Systematic Literature review: The relationship between Attention to the eyes; CU traits and Emotion Recognition in children and youth with CU traits.

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Abstract

Callous-unemotional (CU) traits are a suggested precursor to psychopathy in adulthood and serve as a severity indicator across disorders. This systematic literature review explores the relationship between Callous-Unemotional traits in children and adolescents, focusing on three key aspects: (1) the potential correlation between attentional deficits towards the eye region and CU traits, (2) the connection between attention to the eyes and emotion recognition, and (3) the moderating role of parenting in the link between CU traits and attention to the eyes. Following PRISMA guidelines, 14 eligible articles were included in the literature review. The findings underscore an association between CU traits and reduced attention directed towards the eye region. Notably, this correlation appears to be specific to certain emotions, particularly negative ones. Furthermore, the review indicates that the connection between attention to the eyes and emotion recognition seems specific to the recognition of fear and sadness. When considering the interplay of parenting, the results suggest that parental behaviour does not significantly influence the level of eye contact, but negative parenting might amplify the link between decreased attention to the eye region and the development of CU traits. Implications of this literature review suggest that decreased attention to the eye region is a correlate of CU traits, which might explain specific impairments in emotion recognition. Negative parenting potentially moderates the relationship between attention to the eyes and CU traits. Moreover, the negative association between attention to the eyes and emotion recognition might be specific for boys. While this review provides valuable insights, it is essential to acknowledge its limitations, as discussed within the text.

Keywords: Attention to the eyes; Callous Unemotional traits; Emotion recognition; Parenting; Systematic Review

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Systematic Literature review: The relationship between Attention to the eyes; CU traits and Emotion Recognition in children and youth with CU traits.

Callous-unemotional (CU) traits constitute the affective dimension of psychopathic traits and are a suggested precursor to psychopathic traits in adulthood (Hare & Neuman, 2008). CU traits are characterized by callous use of others, lack of remorse and empathic concern, shallow or deficient emotions, and lack of concern about performance (Frick & Morris, 2004). In recent years, increased scientific attention led to their inclusion in the DSM-5 and the International Classification for Disease 11th edition (ICD-11) as a specifier to conduct disorder and oppositional defiant disorder (ODD) labelled "With Limited Prosocial Emotions" (Frick, 2020). The presence of CU traits forms a severity indicator across disorders and is associated with continuous, stable and severe conduct problems (Frick et al., 2003).

CU traits and attention to the eyes.

To comprehend the development of CU traits, one prominent line of research focuses on the ability to attend to and identify facial emotional expressions which is important for effective social functioning (Blair, 2003, Carlson & Reinke, 2014). An increasing body of literature, grounded in eye-tracking studies, establishes a connection between elevated CU traits and reduced attention toward significant emotional cues, such as the eye region of others (e.g., Bellici et al., 2019; Bours et al., 2018; Dadds et al., 2008; Martin-Key et al., 2018). Attention to the eyes is posited as a distinguishing factor between individuals with high and low CU traits (Demetriou & Fanti, 2021). Eye contact in general is an important aspect of typical development, especially in the early stages of childhood development (Csibra & Gergely, 2006; Morton & Johnson, 1991). Early social interactions such as eye contact or reciprocal smiling are crucial bonding experiences with caregivers during the protected period of postnatal development. In typical development, a preference for human

faces and eye gaze is already exhibited soon after birth (Batki et al., 2000; Johnson, Dziurawiec, Ellis, & Morton, 1991). Research on the etiology of CU traits found that lower preferential face tracking in infants predicted later CU traits (Bedford et al. 2015). These results suggest that decreased attention to important social stimuli, such as faces, could precede the development of CU traits and may already occur during infancy (Bedford et al., 2015; Peltola, Yrttiaho, & Leppänen, 2018) and thus could be an inherited precursor to CU traits (see Waller & Hyde, 2018 for a review). Furthermore, Blair (2006) suggests that directing one's attention towards distress cues, such as fearful faces, is crucial for the development of morality and feelings of empathy and guilt. For instance, humans tend to value actions and objects that elicit a positive response in their caregivers, while avoiding actions that trigger fear in their caregivers (Moses et al., 2001; Mineka & Cook, 1993). Moreover, recent research suggests that children with CU traits show impairments in moral reasoning which may originate from dysfunctional attribution of distress emotions in others (Northam et al., 2021). Thus, the recognition of emotions in others via facial expressions seems crucial for the development of social functioning. One hypothesized pathway for the development of CU traits is that less engagement in early eye contact between children and parents results in impaired social skills, such as a lack of empathy, which is a characteristic of individuals with elevated CU traits (Dadds, 2011).

Underlying neurocognitive patterns seem to explain the differential attentional patterns to emotional stimuli in children and youth with high CU traits. CU traits are related to dysfunctions of the amygdala (see Blair 2013 for a review). In general, activation of the amygdala leads to increased arousal and attention to distress cues and is involved in the processing of distress emotions (such as fearful, sad and painful faces) (Blair, 2013). The amygdala is strongly activated by the white sclera of fearful faces (Whalen et al, 2004). Yet, a hypoactive response of the amygdala to distress cues is observed in children and youth with

high CU traits (e.g., Han et al., 2012). According to Blair and colleagues (2006), the amygdala's hypoactive response leads to impaired stimulus learning via decreased attention to distress cues, which eventually disrupts social functioning. Yet, the activity is not absent and can be enhanced through intensification of the stimuli (Blair et al., 2001) or directing the attention towards the eye region (Dadds, 2006; Stevens et al., 2001). Moreover, cueing towards the eye region has an ameliorating effect on impaired fear recognition, which is often observed in children and youth with high CU traits (Dadds, 2008). This stresses the importance of gaze patterns in the context of fear recognition and potential interaction with the observed hypoactivity of the amygdala.

Attention to the eyes and emotion recognition.

Previous research has shown that children and adolescents with high CU traits are less able to recognize emotions from facial expressions, especially fearful faces (see Cooper, Hobson and van Goozen, 2020 for a review). Yet, research seems inconclusive on whether attention to the eyes is associated with observed impairments in emotion recognition. Some studies find no association between attention to the eyes and emotion recognition in children and youth with high CU traits (e.g., Bedford et al., 2021). The authors argue that observed impairments in emotion recognition arise from dysfunctions in the appraisal of emotional stimuli instead of attentional deficits. On the contrary other studies linked impaired emotion recognition in children with high CU traits to insufficiencies to shift their attention to emotional salient features, such as the eye region for fear recognition (e.g., Bours et al., 2018; Dadds et al., 2008) or the mouth region for happy faces (Demetriou & Fanti, 2021). Thus, the debate is still inconclusive about whether impairments in emotion recognition stem from reduced attention to the eye region or are related to deficits in stimulus appraisal.

Another debate exists on whether decreased attention to the eyes is specific for distress emotions or linked to deficiencies across various emotions. Dadds and colleagues (2006,

2008) suggest that CU traits are linked to pervasive emotion recognition impairments and stem from impairments to spontaneously shift attention towards emotionally salient features such as the eye region across different emotions (Smith et al., 2005; Whalen et al., 2004). In this, the amygdala hypoactivity might be linked to the processing of emotions beyond distress emotions and linked to general impairments to shift attention to the eye region (Dawel et al., 2012; Kyranides et al., 2020).

Attention to the eyes and parenting.

Recent research suggests that gaze patterns in children and youth with CU traits might interact with parenting on the development of CU traits (e.g., Bedford et al., 2017; Levantini et al., 2022b). Results from a longitudinal study depict that fewer mother-directed gazes in infancy are associated with more CU behaviours at a later stage only when maternal sensitivity is low, whereas the main effects of maternal sensitivity and maternal gaze were non-significant (Bedford et al., 2017). These results fit with contemporary research that gene-environment interactions play a crucial role in the development of CU traits beyond substantial genetic factors (Waller & Hyde, 2018). In general, healthy childhood development entails the acquisition of essential skills related to the theory of mind, emotion regulation, and the ability to comprehend and label emotional experiences (Wellman and Liu, 2004; Peterson et al., 2012). Thereby, primary attachment plays a crucial role and attachment styles are often measured through the children's orientation towards the caregiver. Dadds and colleagues (2013) yielded results that lower levels of eye contact in children with high CU traits are largely independent of parental behaviour. They argued that lower levels of eye contact are not merely a representation of attachment between caregiver and child but form a predisposition for the development of CU traits. In addition to eye gaze, similar results indicate that fearlessness, also often considered as an early correlate of CU traits predicts later CU traits only when low levels of parental warmth are present (Waller et al., 2016;

2017). These results stress the importance of parenting styles and the potential interaction effects of parenting and predispositions on the development of CU traits. Importantly, Levantini and colleagues (2022b) found that lower attention to the eyes is a risk factor for the development of CU traits and that negative parenting moderates the link between decreased attention to the eyes and the development of CU traits. The authors suggest that parents who utilize harsh and inconsistent disciplines are potentially more prone to communicate less with their children and to express their emotions more poorly, potentially leaving the child with decreased abilities to recognize and understand the perspectives and emotional states of others. Interestingly, interventions focusing on parent-child interactions are most effective for treating CU traits (see Perlstein et al., 2023 for review). Low levels of parental warmth and the experience of parental harshness are linked to the development of CU traits above genetic factors (Waller, Hyde, Klump, & Burt, 2018). Overall, parenting seems to influence the development of CU traits, yet the question remains whether parenting influences the association between attention to the eyes and CU traits.

