University of Cyprus

DEPARTMENT OF PSYCHOLOGY

ARE CHILDREN WITH LIMITED PROSOCIAL EMOTIONS EMOTIONALLY BLIND? EYE GAZE AND FACIAL EMOTIONAL EXPRESSIONS. THE IMPLEMENTATION OF THREE INTERVENTION PROGRAMS

DOCTOR OF PHILOSOPHY DISSERTATION

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DOCTOR OF PHILOSOPHY DISSERTATION

CHARA A. DEMETRIOU

2018

VALIDATION PAGE

Doctoral Candidate: *Chara A. Demetriou*

Doctoral Thesis: Are Children With Limited Prosocial Emotions Emotionally Blind? Eye Gaze and Facial Emotional Expressions. The Implementation of Three Intervention Programs

The present Doctoral Dissertation was submitted in partial fulfillment of the requirements for the Degree of Doctor of Philosophy at the ***Department of Psychology*** *and was approved on the 8th of May 2018 by the members of the* ***Examination Committee***.

Examination Committee

Research Supervisor: Dr. Kostas Fanti, Assistant Professor

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DECLARATION OF DOCTORAL CANDIDATE

The present doctoral dissertation was submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy of the University of Cyprus. It is a product of original work of my own, unless otherwise mentioned through references, notes, or any other statements.

……..

Chara A. Demetriou

ABSTRACT

Introduction: Current empirical work has focused on understanding the development of psychopathic traits to explain the severe emotional and behavioral problems early in development. Recent studies supported the importance of psychopathic dimensions (Grandiosity-Deceitfulness, Callous-Unemotional, Impulsivity-Need for stimulation) assessed with the newly developed Child Problematic Traits Inventory (Colins et al., 2014), in further investigating their unique associations with theoretically relevant constructs of interest. The increased relation of Callous-Unemotional (CU) traits with deficiencies in empathic concern, come in support of their cognitive deficiency of this population. Their inability to fixate on the eye region of emotional faces make them incapable to identify the emotion expressed and adapt their behavior accordingly. Difficulties that lead research interest in early intervention strategies that can ameliorate emotional processing deficiencies and enable an enhanced emotional engagement and expression.

Methods: *Study 1* consisted of 1,238 children age 3-9 years at initial assessment. Zero-order correlations and regression analyses between CPTI scores and several behavioral, emotional and contextual variables were conducted. For *Study 2* a sub-sample children scoring high on CU traits (31 children) participated in the Eye-tracking experiment. Repeated ANOVA's conducted with the high and low CU traits groups, with the different emotional expressions and areas of interest, in order to assess their eye gaze. For *Study 3*, 16 children participated in the Parent Child Interaction Therapy for children high on CU traits, 16 children participated in the Coaching and Rewarding Emotional Skills, and 21 children participated in the Emotional Engagement. The wait-list groups consisted of 22 children. Repeated ANOVA's were conducted with intervention groups and their facial expressions assessed with FaceReader technology in different emotional contexts, prior, after and in three-months follow-up period aiming to assess the amenability of their emotional processing difficulties.

Results: For the *Study 1*, zero-order correlations and regression analyses revealed a unique contribution of each psychopathic dimension to emotional and behavioral problems. INS dimension indicated its importance in behavioral problems, while CU dimension uniquely predicted an impaired empathic concern. All the psychopathic dimensions were positively

related with negative parental practices and peer problems. For the *Study 2*, a significant area of interest and CU group interaction was indicated for all the emotional expressions, supporting the reduced fixation of the High CU traits group in individuals' eye region irrespective of the emotion expressed. For the *Study 3*, the analysis mainly revealed an increase in expression of sadness indicated in response to distressing cues, while the differentiation of children's emotional expression come in support of the effectiveness of the intervention programs.

Discussion: The findings confirmed the importance of a comprehensive assessment of the psychopathic dimensions early in development in an attempt to understand better this population's special needs and difficulties. Clinical assessment of psychopathic traits should routinely evaluate all these dimensions and their unique relations to external constructs of interest. In addition, by supporting an attention-to-the eyes deficiency in children's high on CU traits emotional processing strategies and the effectiveness of parental warmth and cognitive skills training, the current study further support the development of more adequate intervention programs.

