FFD_E DI	.000	.783	NP× FD_E DI	**-.005**	**.036**

Note. IQ: Intelligence Quotient, SES: Socioeconomic Status; FC_E: Fixation Count Eyes; FFD_E: First Fixation Duration Eyes; FD_E: Fixation Duration Eyes; NP: Negative Parenting; PP: Positive Parenting; DI: Disgust. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

	b	*p*		*b*	*p*		*b*	*p*
Age	.088	.629	Age	.079	.670	Age	.075	.679
IQ	-.023	.429	IQ	-.026	.377	IQ	-.022	.451
SES	.626	.129	SES	.639	.129	SES	.619	.134
Externalizing	**.135**	**.002[b]**	Externalizing	**.128**	**.004[b]**	Externalizing	**.137**	**.002[b]**
PP	-.057	.113	PP	-.051	.159	PP	-.055	.123
FC_E HA	.015	.140	FFD_E HA	-.004	.242	FD_E HA	.075	.679
NP	.051	.369	NP	.045	.431	NP	-.022	.451
NP× FC_E HA	-.004	.078	NP×FFD_E HA	.000	.571	NP× FD_E HA	.619	.134

Note. IQ: Intelligence Quotient, SES: Socioeconomic Status; FC_E: Fixation Count Eyes; FFD_E: First Fixation Duration Eyes; FD_E: Fixation Duration Eyes; NP: Negative Parenting; PP: Positive Parenting; HA: Happiness. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.

	b	*p*		*b*	*p*		*b*	*p*
Age	.111	.545	Age	.087	.637	Age	.105	.567
IQ	-.014	.621	IQ	-.024	.414	IQ	-.012	.686
SES	.536	.188	SES	.604	.150	SES	.47	.252
Externalizing	**.132**	**.002[b]**	Externalizing	**.128**	**.004[b]**	Externalizing	**.128**	**.003[b]**
PP	-.057	.109	PP	-.059	.110	PP	-.056	.118
FC_E NE	-.002	.863	FFD_E NE	-.004	.280	FD_E NE	-.003	.809
NP	.048	.414	NP	.051	.379	NP	.051	.384
NP× FC_E NE	**-.006**	**.014**	NP×FFD_E NE	-.001	.397	NP× FD_E NE	**-.006**	**.013**

Note. IQ: Intelligence Quotient, SES: Socioeconomic Status; FC_E: Fixation Count Eyes; FFD_E: First Fixation Duration Eyes; FD_E: Fixation Duration Eyes; NP: Negative Parenting; PP: Positive Parenting; NE: Neutral. [a] $p < .001$ after false discovery rate (FDR; Benjamini and Hochberg, 1995) correction of the *p*-values; [b] $p < .05$ after FDR correction of the *p*-values.