Purpose of the present study

The primary objective of this systematic literature review is to offer a comprehensive overview of the existing research on attention to the eyes in the context of CU traits. This review aims to emphasize the connection between attention to the eyes and emotion recognition, along with exploring potential interactions with parenting. The model depicted in Figure 1 will be examined, leading to the central research question:

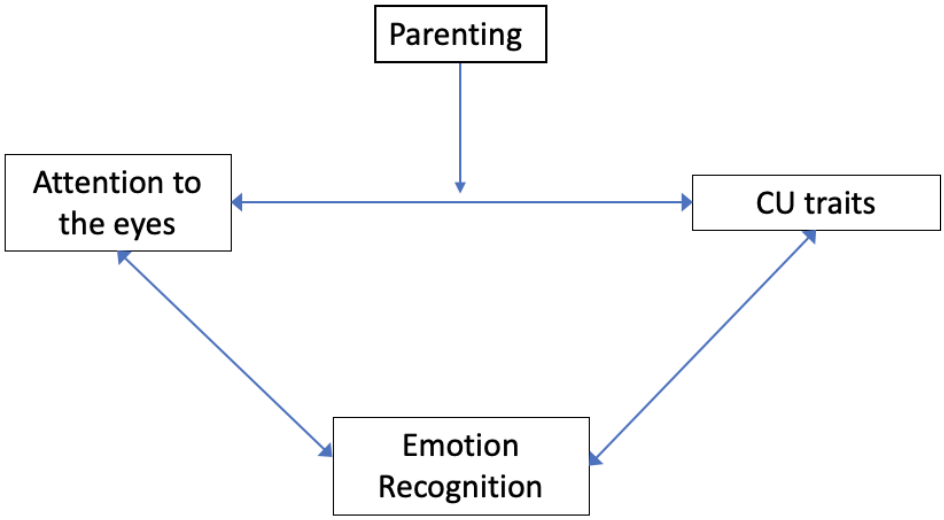
A) What is the evidence base for the association between attention to the eyes and CU traits, and associated emotion recognition deficits, in children and adolescents, and is the link with CU traits affected by parenting?

In order to answer this main research question, the following three sub-questions will be addressed:

1) Are differential patterns in attention to the eyes associated with CU traits?
2) How does attention to the eyes relate to emotion recognition in CU traits?
3) How does parenting relate to the association between attention to the eyes and CU traits?

Figure 1

An explanatory model for the suggested associations between Attention to the eyes and CU traits.



Methods

This literature review followed the actualized Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021). Before the literature review was conducted, a research proposal was formulated and submitted to the University of Groningen. This can be found in the appendix.

The systematic review utilized a comprehensive search strategy to ensure the inclusion of relevant studies that focus on CU traits and attention to the eyes while using children and adolescent samples (see Table 1 for the search terms). Hence, the potential

association between attention to the eyes and emotion recognition and moderation effects of parenting on the link between attention to the eyes and CU traits were also considered. No explicit search strategies were used to identify articles related to these associations, as they were already included by the specified search terms. The inclusion of psychopathic traits in the search was justified because callous-unemotional traits represent the affective facet of psychopathic traits, thus results related to psychopathic traits were relevant to the current literature review. In summary, the search strategy was carefully planned to encompass all the key elements and relevant associations, providing a comprehensive basis for the systematic review.

Eligibility Criteria

Included studies examined the relationship between attention to the eyes and CU traits. Thereby, studies with correlational as well as between-group designs were included. The specific inclusion criteria for this literature review were:

1) For all research aims, the articles should include an established measure of CU traits and a valid measure of attention towards the eyes or eye contact.
    a. For aim 2, the studies should include a valid measure of emotion recognition.
    b. For aim 3, the studies should include a valid measure of parenting or parental behaviour.
2) Samples should include participants with high CU traits to assure validity.
3) Studies that define CU traits as dichotomous (e.g., high CU traits) should include a control group or utilize low CU traits as a reference group.
4) Studies must be fully published in a peer-reviewed journal at the date of the review in English.
5) The studies need to be based on empirical research.

Studies were excluded if the average age was above 18 years and thus based on an adult sample. Furthermore, studies that included cognitive impairments that infer with attention mechanisms such as brain injuries, neurodevelopmental disorders (e.g., autism spectrum disorder), or current substance abuse and did not account for potential confounds in their analysis were excluded. Additionally, studies that solely included participants with a diagnosis of attention deficit hypoactivity disorder and did not control for confounding effects in their analysis were excluded.

Study Identification and Selection

The literature search was performed on PsycInfo, Scopus, PubMed and Web of Science databases. The same search terms were applied to the different databases with adjustments to accommodate the requirements of the databases (see Table 1 for full search terms). Studies were further located through the reference lists of identified studies. In addition, the "cited by" function of Google Scholar for Dadds et al., 2011 was used to identify relevant research. No date restriction was applied because the topic has only recently received scientific attention thus all research is considered important.

Table 1

Search terms for the electronic literature search conducted on 04.06.2023.

Database	PsycInfo	Scopus	PubMed	WOS
Keywords	L1. (callous* OR psychopathy OR psychopathic OR psychopath OR sociopath* OR unemotional) AND L2. (gaze OR eye fix* OR "eye contact" OR "attention to the eyes") AND L3. (child* OR adolesc*)			
Fields	Any Fields (ALL)	Title-ABS-KEY	All Fields	All Fields
Results	53	34	35	42

The PRISMA 2020 flow chart was used for the documentation of the study selection (see Figure 2 in the Results section) and RefWorks was utilized to extract duplicates from the results of the electronic data search via databases. Subsequently, I screened the title and abstract of the articles for the inclusion criteria. A full-text review was conducted for the remaining articles. If articles violated the eligibility criteria, they were classified according to the violation (e.g., No established measure of CU traits; mean age > 18 years).

Quality Assessment

The Appraisal Tool for Cross-Sectional Studies (AXIS) (Downes et al., 2016), which includes 20 questions regarding the introduction, methods, results and discussion of each study was used as an orientation to evaluate the quality of the research. The AXIS tool was used as an indication to evaluate the quality in the process of interpreting the results and not as a selection criterion.

Data Extraction and Synthesis

Data was extracted via three individual extraction sheets for the three research aims (see Appendix). For aim 1, the extraction sheet included descriptions of the sample characteristics (e.g., sample size, age range, type of sample), the measures on CU (e.g., parent report), research methods (e.g., eye gaze measurements) and main results on attention to the eyes and CU traits (e.g., specific numerical data such as means, correlations and significance). For aim 2, the study design to measure emotion recognition was extracted (e.g., portrayed emotions, accuracy measure; presentation time) and the main results specific to emotion recognition and attention to the eyes (e.g., significance levels, confounding variables). For aim 3, the study design to measure parenting was extracted (e.g., observation of parent-child interactions; general parenting measures) and the specific main results of parenting and attention to the eyes (e.g., correlations, significance levels).

The current literature review is organized into three sections, coinciding with the research aims. First, the relationship between attention to the eyes and CU traits is reviewed. Next, the associations between emotion recognition and attention to the eyes are analyzed. Third, the link between parenting and attention to the eyes is examined. Additional results of cueing towards the eye region and mouth region are reported if available.

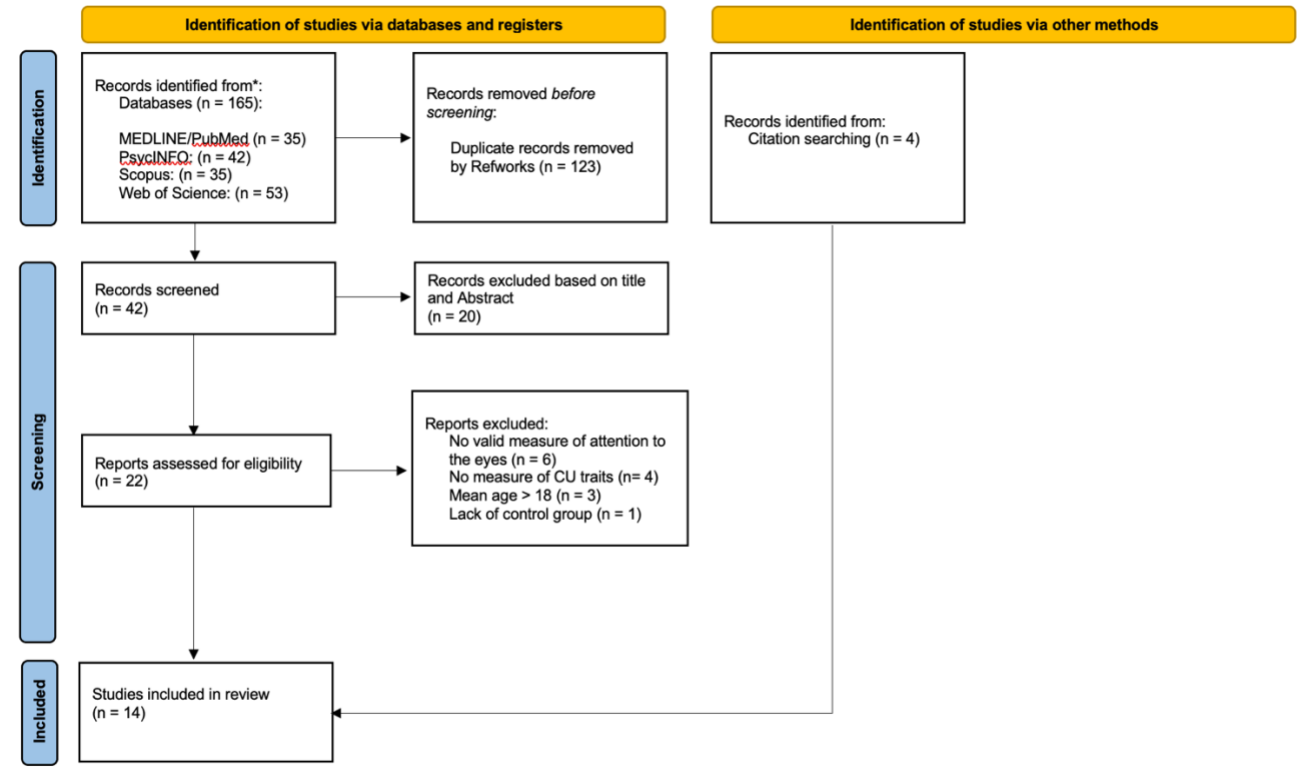
3. Results

Study Selection

The electronic literature search performed on the 4th of June 2023 yielded 165 results and 4 additional articles were identified via the reference list search and the "cited by" method (243 citations, 2nd July 2023). After the exclusion of duplicates from the electronic literature search (*k* = 123), 42 articles were screened for their title and abstracts. Subsequently, I screened the full texts of 22 articles for eligibility to be included in the literature search. Eventually, 10 articles from the electronic search were included in the review. At the full-text review level articles were excluded due to: No valid measure of attention to the eyes (k = 6); no valid measure of CU traits (k = 4); mean age above 18 years (k = 3) and lack of control group (k = 1). Additionally, 4 articles were identified via reference list and "cited by" method leading to a total of 14 articles included in the review (see Figure 2 for the PRISMA flow chart).