ABSTRACT IN GREEK

Εισαγωγή: Η σύγχρονη βιβλιογραφία εστιάζει στην αναπτυξιακή πορεία των ψυχοπαθητικών χαρακτηριστικών σε μια προσπάθεια να εξηγήσει τα συναισθηματικά προβλήματα και τα προβλήματα συμπεριφοράς που παρουσιάζονται στα πρώιμα στάδια της ανάπτυξης. Πρόσφατες έρευνες έχουν υποστηρίξει τη σημαντικότητα όλων των ψυχοπαθητικών χαρακτηριστικών (Μεγαλοπρέπεια, Χαρακτηριστικά σκληρότητας και Παρορμητικότητας), όπως αξιολογούνται από ένα νέο εργαλείο αξιολόγησης, το Child Problematic Traits Inventory (Colins et al., 2014), σε σχέση με άλλες θεωρητικά υποστηριζόμενες έννοιες όπως τα προβλήματα συμπεριφοράς. Η συσχέτιση των Χαρακτηριστικών Σκληρότητας (ΧΣ) με δυσκολίες ως προς την ενσυναίσθηση, έρχονται να υποστηρίξουν τις δυσκολίες του πληθυσμού ως προς τις γνωστικές συναισθηματικής επεξεργασίας. Η δυσκολία να εστιάσουν στην περιοχή των ματιών κατά τη συναισθηματική έκφραση των άλλων, καθιστά αυτή την ομάδα παιδιών λιγότερη ικανή να αναγνωρίσει το συναίσθημα που εκφράζεται και να συμπεριφερθεί κατά αντίστοιχο τρόπο. Δυσκολίες οι οποίες οδηγούν το ερευνητικό ενδιαφέρον στην αναγνώριση και την ανάπτυξη προγραμμάτων παρέμβασης που επιτρέπουν τη διαχείριση των δυσκολιών συναισθηματικής επεξεργασίας, και ενισχύουν τη συναισθηματική εκφραστικότητα.

Μέθοδος: Η *Μελέτη 1* αναφέρεται σε 1,238 παιδιά 3-9 ετών. Ανάλυση συσχέτισης και παλινδρόμησης πραγματοποιήθηκε μεταξύ των παραγόντων του CPTI και άλλων παραγόντων όπως τα προβλήματα συμπεριφοράς και οι γονικές πρακτικές. Για τη *Μελέτη 2* μια υποομάδα με υψηλά επίπεδα ΧΣ (31 παιδιά) συμμετείχαν σε πείραμα οπτικής ιχνηλάτισης. Επαναλαμβανόμενες πολυμεταβλητές αναλύσεις (ANOVA) πραγματοποιήθηκαν μεταξύ των διαφορετικών ομάδων και την περιοχή ενδιαφέροντος, με στόχο την αξιολόγηση της κίνησης των ματιών. Στη *Μελέτη 3* συμμετείχαν 16 παιδιά στο πρόγραμμα PCIT-CDI-CU, 16 παιδιά στο πρόγραμμα CARES, 21 παιδιά στο πρόγραμμα ΕΕ, ενώ 22 παιδιά αποτελούσαν την ομάδα ελέγχου. Επαναλαμβανόμενες πολυμεταβλητές αναλύσεις (ANOVA) με τις ομάδες θεραπείας και τη συναισθηματική τους αντίδραση όπως αξιολογήθηκε από πρόγραμμα πρόσωπο-αγνωσίας σε διαφορετικά συναισθηματικά πλαίσια, πριν, αμέσως μετά και τρεις μετά την ολοκλήρωση της παρέμβασης, είχε σαν στόχο την αξιολόγηση των συναισθηματικών τους δυσκολιών.