Figure 2

PRISMA Flow Chart



Note. This figure presents the PRISMA Flow Chart applied to the systematic literature search. It depicts the different stages of the search strategy and documents the reasons for exclusion.

Study Characteristics

The 14 identified articles were published between 2008 and 2022 and provided data from 1356 children and adolescents (72% male [N = 981]; *M* age = 12.27). Based on age, the group can be distinguished between samples: Children (up to 12 years old; *k* = 7), adolescents (from 12 years old; *k* = 3) and mixed samples of children and adolescents (*k* = 5). Most of the analyzed samples came from European populations (*k* = 12; 5 UK; 3 Italy; 1 Netherlands, 1 Greece; 1 Germany; 1 Switzerland). The remaining studies included samples from Australia (*k* = 2).

Most studies included clinical groups (*k* = 9) composed of participants with a diagnosis of a conduct disorder (CD) or oppositional defiant disorder (ODD) (*k* = 7); a diagnosis of CD (*k* = 2); impulsivity and conduct problems (CP) (Muñoz et al., 2021) or a mixed sample of CD, CP or ODD diagnosis (Dadds et al., 2011). Some studies used non-clinical samples (*k* = 3). In these samples, cut-off scores were defined, and participants were allocated accordingly to high versus low CU traits.

Measures of CU traits

The presence and intensity of CU traits were measured with various instruments including the Inventory of Callous-unemotional Traits (ICU; Frick, 2004) (*k* = 5); the Antisocial Process Screening Device (APSD; Frick & Hare, 2002) (*k* = 4); a combination of the APSD and Strength and Difficulty Questionnaire (SDQ; Goodman, 1997) (*k* = 3), the Child Problematic Inventory (CPTI; Colins et al., 2014) (*k* = 1) and the youth psychopathic traits inventory (YPI; Andershed et al., 2002) (*k* = 1). Different sources of information were used to assess the level of CU traits such as self-, parents- and teachers-reports. Most studies combined multiple sources of information (*k* = 8). Some studies only utilized self-reports (*k* = 3), or parent-reports (*k* = 2) and one study relied on mother-reports only (Dadds, 2012).

Measures of attention to the eyes

Most studies measured attention to the eyes by applying eye tracking in emotion recognition tasks (*k* = 10). Thereby, studies defined the eye region as an area of interest and used different dependent variables for attention to the eyes, such as first fixation duration and eye preference. Some studies measured the attention to the eyes with observations of eye contact (*k* = 3) and one study looked at the reflexive eye movements (saccades) towards the eye region of an emotional stimuli (*k* =1).

Measures of emotion recognition

The studies examining emotion recognition used different emotional stimuli. All studies had a balanced distribution of female and male actors who portrayed the emotion and included adult actors. Two studies additionally included pictures of children who depicted emotions (Dadds et al., 2008; Demetriou and Fanti, 2022). Two studies included different intensity levels of emotions (Bours et al., 2018; Martin-Key et al., 2018) and two studies used static (pictures) and dynamic (videos) portrayals of emotions (Bedford et al., 2021; Martin-Key et al., 2018). Two experiments manipulated the initial fixation to either the mouth region or the eye region (Dadds et al. 2008; Muñoz et al., 2021). These manipulations were either achieved by the inclusion of a marker to direct the gaze to the region of interest (Dadds et al., 2008) or by shifting the faces up or down (Muñoz et al., 2021).

Most studies measured emotion recognition accuracy via multiple-choice screens (k = 8). Two studies additionally asked participants to identify the target emotion previously presented by choosing between another set of pictures portraying emotions (Bedford et al., 2021; Hartmann and Schwenk, 2020). One study asked participants to state the portrayed emotion verbally (Muñoz et al., 2021).

Parenting measures

Most studies that examined the relationship between attention to the eyes and parenting (k = 4) included an observation of interactions between parents and children (k = 3). Additionally, Dadds and colleagues (2012, 2013) measured corporal punishment with a subscale from the Alabama Parent Questionnaire (Shelton, Frick, & Wootton, 1996) and parents' feelings towards their child with a brief version of the parent feelings questionnaire (Deater-Deckard, 2000). They also included a measure of the fathers' psychopathic fearlessness level, which was measured with the Psychopathic Personality Inventory (Lilienfeld & Andrews, 1996). One study (Dadds et al., 2011) utilized the Quality of Family

Environment scale (Rey et al., 1997) and the Griffith empathy measure (Dadds et al., 2008) to measure parenting. Levantini and colleagues (2022b) assessed parenting with the positive and negative parenting subscales of the Alabama Parent Questionnaire (Shelton, Frick, & Wootton, 1996).

Table 2

Results on the association between CU traits and attention to the eyes.

Studies	**Relation between Attention to the eyes and CU traits**			
	No relation	**Specific relation**	**General relation**	**Eye contact**
Bedford et al., (2021)	■			
Bours et al., (2018)	■			
Menks et al. (2021)	■			
Levantini et al., (2022a)		■		
Levantini et al., (2022b)		■		
Martin-Key et al. (2018)		■		
Dadds et al., (2008)			■	
Billeci et al., (2019)			■	
Demetriou & Fanti, (2022)			■	
Muñoz et al. (2021)			■	
Dadds et al., (2011)				■
Dadds et al., (2012)				■
Dadds et al. (2014)				■

Note. This table depicts the yielded results on the potential relationship between attention to the eyes and CU traits. The results are differentiated between specific relations in which links between attention to the eyes and CU traits were only observed for specific emotions and general relations in which attention to the eyes is linked to CU traits across emotions presented.

Results on the proposed association between attention to the eyes and CU traits.

Most studies identified a negative relationship between CU traits and attention towards the eye region or eye contact (k = 11). Some studies found that high CU traits are linked to a general decreased attention to the eye region across different emotions depicted (Bellici et al., 2019; Dadds et al., 2008; Demetriou and Fanti, 2022; Muñoz et al., 2021). Whereas three studies identified that CU traits are significantly linked to decreased attention to the eyes across different emotions depicted (Bellici et al., 2019; Dadds et al., 2008, Demetriou and Fanti, 2022), Muñoz and colleagues (2021) identified non-significant negative correlations between reflexive gaze shifts to the eye region and CU traits. Overall, the presented results provide support for an association between high CU traits and general impairments to shift attention towards the eye region.

Still, some studies identified a more specific negative relationship between CU traits and attention to the eyes (k = 3). Thereby, the link was dependent on the emotions presented (Levantini et al., 2022a; Levantini et al., 2022b; Martin-Key et al., 2018). While Levantini and colleagues (2022b) identified that CU traits were negatively correlated to the first fixation duration to the eye region of pictures depicting negative emotions, they observed no correlation between attention to the eyes and CU traits for positive emotions. One study found specific associations between decreased attention to the eye region and CU traits for sad and disgusted faces (Levantini et al., 2022a) and Martin-Key and colleagues (2018) found a unique significant correlation between reduced initial fixation to the eye region of surprised faces and CU traits. The above-described results depict that CU traits could be associated with differential attentional patterns for different emotions.

In contrast, a few studies found no relationship or a positive link between CU traits and attention to the eyes (Bedford et al., 2021; Bours et al., 2018; Menks et al. 2021). Bours and colleagues (2018) found a marginal negative association between psychopathic traits and

the time needed to fixate on the eye region of fearful faces. In the study of Bedford and colleagues (2021), the fixation cross was placed in the eye region before the emotional stimuli were presented. Interestingly, Menks and colleagues (2021) utilized an implicit emotion recognition task to measure gaze patterns, thereby participants were not explicitly asked to identify the emotions. Overall, the results of no association between CU traits and attention to the eyes could be associated with differences in study design.

Studies focusing on eye contact presented a clear negative relation between high CU traits and eye contact with caregivers (Dadds et al., 2011; 2012; 2013). Whereas participants with high CU traits engaged significantly less in eye contact compared to control groups or participants with low CU traits no significant differences were observed between low CU traits and control groups. These results indicate that lower eye contact may be specific to children with high CU traits.

In general, the results on the relationship between CU traits and attention to the eyes depict that high CU traits are associated with decreased attention towards the eye region. Moreover, it seems that this relationship may depend on the emotions presented.

Results on the proposed association between Attention to the eyes and Emotion recognition.

Some studies report that less attention to the eyes is associated with lower accuracy responses in emotion recognition with varying results on the specificity of the impairment for different emotions (Billeci et al., 2019; Dadds et al., 2008; Demetriou & Fanti, 2022; Levantini et al., 2022 a). Demetriou and colleagues (2022) found that individuals with high CU traits pay less attention to the eyes and make more accuracy errors in identifying emotions across different emotions. Other studies indicated that the association between attention to the eye region and emotion recognition is dependent on the emotions considered. Whereas one study yielded that reduced attention to the eyes observed across different

emotions is uniquely linked with poorer fear recognition (Dadds et al., 2008), another study exclusively linked a lower fixation duration to impaired sadness recognition (Billeci et al., 2019). Levantini and colleagues (2022 a) yielded that reduced attention to the eyes of sad faces is associated with impaired sadness recognition, in contrast, reduced attention to surprised faces was not linked to impaired recognition of surprised faces. Generally, the results suggest that attention to the eyes plays a role in deficits in emotion recognition in youth with CU traits, but it appears to be specific for certain emotions.

Several studies found no association between attention to the eyes and emotion recognition (Bedford et al. 2021; Bours et al., 2018; Hartmann & Schwenck, 2020; Martin-Key et al. 2018; Muñoz et al. 2021). Two specific studies (Hartmann & Schwenck, 2020; Martin-Key et al., 2018) revealed that a preference to look at the eye region was not associated with the relationship between CU traits and emotion recognition. Two other studies found no association between decreased attention to the eyes and Cu traits, thus no association with observed impairments in fear recognition were yielded (Bedford et al., 2021, Bours et al., 2018). Moreover, Muñoz and colleagues (2021) found that saccades to the eye region were unrelated to emotion recognition. Hence, these results suggest that deficits in emotion recognition in children and adolescents with CU traits are not associated with attention to the eyes regardless of the specific emotion presented.