Ευρήματα: Οι αναλύσεις συσχέτισης και παλινδρόμησης (*Μελέτη 1*) υποστήριξαν τη μοναδική συσχέτιση των ψυχοπαθητικών χαρακτηριστικών με τα συναισθηματικά προβλήματα και τα προβλήματα συμπεριφοράς. Η Παρορμητικότητα παρουσίασε υψηλή συσχέτιση με τα προβλήματα συμπεριφορά, καθώς υψηλή ήταν και η συσχέτιση των ΧΣ με δυσκολίες στην Ενσυναίσθηση. Όλα τα ψυχοπαθητικά χαρακτηριστικά σχετίζονταν θετικά με τις μη αποτελεσματικές γονικές πρακτικές και τα προβλήματα στις σχέσεις με τους συνομήλικους. Η *Μελέτη 2* παρουσίασε μια σημαντική αλληλεπίδραση μεταξύ της περιοχής ενδιαφέροντος και των επιπέδων των ΧΣ, ανεξάρτητα από το εκφραζόμενο συναίσθημα, προσφέροντας επιπλέον υποστήριξη στη θεωρία που αφορά τη μειωμένη βλεμματική επαφή εκ μέρους της ομάδας αυτής. Τέλος, η *Μελέτη 3* έχει υποστηρίξει αύξηση της έκφρασης της λύπης σε απάντηση αρνητικών συναισθημάτων, υποστηρίζοντας τη σημαντικότητα της πρώιμης παρέμβασης.

Συζήτηση: Τα ευρήματα επιβεβαιώνουν τη σημαντικότητα όλων των ψυχοπαθητικών χαρακτηριστικών στα πλαίσια μιας περιεκτικής αξιολόγησης των δυσκολιών που αντιμετωπίζουν τα παιδιά αυτά στα πρώιμα στάδια της ανάπτυξης. Η κλινικής αξιολόγηση θα πρέπει να αξιολογεί το σύνολο των χαρακτηριστικών αυτών και τη σχέση τους με άλλα χαρακτηριστικά, όπως τα προβλήματα συμπεριφοράς ή και τα συναισθηματικά προβλήματα. Επιπλέον, υποδεικνύοντας τις γνωστικές δυσκολίες παιδιών με ΧΣ, τη δυσκολία τους να εστιαστούν στην περιοχή των ματιών, και την αποτελεσματικότητα παρεμβάσεων που ενισχύουν τις γονικές πρακτικές και τις γνωστικές δεξιότητες των παιδιών, η παρούσα έρευνα υποστηρίζει τη σημαντικότητα της πρώιμης παρέμβασης.

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Completing a doctoral program is a highly challenging multi-year experience that needs your loyalty, persistence and patience. Although, nothing could not be accomplished without the emotional and practical support of your beloved ones. Specifically, I want to thank my father, Andreas Demetriou, my mother, Androulla Papachristoforou, and my sister, Elena Demetriou and her family for encouraging and practically supporting my decision to undergo this long procedure. A special thank you to Loizos Poyiadjis, for being next to me all these years, and supporting in any way my effort to become the best of me, and my friends for their unconditional love and emotional support during times when fatigue, stress and disappointment were overwhelming. I would not have made it this far without all of their support and love.

DEDICATION

Dedicated to all those young researchers who wonder,

and they are sometimes lost.

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GENERAL INTRODUCTION

"The psychopath can thus be said to be one who knows the words but not the music; the denotative meaning of words and phrase may be intact, but the connotative emotional or motivational component is lost"

Herbert, C. Quay, 1962, scientist, referring to individuals with psychopathic traits deficiencies in recognizing and responding to others' emotional expressions

Psychopathic personality, as described in adult populations, is a multidimensional syndrome consisting of a constellation of co-occurring interpersonal, affective, and behavioral traits, such as callous use of others, lack of remorse, and impulsivity (e.g., Andershed, Kerr, Stattin, & Levander, 2002; Hare & Neumann, 2008; Patrick, Fowles, & Krueger, 2009). Increased research interest in understanding the etiology, developmental trajectory, and stability of this construct has led to the extension of psychopathy in early childhood. The importance of psychopathic traits in childhood and adolescence has been supported by their consistent associations with aggressive behavior (e.g., Ansel, Barry, Gillen, & Herrington, 2015; Kimonis, Frick, Fazekas, & Loney, 2006); conduct problems (e.g., Frick, Bodin, & Barry, 2000; Colins, Bijttebier, Broekaert, & Andershed, 2014b); and delinquency (e.g., Chabrol, van Leeuwen, Rodgers, & Séjourné, 2009; Marsee, Silverthorn, & Frick, 2005).

This body of evidence has led scientists to describe psychopathic personality as a developmental phenomenon rooted in early childhood (Frick, Ray, Thornton, & Kahn, 2014), stressing the need for a more accurate assessment of these traits early in development. The Child Problematic Traits Inventory (CPTI) is a measure developed to assess psychopathic traits as early as in the age of three (Colins et al., 2014a). Specifically, CPTI refers to the three-factor conceptualization of the psychopathic personality, and includes an interpersonal dimension (labelled: Grandiose-Deceitful; GD), an affective dimension (labelled: Callous-Unemotional; CU) traits and a behavioral dimension (labelled: Impulsive-Need for Stimulation; INS) (Colins et al., 2014a). This newly developed questionnaire has indicated

its effectiveness in assessing psychopathic traits early in development in a number of different studies conducted in several countries with both teachers and parents ratings (e.g., Colins et al., 2014a; 2016; 2017; López-Romero et al., 2018; Somma, Andershed, Borroni, & Fossati, 2016; Wang et al., 2018).

The importance of psychopathic traits early in development lays largely in their relation to a number of externalizing difficulties experienced by children such as: hyperactivity, defiance, destructive and aggressive behaviour (e.g., Fanti & Henrich, 2010; Rutter, Kim-Cohen, & Maughan, 2006). The relation of psychopathic traits with symptoms of CD, ODD and ADHD is well supported (Frick et al., 2014; Eisenbarth et al., 2008). The research developments in the field of psychopathy and its relation to externalizing problems have led to debates surrounding the centrality of the different psychopathic dimensions. The assessment of the way different psychopathic traits and their combination relate to one another and to key external constructs of interest, such as conduct problems and aggressive behavior, is of high priority as the research interest focuses on the debate between the central and more peripheral dimensions of psychopathy.

Empathy dysfunction is a common component of psychopathy construct; as a result, research emphasis is mainly focused on the identification of specific deficits experienced by individuals with psychopathic traits in cognitive and affective empathy. Cognitive empathy refers to the individual's ability to understand the affective state of others, while affective empathy is the ability to respond to the expressions of different emotions indicated by others (e.g., Decety, Michalska, Akitsuki, & Lahey, 2009; Shamay-Tsoory, Aharon-Peretz, & Perry, 2009; Walter, 2012). Over the years, various studies have been conducted to assess the relationship between empathic concern and psychopathic traits, with an emphasis given in the affective dimension of psychopathy. However, researchers disagreeing on whether high CU traits in childhood is related to deficits in cognitive, affective or both types of empathy (e.g., Georgiou, Kimonis, & Fanti, under review).

These difficulties experienced by this population in empathic concern have also lead research to investigate the cognitive strategies employed in emotional processing. The association of CU traits with reduced attentional orientation and responsiveness to emotional