Some studies examined the potential effect of cueing towards the eye or mouth region during the emotion recognition process (Dadds et al., 2008; Muñoz et al. 2021). Muñoz and colleagues (2021) observed more accuracy errors in fear recognition when the initial gaze was cued to the mouth region compared to no cueing or cueing towards the eye region for participants with high CU traits. Similarly, fear recognition seems improved when the eye region is fixated compared to no cue provided or cueing to the mouth region (Dadds et al., 2008). These findings suggest that initial fixation influences the process of fear recognition.

Overall, the results suggest that a potential association between attention to the eyes and emotion recognition would likely be specific to negative emotions and dependent on the initial fixation. Moreover, the initial fixation towards the eye or mouth region appears to play an important role in the recognition of fear.

Results on the proposed association between Attention to the eyes and parenting.

Other studies explored the relationship between parenting and attention to the eyes. The overall findings suggest that lower levels of eye contact are primarily influenced by child behaviour and appear to be independent of maternal behaviour (Dadds et al., 2008; 2011; 2013). Thus, the level of engagement in eye contact from children with high CU traits seems independent of parental behaviour. However, it seems that the father's psychopathic fearlessness is associated with reduced eye contact and higher CU traits (Dadds et al., 2011; 2013). Levantini and colleagues (2022b) found that negative parenting moderated the negative relationship between attention to the eyes and CU traits, such that the link between attention to the eyes and CU traits was stronger for those having experienced more negative parenting. Conversely, the association between attention to the eyes and CU traits seems less influenced by negative parenting in children who pay more attention to the eye region.

Overall, the findings indicate that the connection between attention to the eyes and CU traits remains unaffected by maternal behaviour but could potentially interact with a broader exposure to negative parenting. This interaction appears to be more pronounced in children who allocate less attention to the eyes. Additionally, the involvement of the father's psychopathic characteristics adds another layer of complexity. These results underscore the complexity of the interplay among parenting, attention to the eyes, and the development of CU traits.

Discussion

The aim of this systematic literature was to assess the current literature on the relationship between attention to the eyes and CU traits in child and adolescent samples. Specifically, the role of attention to the eyes in emotion recognition deficits was reviewed as well as potential interaction effects of parenting on the link between attention to the eyes and CU traits. Thereby significant variables such as study design and sample composition were considered.

Proposed association between attention to the eyes and CU traits

Importantly, attention to emotionally salient facial features is a fundamental building block of the development of higher-order human functions such as empathy and theory of mind (Blakemore, 2008; Skuse, 2003). Research on the development of CU traits has indicated that a preference to look at faces in infants is negatively associated with the later CU traits (Bedford, 2015). Similarly, high CU traits seem to be associated with reduced eye contact with caregivers (Dadds et al., 2011; 2012; 2014). Moreover, low levels of eye contact seem to be uniquely present in children with high CU traits and not in children with low CU traits (Dadds et al., 2013). Thus, the results indicate that lower levels of eye contact are only observed in children with high CU traits and could be an important aspect of the development CU traits.

Most studies included in this review found that CU traits correlate with lower attention towards the eye region. However, results differed on whether the association is specific for certain emotions or more general across emotions. In some studies, CU traits were linked to reduced attention to the eyes irrespective of the emotion presented (Bellici et al., 2019; Dadds et al., 2008; Demetriou and Fanti, 2022; Muñoz et al., 2021). These results are in line with the hypothesized model that CU traits arise from a lack of spontaneous attention to the eye region across different emotions (Dadds et al., 2006; Dadds et al., 2013).

Some studies observed that participants with high CU traits paid less attention to the eyes only when specific emotions were presented. Thereby, CU traits were linked to decreased attention to negative emotions, and surprised or sad and disgusted faces (Levantini et al., 2022a; Levantini et al., 2022b; Martin-Key et al., 2018). These results underline a more specific association between CU traits and attention to the eyes. Yet, the results were not specific to distress cues as previously suggested by Blair and colleagues (2006). Therefore, these results seem to support a more pervasive association between CU traits and attention to the eye than a distress-specific association.

Other studies found no association between attention to the eyes and CU traits irrespective of the emotions considered. Several methodological aspects may explain these findings. One study used a fixation cross that was placed at the height of the eye region of the subsequent emotional picture (Bedford et al., 2021). It is noteworthy that cueing towards the eye region may cause subsequent attention to the eyes (Dadds et al., 2008; Munõz et al., 2021). In another study, an implicit emotion recognition task was used, potentially reducing the relevance of the eye region for the task (Menks et al., 2021). Consequently, participants may have paid less attention to the eye region compared to explicit emotion recognition tasks. Previous research has shown that amygdala activity is decreased during implicit emotion recognition tasks compared to explicit emotion recognition tasks (Habel et al., 2007). Given the potential link between attention to the eyes and amygdala hypoactivity in children and youth with high CU traits (Blair, 2011), it is crucial to account for variations in task design. Implicit emotion recognition tasks offer the advantage of replicating more naturalistic eye gaze patterns. Henceforth, it could be interesting for future research to investigate whether observed associations between decreased attention to the eyes and CU traits are only present in explicit emotion recognition tasks. At large, the observed non-relations between CU traits and attention to the eyes could be explained by differences in study designs. Thus, further

homogenization of research methods would benefit the comparability of research, as well as the extension of experimental designs to measure more naturalistic eye gaze behaviour such as implicit emotion recognition tasks.

Overall, the results of the literature review seem to depict an association between attention to the eyes and high CU traits and thus are in line with the hypothesized model. Thereby, the results suggest that lower levels of attention towards the eyes are not specific distress emotions and are more pervasive. Yet, it remains unclear whether a general decrease in attention to the eyes is task-specific, thus future research would benefit from utilizing more naturalistic observations of eye gaze behaviour such as implicit emotion recognition tasks or observations during live social interactions (Gehrer et al., 2020).

Proposed Association between attention to the eyes and emotion recognition

Some studies identified that reduced attention to the eyes is associated with impairments in emotion recognition (Billeci et al., 2019; Dadds et al., 2008; Demetriou and Fanti, 2021; Levantini et al., 2022a). These associations were mostly specific to certain emotions and not prevalent for other emotions. Moreover, the studies that depict an association between decreased attention to the eyes and impaired emotion recognition for specific emotions utilized only male-based samples (Billeci et al., 2019; Dadds et al., 2008; Levantini et al., 2022a). Typically, in the process of emotion recognition, the attention is shifted towards the emotionally salient features such as the eye region for fearful faces or the mouth region for happy faces (Eisenbarth & Alpers, 2011; Wells et al., 2016). Therefore, researchers argue that impairments to shift attention to the eye region could explain selective deficits in recognizing fear (e.g., Adolphs et al., 2005). Yet only one study identified a unique association between attention to the eyes and deficits in fear recognition in boys with high CU traits (Dadds et al., 2008). This result is in line with Blair´s “Violence Inhibition

Mechanism" (2006) which suggests that cold and unremorseful behaviour in high CU traits individuals is associated with an inability to identify distress emotions in others.

Others found an association between attention to the eyes and impairments in sadness recognition in boys with high CU traits (Belleci et al., 2019; Levantini et al., 2022 a). Previous research has shown children and youth with high CU traits are a heterogeneous group (Coto et al., 2018). One study identified that differential clusters within CU traits based on reactive or proactive aggression were linked to impairments in fear recognition. In the high reactive aggressive cluster individuals with high CU traits showed additional deficits in the recognition of sadness and disgust (Kleine Deters et al., 2022). Thus, differences in observed impairments in emotion recognition for specific emotions could be associated with different clusters within CU traits. Yet attention to the eyes was not considered in these studies. Future research could explore whether variations in CU traits are associated with differences in the relationship between attention to the eyes and emotion recognition. One study included in the review yielded that lower attention to the eye region in children including male and female participants with high CU traits is related to more general impairments in emotion recognition (Demetriou and Fanti, 2021). This result points in the direction that CU traits are linked to more pervasive impairments in emotion recognition (Dawel et al., 2012) and may originate from impaired attention to the eyes. Overall, the results indicate that deficits in emotion recognition could be associated with decreased attention to the eye region for specific emotions. Still, the association between emotion recognition and attention to the eyes is likely to be more pervasive than a selective association of attention to the eyes with fear recognition.

On the contrary, multiple results indicated that attention to the eyes is unrelated to observed impairments in emotion recognition (Bedford et al., 2019; Bours et al., 2018; Hartmann & Schwenck, 2020; Martin-Key et al., 2018; Muñoz et al., 2021). Most of these

studies yielded that CU traits are associated with impairments in fear recognition (Bours et al., 2018; Hartmann & Schwenck, 2020; Martin-Key et al., 2018; Muñoz et al., 2021, whereas one study yielded impairments in the recognition of anger and happy faces (Bedford et al., 2021). Martin-Key and colleagues (2018) argued that observed deficits in fear recognition may not arise from decreased attention but from an impaired appraisal of the emotional stimuli. Interestingly the role of attention to the eyes in emotion recognition may differ between boys and girls with high CU traits, as girls seem to pay more attention to the eye region (Hartmann & Schwenck, 2020; Martin-Key et al., 2018). Based on these results, the authors argued that an association between the preference to look at the eye region and emotion recognition could be specific for boys (Hartmann & Schwenck, 2020). Most research that yielded an association between attention to the eyes and emotion recognition utilized boys-only samples (Billeci et al., 2019; Dadds et al., 2008; Levantini et al., 2022). Moreover, Martin-Key and colleagues (2018) found that initial fixation on the eye region is related to fear recognition in high-intensity portrayals. Thus, the intensity of the emotion depicted could influence the association between attention to the eyes and fear recognition. Overall, the above-described results suggest that general impairments in emotion recognition may not arise from decreased attention to the eyes, however, it seems that attention to the eyes could be an important aspect in the recognition of sadness or fear for boys with high CU traits. Moreover, the intensity of the emotional stimuli may influence attention to the eyes and the association with impaired fear recognition.