information was supported with a number of stimuli, including emotional words (e.g., Frick et al., 2003; Loney, Frick, Clements, Ellis, & Kerlin, 2003), images (e.g., Gillespie, Rotshtein, Wells, Beech, & Mitchell, 2015; Kimonis, Frick, Fazekas, & Loney, 2006; Kimonis, Frick, Muñoz, & Aucoin, 2007; Kyranides, 2014), and dynamic scenes (Fanti, Kyranides, & Panayiotou, 2017). Findings support an attention abnormality that inhibit the processing of emotional information and lead to deficiencies in children normal socialization (Baskin-Sommers, Curtin, & Newman, 2013; 2015; Newman, Curtin, Bertsch, & Baskin-Sommers, 2010). Dadds and colleagues in an attempt to further understand this selective attention abnormality shown by individuals high on CU traits, proposed an attentional deficit to socially relevant cues (i.e., eyes) that serve as the basis for the emotion recognition difficulties experienced by this population (Dadds et al., 2006; 2008; 2011; 2014). According to Tinbergen (1972), eyes serve as "super-stimuli" that enable the activation of a number of complex autonomic and behavioral processes. This autonomic process allows infants to attend to the emotional information expressed by eyes; develop a healthy attachment with their caregiver and become more socially competent (Skuse, 2003). Therefore, the inability of these individuals to attend to the emotional expressions of their caregivers lead to poorer emotional connections and a reduced effectiveness of classical parenting practices (Dadds et al., 2006).

Research also referred to individuals high on CU traits impaired emotional awareness and disturbances in emotion recognition and reaction that can cause a number of errors in individual's emotional and social development. In response to their reduced electromyography reactivity, individuals with increased levels of CU traits were less likely to imitate yawn and laugh (Hagenmuller, Rössler, Endrass, Rossegger, & Haker, 2012); were less able to respond to anger, but not happy expressions (de Wied, van Boxtel, Zaalberg, Goudena, & Matthys, 2006); and showed a low corrugator muscle activity, which is an indication of displeasure, in response to the distress expressed by victims (Fanti et al., 2017). These findings support a reduced sensitivity of individuals high on CU traits to expressions of sadness and fear, although contradicting findings point to the need for further experimental investigation in relation to positive emotions. In an attempt to overcome the difficulties imposed by facial electromyography research, Fanti and colleagues (2017) employed for the first time FaceReader methodology to compare individuals low and high on CU traits. Their

findings built on prior studies and supported reduced facial reactions of sadness and disgust to violent emotional scenes. A pattern that is in accordance with these individuals low empathic concern in response to victims' distressing emotional expressions.

Consequently, the difficulties experienced by children high on CU traits on identifying and responding to others emotional expressions, and the proposition of an affective deficit mechanism by which callous and manipulative psychopathic traits develop has led research interest in the investigation of more effective intervention and prevention strategies. A limited number of studies has examined intervention outcomes and findings to date have shown mixed results with reference to the effectiveness of interventions for children high on CU traits (Hawes, Price & Dadds, 2014). Parent Child Interaction Therapy (PCIT) is among the most well supported interventions that aims through the improvement of parenting skills to enhance parent-child warmth and affection (Eyberg, Nelson, & Boggs, 2008). Mounting research findings have supported the importance of healthy attachment style in children's moral and behavioral development, with meta-analytic findings indicating that securely attached children show significantly lower levels of behavioral and emotional problems (Fearon, Bakermans-Kranenburg, Van IJzendoorn, Lapsley, & Roisman, 2010). Additionally, through the development of specific cognitive skills, like the identification of facial micro-expressions and mutual eye contact, Coaching and Rewarding Emotional Skills (CARES) and Emotional Engagement (EE) adjunctive modules aim to enhance children's ability to accurately identify information regarding others emotional state and respond adaptively through their facial emotional expressions.

The current research project is organized into three inter-connected but distinct studies, all of which have been developed to investigate the importance of psychopathic dimensions (i.e., Grandiose/Deceitful, Callous-unemotional, and Impulsive/Need for stimulation) early in development. In addition, the present study aimed to investigate the patterns employed by children high on the affective dimension of psychopathy in emotional processing indicated by children from the age of three years as measured by their eye gaze in facial emotional expression and their facial responsivity in emotional contexts. The basic premise of this current project is that all the psychopathic dimensions, as measured by the newly developed Child Problematic Traits Inventory (CPTI, Colins et al., 2014), can led to a

better understanding of the manifestation of severe and stable behavioral problems, and other deficiencies indicated by this population such as in empathic concern and children's social relations. Therefore, the need for a more accurate assessment of these individuals' difficulties leads to the study of all the psychopathic dimensions together.