Moreover, cueing the attention towards the eye region can ameliorate deficits in fear recognition (Dadds et al., 2008). The associated improvement in fear recognition is not maintained when the instructions are not presented anymore. Initial results indicate that maintenance of shifting the attention towards the eye region of fearful faces can be achieved through extensive training and associated impairments in fear recognition can be ameliorated

(Muñoz et al., 2021). These results underline the importance of the eye region in the process of fear recognition and that stable improvements in fear recognition could be achieved through extensive training. Yet, until now no longitudinal study has looked at the relationship between attention to the eyes and fear recognition, thus no conclusions can be drawn on the causal relationship between attention to the eyes and potential impairments in fear recognition (Blair, 2011). Henceforth future research could aim to investigate the temporal association of attention to the eyes and the development of CU traits through longitudinal studies.

Overall, the results of a potential association of attention to the eyes and emotion recognition are inconclusive. Yet, the eye region seems important in the process of recognizing certain emotions and the association might be only present in boys. Future research could benefit from analyzing potential interaction effects of gender and attention to the eyes to further understand the potential association between attention to the eyes and emotion recognition in children and youth with CU traits.

Potential association between parenting and the relationship between Attention to the eyes and CU traits

Previous reviews emphasized the role of parenting in the development of CU traits (Hawes et al., 2014; Waller et al., 2013; Wilkinson et al., 2016). It has been suggested that parenting may interact with predispositions for the development of CU traits such as decreased attention to the eyes (Bedford et al., 2017). The results of the current literature review underline that lower levels of eye contact are likely driven by the child and relatively independent of parental behaviour (Dadds et al., 2011; 2012; 2013). These results would suggest that attention to the eyes in children with high CU traits is not affected by parental behaviour and thus would be a correlate of CU traits. Levantini and colleagues (2021b) found that children who had a lower first fixation duration to the eyes and experienced high levels

of positive parenting scored high on CU traits, whereas children with longer initial fixation to the eye region and high levels of positive parenting had low CU traits. Thus, it seems that the association between low attention to the eyes and CU traits is relatively independent of positive parental behaviour. The authors suggested that children with low attention to the eyes could be associated with the "primary" variant of CU traits, which is thought to be less affected by environmental factors such as positive parenting compared to the "secondary" variant of CU traits (Dadds et al., 2018). Concerning negative parenting in the aforementioned study, the results indicate a moderation effect of negative parenting on the association between low levels of attention to the eyes and the development of CU traits. Hence, children with low levels of attention to the eyes and high experience of negative parenting were among the highest-scoring children on CU traits in their sample, whereas children with similar levels of attention to the eyes and lower levels of negative parenting scored lower on CU traits (Levantini et al., 2021b). Thus, it seems that negative parenting affects the development of CU traits in children with lower attention to the eyes. Overall, the level of attention to the eyes seems greatly independent of positive parenting, whereas negative parenting might moderate the association between attention to the eyes and CU. Yet, these results are based on very limited data and are thus rather speculative in nature, hence more research is needed on the potential interaction between parenting and the association between attention to the eyes and CU traits.

Strength, Limitations and recommendations for future research.

The results of the current literature review should be considered in light of multiple limitations. Firstly, the suggested model includes multiple differential aspects of CU traits such as attention to the eyes, emotion recognition and parenting. Potential differences in CU traits, such as severity or differential clusters within CU traits were not in the scope of this review. Thus, future research would benefit from highlighting potential moderating variables

such as the severity or origin of the association between CU traits and potential deficits in attention to the eyes.

Moreover, different study designs and methodologies were included. This could influence the validity and comparability of the yielded results. Thereby, important factors to be considered are the age of the actor presenting the emotion and the emotion recognition task at hand (static versus dynamic emotion recognition tasks). In this, a closer approximation of naturalistic settings has the advantage of mimicking the daily interactions of the observed participants. However, it comes at a cost of accuracy to interpret whether the attention is directed towards the eye region and could be misinterpreted (mouth versus eye region). This complicates the interpretation of the results regarding the specificity of the attentional bias. Still, future research would benefit from utilizing more naturalistic settings than static emotion recognition tasks to test the validity of the association between attention to the eyes and emotion recognition. Bedford and colleagues (2021) included static as well as dynamic emotion recognition tasks, they found that CU traits were only associated with impairments in emotion recognition in the static condition. The authors suggested that the differences in observation could be associated with the more engaging and active nature of the dynamic recognition tasks. Yet, recent research found no differences between dynamic and static emotion recognition tasks for children with high CU traits (Powell et al., 2023). To further understand the association between CU traits and attention to the eyes future research could benefit from using more ecological emotion recognition tasks.

Concerning the potential moderation effect of parenting only a few studies have been identified, thus no conclusion can be drawn. Moreover, Dadds and colleagues (2011, 2012, 2014) included tasks in which caregivers were instructed to express affection. These tasks may only portray the ability to express affection instead of delivering an indication of more general behaviour. Thus, more general indications of parental behaviour could be beneficial

to gain a better understanding of a potential moderation effect of parenting on the association between attention to the eyes and CU traits.

Moreover, most participants were male thus it is difficult to generalize the results across gender groups. This seems especially crucial in the context of the potential association between attention to the eyes and emotion recognition since currently most studies that found such an association are based on male samples. Additionally, no longitudinal studies were included thus no conclusion can be drawn on the causal relationship between attention to the eyes and the development of CU traits. Henceforth, future research could focus on the potential role of gender in the association between attention to the eyes and CU traits. Moreover, longitudinal studies would be needed to understand the temporal association between attention to the eyes and the development of CU traits.

Conclusion

Overall, the results of the current literature review highlight the complexity of CU traits. Thereby, the hypothesized model of the potential association between attention to the eyes, emotion recognition and parenting was only partially confirmed. Overall, the results of this review do support attention to the eyes as a correlate of CU traits, which may also in part explain the emotion recognition deficits frequently observed in individuals with high CU traits. However, studies differ in the degree to which they link this to specific emotions or emotions in general. Moreover, mostly boys-based samples identified such an association, whereas most cross-gender studies found no association. Hence future research could investigate whether a potential association between attention to the eyes and emotion recognition in children and adolescents with CU traits is gender specific. Regarding parenting, the results support that negative parenting moderates the association between attention to the eyes and CU traits. Still, the association between attention to the eyes and CU traits seems relatively independent of positive parenting. In general, this review is a first

attempt to summarize the literature on the complex association of attention to the eyes, emotion recognition and parenting in the context of CU traits. Thereby, it is stressed that no conclusions on the validity of the model can be made due to several limitations. Still, it provides indications and highlights potential implications for future research.

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Appendix

Table 1

Studies examining the relationship between CU traits and Attention to the eyes.

Study	Participants			CU Measure	Attention to the eyes			Control variables	Main outcome specific to attention to the eyes
	N (female)	Sample type	Age range (*M; SD*)		Stimuli	AOI	Measurement		
Bedford et al. (2021)	N = 293 (140 males)	Community	7-year-old children (*M* = 7.25; *SD* = 0.23)	ICU Total Score (PR; *M* = 17.08*; SD = 7.8)*	Static and dynamic Facial	Around eye region	Looking time to the eyes÷ Total looking time	Age; sex; socioeconomic deprivation	No main effect of CU traits on attention to the eyes (B = -0.001, p = 0.482) in dynamic and static.
Billeci et al. (2019)	N = 58 CD = 16 ODD =19 Control = 23	Clinical	7 – 10 (*M* = 8.90)	APSD (combined PR and TR; *M* = 8.77; *SD* = 2.36; Control: M = 4.76; SD = 0.89)	Facial	Face, eyes, mouth	Number of fixations, average length of fixation, length of first fixation *threshold > 100ms*	Age; income; IQ; externalising behaviour	Elevated CU traits were associated with a lower number of fixations ($p < 0.01$) and lower average fixation duration ($p < 0.01$) to eye region.

Study	Participants			CU Measure	Attention to the eyes			Control variables	Main outcome specific to attention to the eyes
	N (female)	Sample type	Age range (*M; SD*)		Stimuli	AOI	Measurement		
Bours et al. (2018)	N = 122 ASD = 50 ODD or CD = 44 **41 % comorbid ADHD* Control = 28	Clinical	12 – 19 (*M* = 15.26; *SD* = 1.9)	ICU (SR; PR YPI Total score and CU subscale (SR)	Facial	Eyes, mouth, rest of image	Total fixation duration, time for first fixation, percentage of total fixation	Age; comorbidity (ADHD); ethnicity parents; FSIQ; medication; parent education; proactive aggression	1. Psychopathic traits within CD/ODD group were nominally negatively correlated with the time of first fixation for fearful faces (*r* = 0.35, *p* = 0.02), did not survive Bonferroni correction. 2. No correlation between CU traits and eye tracking variables and other emotional faces (happiness, sadness, neutral, anger).
Dadds et al. (2008)	N = 100 (-)	Community	8 – 15 (*M* =	Combined APSD and SDQ	Facial	Eyes, Mouth	Mean number of fixations;	Antisocial; emotional problems/anxiety;	High CU traits were associated with decreased

Study	Participants			CU Measure	Attention to the eyes			Control variables	Main outcome specific to attention to the eyes
	N (female)	Sample type	Age range (*M; SD*)		Stimuli	AOI	Measurement		
			12.4; *SD* = 2.2)	(combined PR and SR; highest score counts) HCU > 75th; LCU < 25th			mean length of fixation; number of times looking at AOI	hyperactivity; peer problems	number, length, and first order fixations to the eye region for all emotions.
Dadds et al. (2011)	N = 92 (-) **Primary diagnoses of conduct problems; CD or ODD*	Clinical	5 – 16 (*M* = 8.93; *SD* = 2.71)	Combined APSD and SDQ; (combined TR; PR and SR; highest score counts) High CU > 75th Low CU < 25th	Facial, Eye contact between parent and child	Eyes	(Number of times of eye contact ÷ number of times the dyad interacted) * 100	Age; adults at home; gender; marital status; mother´s and father´s education; number of informants for CU traits; siblings at home	1.Lower eye contact of children with high CU traits towards parents than low CU traits children ($p < 0.0039$). 2.Correlations between CU traits and eye contact (free play: child-mother $r = -0.242$, $p = 0.01$; child-father $r = -0.017$, $p = 0.462$; emotion talk: child-mother r = -