Study 1, "Assessing psychopathic traits early in development: Testing potential associations with behavioral, affective, and contextual factors" takes into account the recent advances in the literature regarding the significance of all the psychopathic dimensions: grandiosity, callousness and impulsivity, aiming to investigate their relationship with a number of external constructs of interest. Psychopathic traits refer to a constellation of maladaptive affective and interpersonal features, accompanied by a dysregulated pattern of behaviors (Fanti, Kyranides, Drislane, Colins, & Andershed, 2015). By extending this long-standing debate regarding the fundamental dimensions of this construct early in development, current aimed to develop a better understanding of the developmental mechanisms of psychopathic and antisocial behavior. Specifically, a better understanding of the unique relations indicated between Grandiose/Deceitful, Callous-unemotional, and Impulsive/Need for stimulation dimensions of psychopathy from the age of three can led research to a better understanding of the conduct problems, oppositional defiant, hyperactive and inattentive behavior. This study is based on a community sample of 1,238 preschool and primary school children whose parents and teachers answered a battery of questionnaires measuring behavioral problems (i.e., oppositional defiant, inattentive and hyperactive behavior; conduct problems; overt and relation aggression), empathic concern deficiencies (i.e., cognitive and affective empathy), and social relations (e.g., peers and family).

Study 2, "Are children with "Limited Prosocial Emotions" emotionally blind? Testing Eye-gaze differences", by extending a prominent line of research supporting individuals' high on CU traits deficits in emotional processing employs eye-tracking methodology to explore attention allocation hypothesis in childhood. By providing further support for Dadds and colleagues (2006) "Attention-to-the-eyes hypothesis", the current study provides further support of a possible mechanism leading to children deficits in emotional processing. A sample of 59 preschool and primary school children with varying levels of CU traits,

participated in an experiment aiming to assess their total fixation duration to the eye region of different facial emotional expressions of adults and peers.

Study 3, "Are children with "Limited Prosocial Emotions" emotionally blind? Emotional processing and facial emotional expressions in response to three intervention programs", is the first pilot study applying FaceReader methodology early in development in an attempt to assess the effectiveness of interventions in children high on Callous-unemotional traits. FaceReader a face-recording software that indicates the probability of emotion expressed through children facial reactions to a number of emotional contexts and was used to assess interventions' effectiveness in children's emotional responding in different emotional contexts. By implementing three different intervention programs: Parent Child Interaction Therapy, Child Directed Interaction adapted for children scoring high on CU traits (PCIT-CDI-CU), Coaching and Rewarding Emotions Skills (CARES) and Emotional Engagement (EE), the current study aimed to access the effectiveness of parental warmth and cognitive skills training (i.e., identification of micro-expressions of different emotions) in children's facial emotional expressions. A sample of 75 children with their mothers, participated in three intervention programs and the wait-list group.

As will be discussed, taking together, the three studies further support the importance of all the psychopathic traits assessed early in development in an attempt to inform research in prevention and intervention strategies. In addition, the support provided for a specific mechanism that prevents children's effective emotional processing and leads to reduced emotional expressivity can enable the better understanding of this population's severe and stable behavioural problems later in development and can inform research on prevention and intervention programs.

Study 1

Assessing psychopathic traits early in development: Testing potential associations with behavioral, affective, and contextual factors

Abstract

Current empirical and clinical work has been focused on understanding the development of distinct psychopathic personality traits to explain severe and stable behavioral problems. Child Problematic Traits Inventory (CPTI; Colins et al., 2014a) is a newly developed instrument that enables the assessment of psychopathic dimensions from the age of three. Using a multi-informant approach (i.e., fathers, mothers, teachers) the aim of the current study was to further investigate the unique associations between psychopathic dimensions as measured by CPTI with theoretically relevant constructs of interest such as conduct problems, hyperactive, inattentive and oppositional behavior, and cognitive and affective empathic concern. Both parents and teachers of preschool and primary school children (N = 1283, *M*age = 6.35) completed a battery of questionnaires assessing children's behaviors, emotions, and social relations. Our findings provided further support for the importance of all psychopathic dimensions in predicting behavioral problems, by indicating a unique association with conduct problems, hyperactive, inattentive and oppositional behaviors. In addition, the stronger association of CU dimension with empathic concern contributes to the discussion regarding the deficiencies indicated in cognitive and empathic responding to others' emotional state. The increased relation of CU dimension with social problems, in both their peer and family relations, also highlighted the difficulties imposed in children's environment by the manifestation of psychopathic behaviors and traits. The current study aimed to inform prevention and intervention research in more effective strategies.