Study	Participants			CU Measure	Attention to the eyes			Control variables	Main outcome specific to attention to the eyes
	N (female)	Sample type	Age range (*M; SD*)		Stimuli	AOI	Measurement		
									0.259, $p = 0.05$; child-father $r = -0.442$, $p = 0.029$)
Dadds et al. (2012)	N = 24 (-) ODD = 12 CG = 12	Clinical	4 – 8 (*M* = 5.9; *SD* = 0.6)	APSD (MR) High CU = upper third Low CU = remaining	Facial, eye contact between Mother and child	Eyes	Combined score for Initiated or rejected (reversed) eye contact	Age; ASD; ethnic identity; gender; household income diagnostic severity of ODD	1. Lower eye contact from children with HCU children in comparison to LCU children and control ($F(2, 24) = 3.31$, $p = 0.05$); no difference between low CU traits group and control group. 2. Correlation of CU traits and eye contact ($r = -0.325$) after controlling for Ethnic identity, household income, age, gender,

Study	Participants			CU Measure	Attention to the eyes			Control variables	Main outcome specific to attention to the eyes
	N (female)	Sample type	Age range (*M; SD*)		Stimuli	AOI	Measurement		
									diagnostic severity of ODD, CAST score
Dadds et al. (2013)	N = 99 (41) ODD = 60 CG = 39	Clinical	4 – 8 (*M* = 5.64; *SD* = 1.58)	Combined APSD and SDQ; PR; Combined UNSW; PR; TR for 50 children; continuous and High CU = upper third Low CU = remaining	Facial, eye contact between mother and child	Eyes	Initiated or rejected eye contact	ASD; Severity of ODD; SDQ total score	1. No significant difference between control and low- clinic CU traits; high-clinical CU traits had significant lower eye contact than both groups. 2. Eye contacted was not related to levels of ASD.
Demetriou & Fanti (2022)	N = 59 (27) High CU = 31 (14) Low CU = 28 (13)	Community	5 – 10 (*M* = 7.5)	CPTI CU subscale (combined mean score FR and MR)	Facial	Eyes, Mouth	Total fixation duration; average fixation duration	Child/adult picture; check for epilepsy, Gender; serios physical or mental handicap	Lower attention to the eyes (d = 0.61) and more attention to mouth region (d = 0.65) in high CU traits than

Study	Participants			CU Measure	Attention to the eyes			Control variables	Main outcome specific to attention to the eyes
	N (female)	Sample type	Age range (*M; SD*)		Stimuli	AOI	Measurement		
				High CU > 1 SD Low CU < 1 SD					low CU traits for all emotions ($F(3, 171) = 27.19$, $p < 0.001$, $\eta 2 = 0.35$).
Hartmann & Schwenck (2020)	N = 94 (38) ODD = 29 (7) CD = 1 (1) ** 29% comorbid ADHD* CG = 49	Clinical Community	8 – 14 (*M* = 10.4)	ICU total score (PR)	Facial	Eyes, Mouth	Fixation count = mean number of fixations to the eyes – mean number of fixations to mouth; Total fixation duration = mean time fixating eyes – mean time fixating mouth	Age, externalizing behaviours; gender	1.No evidence that a preference to look at the eyes mediated the association between CU traits and the recognition or categorization of emotional faces. 2. Higher eye preference in girls than boys.
Levantini et al. (2022 A)	N = 116 (-) ODD = 94	Clinical	7 – 12 (*M* = 9.0; *SD* = 1.29)	APSD subscales (Combined; highest	Facial	Face, eyes, mouth	Fixation count (FC), fixation duration	Age; externalizing problems; IQ; psychopathic	1. CU traits associated to fixation count to the eyes of

Study	Participants			CU Measure	Attention to the eyes			Control variables	Main outcome specific to attention to the eyes
	N (female)	Sample type	Age range (*M; SD*)		Stimuli	AOI	Measurement		
	CD = 22 ** 48.28 % comorbid ADHD*			score; PR and TR)			(FD), first fixation duration (FFD). **Calculated FD and FC for each AOI as percentage of the overall FD or FC for whole face* *threshold > 100ms*	traits (impulsitivity; narcissism); SES	sad faces (r = -0.225, p = 0.038) and first fixation duration to the eyes of disgusted faces (r = -0.253, p = 0.019). 2. Negative correlation FFD to the mouth of angry faces and CU traits (r = −.283, p = .008).
Levantini et al. (2022 B)	N = 92 (-) ODD = 80 CD = 12	Clinical	7 – 12 (*M* = 9.0; *SD* = 1.29)	APSD subscales (Combined; highest score; PR and TR)	Facial	Face, Eyes, mouth	Fixation count, fixation duration, first fixation duration (FFD).	Age; externalizing problems score; SES	CU traits were correlated to FFD to the mouth of positive emotions (r = -0.231, p < 0.05) and FFD to the eyes of negative

Study	Participants			CU Measure	Attention to the eyes			Control variables	Main outcome specific to attention to the eyes
	N (female)	Sample type	Age range (*M; SD*)		Stimuli	AOI	Measurement		
							threshold > 100ms		emotions (r = -0.231, p < 0.05).
Martin-Key et al. (2018)	N = 101 (49) CD = 50 (24) ** 34% comorbid ADHD* CG = 51 (25)	Forensic & Community	13 – 18	ICU total score (SR)	Facial static and dynamic	Eyes and mouth	Initial eye preference and total eye preference	CD status, gender; emotional intensity; IQ; SES; stimulus type (dynamic vs. static); emotional intensity	1. CU traits were not significantly correlated with initial or total eye preference across all emotional expressions. 2. CU traits were associated with a reduced initial fixation to the eyes with surprised faces (r = 0.20). 3. CU traits interacted with emotional intensity to predict initial

Study	Participants			CU Measure	Attention to the eyes			Control variables	Main outcome specific to attention to the eyes
	N (female)	Sample type	Age range (*M; SD*)		Stimuli	AOI	Measurement		
									eye preference for surprise.
Menks et al. (2021)	N = 58 (39) CD = 23 (14) **26% comorbid ADHD* CG = 35 (25)	Clinical & Community	14 – 19 (M_{CD} = 16.7; M_{CG} = 16.6)	YPI; CU subscale (SR)	Facial	Eyes and remaining screen	Number of fixations (FC); Fixation duration (FD) ** Removal of blinks and correction for small head movements; excluded data from >60% with <500ms*	Age; gender; IQ	Positive correlation between CU traits and fixations to the mouth (r = 0.613, p =.004), but not to the eye region within CD group. No significant relation between CU traits and eye gaze pattern in CG.
Muñoz et al. (2021)	N = 73 (12) ** 52 % comorbid ADHD*	Clinical	11 – 16 (*M* = 14.0)	ICU total score (SR); 60 participants	Facial	Eyes and mouth	Saccades towards facial features presented in periphery;	Age; Anxiety; ICP	1. CU traits were not significantly related to saccades to the eye region of fearful faces

Study	Participants			CU Measure	Attention to the eyes			Control variables	Main outcome specific to attention to the eyes
	N (female)	Sample type	Age range (*M; SD*)		Stimuli	AOI	Measurement		
							velocity and acceleration. * *Thresholds of 30◦/s and 8000◦/s2;* trials with saccades >1° or eye blinks during -300 to 150ms were invalid		(fix mouth: *r* = -0.09; fix eye: *r* = - 0.08); non-significant results for other emotions; however, correlations were negative showing indication for impairments to shift attention. 2. Reduced eye gaze shifts of participants with ICP; interaction effect with callousness; controlled for other facets of CU traits.

Note. ADHD = Attention deficit hyperactivity disorder; APSD = Antisocial Process Screening Device; ASD = Autism spectrum disorder; CD = Conduct disorder; CG = Comparison group; CP = Conduct problems; CU = Callous-unemotional; FR = Father report; ICU = Inventory of Callous-unemotional traits; *M* = Mean; MR = Mother report; ODD = Oppositional defiant disorder; PR = Parent report; *r* = Correlation; SD =

Standard Deviation; SDQ = Strength and Difficulty Questionnaire; SR = Self-report; TR = Teacher report; UNSW = University of South Wales; YPI = Youth Psychopathic Traits Inventory.

Table 2

Studies examining the relationship between attention to the eyes and emotion recognition in the context of CU traits.

Study	Emotion recognition			Main outcome specific to attention to the eyes and emotion recognition
	Type of Stimuli	Emotions	Measurement	
Bedford et al. (2021)	Static: 20 trials; pictures from NimStem (4 actors; 50% female; all white); presented for 2s. Dynamic: 20 trials; videos (4 female actors; all white); 1.5s of motion; 1s freeze frame of expression.	Happy Sadness Fearful Neutral Angry	Static: A choice between the five different emotions; left until the choice was made. Dynamic: Choice screen portraying 4 different emotions of different actors; presented for 8s; (3-quarter views, location of previous presented fixation cross varied between central nose bridge and left eye) 50% averted and 50% direct gaze	1. Static: Marginally significant effect between Emotion recognition and CU-traits (p = 0.05); posthoc: reduced recognition for anger (Wald χ^2 = 6.059, B = -.037, p = 0.14) and happy (Wald χ^2 = 7.745, B = -.064, p = 0.05) and not for any other emotion (all $p > 0.359$); diminished when autistic traits were added ($p = 0.151$); main effect of autistic traits on all emotions ($p = 0.003$). 2. Dynamic: No significant main effect of CU-traits (B = .005, $p = 0.550$), covariate sex was significant (p = .007; greater ER accuracy in females; main effect of autistic traits (p = 0.27) reduced ER.
Billeci et al. (2019)	24 trials; pictures from NimStem (4 actors;	Happy Sadness	Accuracy, choice between six emotions, no time limit,	1. Elevated CU traits and lower ability to recognize sadness ($p < 0.05$)

Study	Emotion recognition			Main outcome specific to attention to the eyes and emotion recognition
	Type of Stimuli	Emotions	Measurement	
	50% female); presented for 4s	Fearful Neutral Angry Disgusted	instructed to be as fast as possible.	2. In children with DBD a shorter average length of fixation on the eye region of sad faces has been associated with higher CU traits FD ($p < 0.05$). This has in turn been associated with a lower ability to recognize sadness which suggests that the relation between elevated CU and poor sadness recognition could be mediated by FD in the group with DBD diagnosis.
Bours et al. (2018)	60 trials; 2 sessions each 30 trials; pictures from NimStem (balanced on gender, ethnicity, adult age range); presented for 6s. **Intensity of emotions varied*	Happy Sadness Fearful Neutral Angry	Accuracy, choice between five emotions, % of correct answers.	Psychopathic traits within CD/ODD group were nominally negatively correlated with time of first fixation in the process of recognizing fearful faces ($r = 0.35$, $p = 0.02$), however the difference did not survive Bonferroni correction.
Dadds et al. (2008)	UNSW facial emotion task: First free gaze: 6 faces (2 adults, 2 adolescents, 2 child); presented for 2 seconds.	Happy Sadness Fearful Neutral Angry Disgusted	Accurracy, choice from booklet between six emotions	1. High CU traits were associated with poorer fear recognition, not evident in eye gaze condition. Not with any other emotion. 2. Fear recognition accuracy and FD ($r = 0.327$) as well as FFC_E ($r = 0.501$) in high CU traits group.

Study	Emotion recognition			Main outcome specific to attention to the eyes and emotion recognition
	Type of Stimuli	Emotions	Measurement	
	Eye-gaze condition & mouth-gaze: Instruction to focus on eyes or mouth supported by slide with X placed in the corresponding region (1 second); 2 Adult pictures.			
Demetriou & Fanti (2022)	32 trials; pictures from Montréal Pain and Affective Face Clips (MPAFC) (4 actors: 2 children, 2 adult); presented for 3s	Happy Sadness Fearful Angry	Accuracy; Choice from four emotions. The sum of all misclassifications was measured.	1. High CU traits (M = 3.07, SE = 0.10) participants made more accuracy errors irrespective of emotions presented than low CU traits participants (M = 2.71, SE = 0.10, d = 0.67). 2. No difference in fixation patterns between children and adult pictures.
Hartmann & Schwenck (2020)	Emotion recognition: 36 trials; Pictures from Radboud faces Database; find target emotion amongst three emotional faces of same actor (18 actors, 50% female, all Caucasian). Emotion categorization:	Sadness Fearful Angry	Emotion recognition: mean reaction time for each emotion; Short buzzer sound for wrong response and repeat task until correct. Accuracy; number of mistakes; no time limit; instructed to answer correct and fast.	1. Emotion recognition task. Higher CU traits were linked to longer time needed to identify angry (p = 0.002), fearful (p = 0.010) and sad (p = 0.020) facial expressions. CU traits did not predict error rate in emotion recognition. 2. Emotion categorization Higher CU levels predicted greater number of errors across all emotions (p = 0.045). Children with higher CU traits tended to make more mistakes in anger recognition. 3. Eye gaze

Study	Emotion recognition			Main outcome specific to attention to the eyes and emotion recognition
	Type of Stimuli	Emotions	Measurement	
	First block: 30 trials; pictures from Radboud faces Databases (10 actors, 50% female); presented for 2 seconds. Second Block: 60 trials like first block but picture only depicting lower half (mouth region) or upper half (eye region) of emotional picture.			No evidence that a preference to look at the eyes mediated the association between CU traits and the recognition or categorization of emotional faces.
Levantini et al. (2022)	24 trials; pictures from NimStim (4 actors, 50% female); presented for 4s.	Happy Sad Fearful Neutral Angry Disgusted	Accuracy; choice between six emotion labels	CU traits were significantly associated with impaired sadness recognition (r = - 0.385, p < 0.001; not for anger (r = - 0.164), fear (r = - 0.063), disgust (r = - 0.006), happiness (r = -0.159), neutral (r = 0.098).
Martin-Key et al. (2018)	Static: 156 trials; pictures from Amsterdam facial dynamic expression set (8 actors, 50% female, intensity, elliptic mask	Happy Sad Fearful Neutral Angry Disgusted Surprise	Accuracy; choice between seven emotion labels; instructed to answer quick and accurately, unlimited time.	1. CU traits were associated with poorer fear recognition (r = 0.30) across whole sample. Within CD group, higher CU traits were associated with better fear recognition. 2. Initial and total eye preference significantly improved the best-fitting model (small effect sizes). The addition of

Study	Emotion recognition			Main outcome specific to attention to the eyes and emotion recognition
	Type of Stimuli	Emotions	Measurement	
	to hide hair), 4 blocks with each 39 trials, presented for 1s. **Intensity of emotions varied (30%, 50%,70%,100%)* Dynamic: 56 Stimuli, videos from Amsterdam facial dynamic expression set (8 actors, 50% female, elliptic mask to hide hair); transition from neutral to full emotion in 1s.			eye preference had no effect on the influence of CU traits on accuracy, thus no mediation effect of eye preference. 3. Greater initial eye preference was related to better fear categorisation only for high intensity expressions; however an opposite relation was found for low intensity expressions. 4. Emotion categorization accuracy increased with increased intensity of the emotional stimuli. CD interacted with intensity for disgust, the improvements were significantly lower for CD group over CG. 5. Emotion categorization accuracy was higher in dynamic condition for all emotions except fear and disgust.
Muñoz et al. (2021)	160 trials; pictures from KDEF, NimStem, pictures of facial affect, FACES database (40 individual faces, 50% female, elliptic mask to hide hair); 3 Sessions with 55, 55, 50 trials. Stimuli	Happy Fearful Neutral Angry	Accuracy; verbal question about facial expression presented, chin rest	1. Saccades to the eye region were not significantly related to emotion recognition (fear: $r = 0.05$; anger: $r = 0.09$; neutral: $r = 0.11$; happy: r=- 0.09)- 2. CU traits were significantly related to poorer fear recognition in mouth fixation ($r = - 0.20$; $p < 0.05$); no significant difference regarding fear recognition across mouth fix and eye fix condition ($t(50) = 0.53$, $p = 0.596$).

Study	Emotion recognition			Main outcome specific to attention to the eyes and emotion recognition
	Type of Stimuli	Emotions	Measurement	
	presented for either 150 ms (brief) or 3000 ms (extensive). ** Faces were shifted up or down to control initial fixation to either mouth or eyes (randomn)*			

Note. CD = Conduct disorder; CP = Conduct problem; CU = Callous-unemotional; KDEF = Karolinska Directed Emotional Faces; *M* = Mean; UNSW = University of South Wales.

Table 3

Studies examined the role of parenting in relation to attention to the eyes and CU traits.

Study	Sample	Parenting measure		Measurement	Main Outcomes on the Relationship between parenting and CU Traits
		Experimental Task	General parenting		
Dadds et al., 2011	Mixed age group; Clinical; sample size = 92 (-); CP, ODD or CD diagnoses	Free Play: Families were instructed to play freely (10- 15 minutes) and draw a family picture (10 - 15 minutes) and agree on one word that describes each person. Emotion talk: Parents and children were instructed to discuss a happy and a sad time they recently experienced together.	Child´s environment (Quality of Family Environment Scale; QFE) Trait cognitive- & emotional empathy of mother (Griffith empathy Measure; GME)	Five psychologists using FOS-VI. Multistage coding: global (contextualize) – general levels of engagement, talk and warmth; Interval – eye contact (1-minute sampling), direct eye contact between child and parent	1. No significant relationship between warmth and eye contact for mothers, for fathers the association was significant in the free-play setting only (father–to-son r = 0.276, p = 0.05; son-to-father r = 0.324, p = 0.019). 2. No association of parental warmth with the correlation between eye contact and CU traits.
Dadds et al., 2012	Children; Community; sample size = 24 (-); 12 ODD; 12 CG	I love you task: 30 minutes of free play and story reading; afterwards Mothers were instructed that she shows that she loves him or her; two cameras used to gain access to mother´s and children´s face; Experimenter blind to child´s CU status placed adjacent behind two-way	Corporal Punishment Mothers´ corporal punishment measured by a subscale of Alabama Parent Questionnaire Fearlessness Father report on the subscale of the psychopathic personality inventory	Coded for child and mother's level of genuineness during interaction; verbal and physical expression of affection; initiated and rejected eye contact; started when experimenter left the room until reentering (90s); raters were	1. Lower eye contact in high CU trait children was not influenced by parent behaviour. 2. Mothers´ positive feelings were related to higher child eye contact (r = 0.305) and lower CU traits across the whole sample (r =

Study	Sample	Parenting measure		Measurement	Main Outcomes on the Relationship between parenting and CU Traits
		Experimental Task	General parenting		
		mirror, access to audible; verbal instruction via phone.	Parents' feelings Brief version of parent feelings questionnaire; 6 items (3 positive; 3 negative).	trained; all recordings were coded by second coder.	- 0.538, $p < 0.05$) but not within clinic sample ($r = -0.151$). 3. Corporal punishment was related to CU traits across whole sample ($r = 0.440$, $p < 0.05$) but not to eye contact. 4. Father´s psychopathic fearlessness was correlated to CU traits ($r = 0.309$) and eye-contact ($r = - 0.423$, $p < 0.05$) in whole sample and clinic group ($r = - 0.538$); ($r = 0.629$, $p < 0.1$).
Dadds et al., 2013	Children, Community; sample size = 99 (41); ODD = 60; CG = 39. ** 24 participants*	Mother-Child Procedure 5 minutes free play coded with Coding of Attachment-Related Parenting (CARP) (Matias, Scott, & O'Connor, 2006) measure on attachment related parenting.	Corporal Punishment Mothers´ corporal punishment measured by a subscale of Alabama Parent Questionnaire Fearlessness Father report on the subscale of the	Coded for child and mother's level of genuineness during interaction; verbal and physical expression of affection; initiated and rejected eye contact; started when room until reentering (90s); raters	1. Mother´s positive feelings were associated with higher child eye contact ($r = 0.27$, $p < 0.1$). 2. Corporal punishment was unrelated to eye contact.