Keywords: Child Problematic Traits Inventory (CPTI), childhood, psychopathic traits, behavioral difficulties, contextual factors, parenting

Introduction

Adult psychopathic personality is a multidimensional syndrome consisting of a constellation of co-occurring interpersonal, affective, and behavioral traits, such as callous use of others, lack of remorse, and impulsivity (e.g., Andershed, Kerr, Stattin, & Levander, 2002; Hare & Neumann, 2008; Patrick, Fowles, & Krueger, 2009). Increased research interest in understanding the etiology, developmental trajectory, and stability of this construct has led to the downward extension of psychopathy in early childhood. The importance of psychopathic traits in childhood and adolescence has been supported by their consistent associations with aggressive behavior (e.g., Ansel, Barry, Gillen, & Herrington, 2015; Kimonis, Frick, Fazekas, & Loney, 2006); conduct problems (e.g., Frick, Bodin, & Barry, 2000; Colins, Bijttebier, Broekaert, & Andershed, 2014b); and delinquency (e.g., Chabrol, van Leeuwen, Rodgers, & Séjourné, 2009; Marsee, Silverthorn, & Frick, 2005).

This body of evidence has led scientists to describe psychopathic personality as a developmental phenomenon rooted in early childhood (Frick, Ray, Thorton, & Kahn, 2014), stressing the need for a more accurate assessment of these traits early in development. Child Problematic Traits Inventory (CPTI) is a measure developed to assess psychopathic traits as early as age three (Colins et al., 2014a). Specifically, CPTI refers to the three-factor conceptualization of psychopathic personality, and includes an interpersonal (labelled: Grandiose-Deceitful; GD), an affective (labelled: Callous-Unemotional; CU), and a behavioral dimension (labelled: Impulsive-Need for Stimulation; INS). This newly developed questionnaire has indicated its' effectiveness in assessing psychopathic traits early in development in a number of studies conducted in several countries with both teacher and parent ratings (e.g., Colins et al., 2014a; 2016; 2017; López-Romero et al., 2018; Somma, Andershed, Borroni, & Fossati, 2016; Wang et al., 2018). Findings from existing work further supported CPTI effectiveness by testing associations with theoretically-relevant temperamental dimensions, such as fearlessness and easy temperament (Somma et al., 2016), as well as proactive, reactive, and relational aggression (Colins et al., 2016; 2017). Aiming to extend the literature on the effectiveness of CPTI, the current study examined the associations of distinct psychopathic dimensions with variables that shape child's development, such as empathy deficits, and parent and peer relationships. A novel aim of the present study was the investigation of how the three dimensions of psychopathy as well as

the total psychopathy score relate to parenting practices such as parental involvement and care, and the parents' perceptions about their role and their parenting practices, since evidence examining the unique associations of each dimensions with contextual factors is limited.