Study	Sample	Parenting measure		Measurement	Main Outcomes on the Relationship between parenting and CU Traits
		Experimental Task	General parenting		
	from Dadds et al., 2011	30 minutes of free play and story reading; afterwards Mothers were instructed that she shows that she loves him or her; two cameras used to gain access to mother´s and children´s face; Experimenter blind to child´s CU status placed adjacent behind two-way mirror, access to audible; verbal instruction via phone.	psychopathic personality inventory Parents' feelings Brief version of parent feelings questionnaire; 6 items (FEEL; 3 positive; 3 negative).	were trained; every sixth recording was coded by second coder.	3. Father psychopathic fearlessness was associated to lower eye contact (r = - 0.33, p < 0.1) 4. None of the attachment related behaviors were associated to eye contact. 5. Children with high CU traits showed trends to reject more eye contact (F(2,88) = 3.28, p < .05) and physical affection (F(2,88) = 4.33, p < .05)
Levantini et al., 2022	Children, Clinical; sample size = 92 (-); ODD = 80; CD = 12	Emotion recognition task, no parent child interaction.	Alabama Parenting Questionnaire (APQ); subscales: positive parenting (parental involvement & positive parenting), negative parenting (poor monitoring/supervision, inconsistent discipline)	Items are scored on a five-point Likert scale.	1. Positive parenting moderated link between first fixation duration to the eyes (FFD_E) of negative emotions (sad, angry, disgusted, fear) and CU traits (b = - 0.002, p < 0.05).

Study	Sample	Parenting measure		Measurement	Main Outcomes on the Relationship between parenting and CU Traits
		Experimental Task	General parenting		
					2. FFD_E was significantly correlated with CU traits in children with high (b = - 0.026, p < 0.001) and average positive parenting (b = - 0.015, p < .05). 3. Negative parenting (NP) moderated the link between Fixation count to the eyes (FC_E) of negative emotions and CU traits (b = - 0.009, p < 0.05); FC_E in negative emotions was associated with CU traits in children with higher NP (b = -0.050, p < 0.05). 4. NP moderated link between fixation duration to the eyes (FD_E) of negative emotions and CU traits (b = - 0.008, p < 0.05); FD_E negative

Study	Sample	Parenting measure		Measurement	Main Outcomes on the Relationship between parenting and CU Traits
		Experimental Task	General parenting		
					emotions was correlated with CU traits in children with higher NP (b= - 0.045, $p < 0.05$).

Note. CD = Conduct disorder; CG = Control Group; CP = Conduct problem; CU = Callous-unemotional; FOS = Family observation schedule.

Research Proposal

Master's Thesis Research Proposal

Master's Degree Programme in Psychology of the University of Groningen

Submission date: 15.03.2023 Approved on: 27.03.2023

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Credit points: 20 EC

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Title:

The relationship between parenting; emotion recognition and attention to the eyes in children and youth with callous-unemotional traits.

Research Proposal (*800 words at most for sections A-D*)

A. Background and scientific framework:

Callous-unemotional (CU) traits in children are proposed as a precursor to adult psychopathy and are associated with callous use of others, lack of remorse and empathic concern, shallow or deficient emotions, and lack of concern about performance (Frick & Morris, 2004).

CU traits are further linked to impaired attention to important emotional and social cues, such as the eye region. Recent research has demonstrated that children scoring high

on CU traits are showing less attention to the eyes than children with low CU traits, suggesting that attention to the eyes is a discriminatory factor in the development of CU traits (Demetriou and Fanti, 2021). In this, research has shown that less attention to important social stimuli, such as faces, precedes the development of CU traits and already occurs during infancy (Peltola, Yrttiaho, & Leppänen, 2018). One hypothesized pathway for developing CU traits is: less engagement in early eye contact between children and parents results in impaired social skills, such as a lack of empathy and impaired emotion recognition, which then results in elevated CU traits (Dadds, 2011).

Levantini and colleagues (2022) have identified that parenting moderates the negative relationship between attention to the eyes and CU traits. In this, children experiencing less positive parenting and having above mean initial fixation duration had higher CU traits when compared to children that showed similar initial fixation duration and experienced more positive parenting. This result suggests that positive parenting strengthens the negative relationship between attention to the eyes and CU traits.

CU traits are further associated with an impairment to recognize emotions. Yet, research is inconclusive of whether the impairment arises from an inability to shift the attention to emotional informant features, such as the eyes, or from problems interpreting the information. Attention to the eyes seems especially crucial in the recognition of fear, as previous research has shown that shifting the attention of children with high CU traits towards the eyes alleviated their inability to recognize fearful faces (Dadds et al., 2006). Whereas Martin-Key and colleagues (2018) found that attention to the eyes did not mediate the relationship between emotion recognition and CU traits. They suggest that the inability to recognize emotions arises from impairments to interpret the information instead of an inability to shift attention to the informative stimuli.

As presented above research identified and proposed multiple pathways of how attention to the eyes relates to CU traits. Yet, no literature review has been conducted that provides an overview of the potential relationships between attention to the eyes, emotion recognition and parenting in the context of CU traits (see figure 1 for a visualization of the proposed model). Thus, this literature review aims to fill this gap by summarizing and analysing relevant literature.

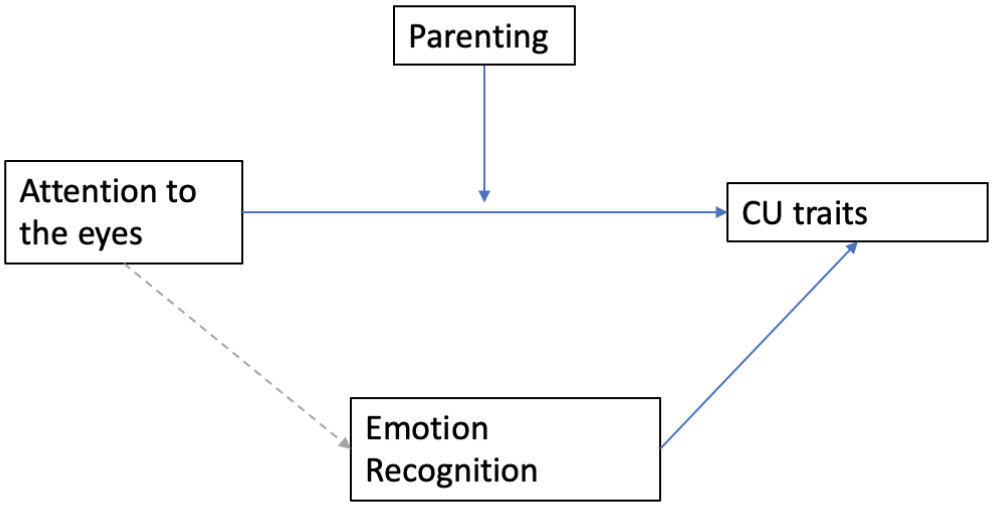

Figure 1. Presents the suggested model for the relation between attention to the eyes; emotion recognition; CU traits and parenting.

B. Research question:

Main Research Question:

i) What is the relationship between attention to the eyes, parenting, emotion regulation, and callous-unemotional traits?

The sub-questions would be:

4) How does attention to the eyes relate to the ability to recognize emotions in CU traits?
5) How does parenting relate to the association between attention to the eyes and the development of CU traits?

C. Method (participants, material, procedure/design, method of analysis):

Design. The study design is a systematic literature review that orients itself to the guidelines of Cochrane Reviews.

Participants. Not applicable

Material. The literature search is conducted by utilizing databases such as PsychInfo, SmartCat, Web of Science and Google Scholar.

Search terms

Callous-unemotional traits and Attention to the eyes

callous* OR psychopathy OR psychopathic OR psychopath OR sociopath* OR unemotional AND gaze OR eye OR "eye contact" OR “attention to the eyes”

Further search method:

Utilizing the “cited by” function of Dadds (2011).

Inclusion Criteria:

- The studies need to include callous-unemotional traits
- Empirical studies only, including cross-sectional, longitudinal, monozygotic twin studies
- Children and adolescence

Exclusion Criteria:

- Literature reviews, Meta-analysis, Editorials

- Published in non-peer-reviewed journals

- Self-reports

D. References (the 3-5 most relevant):

Dadds, M. R., Jambrak, J., Pasalich, D., Hawes, D. J., & Brennan, J. (2011). Impaired attention to the eyes of attachment figures and the developmental origins of psychopathy. *Journal of Child Psychology and Psychiatry, 52*(3), 238-245.

Dadds, M., Perry, Y., Hawes, D., Merz, S., Riddell, A., Haines, D., Solak, E., & Abeygunawardane, A. (2006). Attention to the eyes and fear-recognition deficits in child psychopathy. *The British Journal of Psychiatry, 189*(3), 280-281. doi:10.1192/bjp.bp.105.018150

Demetriou, C. A., & Fanti, K. A. (2021). Are children high on callous-unemotional traits emotionally blind? Testing eye-gaze differences. *Child Psychiatry & Human Development*, 1-12.

Levantini, V., Muratori, P., Calderoni, S., Inguaggiato, E., Masi, G., Milone, A., Tonacci, A., & Billeci, L. (2022). Parenting practices moderate the link between attention to the eyes and callous unemotional traits in children with Disruptive Behavior Disorder: An eye-tracking study. *Journal of psychiatric research*, *146*, 272-278.

Martin-Key, N. A., Graf, E. W., Adams, W. J., & Fairchild, G. (2018). Facial emotion recognition and eye movement behaviour in conduct disorder. *Journal of Child Psychology and Psychiatry*, *59*(3), 247-257.

Time Schedule

- Initial period (study of literature/design):

February 9th until February 16th, 2023 - Write research proposal

February 16th until March 16th, 2023 – Incorporate feedback

- Realization of the research:

March 13th until March 17th, 2023 – Conduct literature search

- Completion of the report:

March 14th until March 31st – Write introduction

April 1st until April 28th – Write methods and results

28th April until May 15th – Write discussion and conclusion

May 15th until June 26th, 2023 – Write full draft