Externalizing problems

The importance of psychopathic traits early in development lays largely in their relation to a number of externalizing difficulties such as conduct problems, oppositional defiant, inattentive and aggressive behavior (e.g., Fanti & Henrich, 2010; Frick et al., 2014; Eisenbarth et al., 2008; Rutter, Kim-Cohen, & Maughan, 2006). Prior research examining the role of psychopathic traits in externalizing problems has been mainly focused in the affective dimension of psychopathy or CU traits (e.g., Fanti, Demetriou, & Kimonis, 2013; Fanti, Kyranides, Lordos, Colins, & Andershed, 2018; Kimonis et al., 2016). A number of studies have supported that children and adolescent with co-occurring CU traits and conduct problems show severe and aggressive patterns of antisocial behavior placing them at high risk for severe and stable behavioral problems (e.g., Andershed et al., 2018; Frick et al., 2014). In addition, Ezpeleta and colleagues (2013) showed that CU traits in early childhood could predict difficulties in the spectrum of oppositional behavior and conduct problems a year later after controlling for baseline conduct problems. A finding that is also supported in the Attention Deficits and Hyperactivity Disorder literature, highlighting the strong relation between inattentive behavior, hyperactivity and CU traits (Barry et al., 2000; Colledge & Blair, 2001; Fanti, 2013; Frick et al., 2000; Loeber et al., 2001).

Notwithstanding the great progress in the study of externalizing problems and CU traits, mounting research findings support the importance of impulsivity and grandiosity in relation to conduct problems, hyperactivity and delinquency (Andershed, 2010; Colins et al., 2016; Frick & Dickens, 2006; Frick & White, 2008; Salekin, 2016). The behavioral dimension of the psychopathic construct, that refers to impulsivity, need for stimulation, sensation seeking and proneness to boredom has proven to play a vital role in the description of severely disturbed and inattentive behaviors (Fronger, Andershed, & Andershed, 2018). Mathias and colleagues (2007) showed that impulsiveness is a risk factor for both Attention Deficits and Hyperactivity and Conduct Disorder early in development as is strongly related

to inattention and hyperactivity. Further, the interpersonal dimension of psychopathy, grandiosity and deceitfulness, has proven to be an important indicator of aggressive behavior, bullying and delinquency (e.g., Fanti & Henrich, 2015; López-Romero et al., 2018).

In addition, given that psychopathic traits are the most robust dispositional predictors of aggressive behavior, research has studied their relation to various forms of aggression, including relational and overt aggression (e.g., Frick et al., 2014; Lynam, Miller, Vachon, Loeber, & Stouthamer-Loeber, 2009; Salekin, 2008; Salekin & Lynam, 2010). Relational aggression refers to nonphysical aggression that aims to damage individual's social relations and interactions (e.g., Czar, Dahlen, Bullock, & Nicholson, 2011); whereas overt aggression includes both physical and verbal behaviors that aim to harm others. A number of studies have supported the importance of the CU dimension in distinguishing a more severe and aggressive subgroup among youth and adults (Frick, Cornell, Barry, Bodin, & Dane, 2003; Miller, Wilson, Hyatt, & Zeichner, 2015), whereas grandiosity was shown to be more strongly related with bullying and delinquency (e.g., López-Romero et al., 2018). Fanti and colleagues (2012; 2015), provided evidence that grandiosity and deceitfulness were positively associated with aggressive behavior and predicted bullying longitudinally. In support of these findings, Ojanen and Findley-Van Nonstrand (2018) in a recent study referred to the goal-directed nature of the aggressive behavior indicated by individuals high on affective and interpersonal dimension of psychopathy, highlighting their need for social dominance among their peers.

The research findings are more confusing regarding the expression of relational aggression in individuals high on psychopathic traits, with Czar and colleagues (2011) supporting a strong relation between impulsive traits, manipulativeness and relational aggression; a finding that was also supported by Schmeelk and colleagues (2008) who found a positive association between impulsivity and relational aggression only. Although, some studies have supported a specific association of affective dimension and relational aggression (Loudin, Loukas, & Robinson, 2003), some others indicated a non-so clear difference in the relation between the three psychopathic dimensions (i.e., CU, narcissism, and impulsivity) (Marsee et al., 2005). Specifically, Marsee and colleagues supported that when the three psychopathic traits were studied together, their shared variance was most strongly associated with relational aggression.

The research developments in the field of psychopathy and its relation to externalizing problems have led to debates surrounding the centrality of the different psychopathic dimensions. By gaining a clearer understanding regarding the conceptualization of psychopathy dimensions in early childhood, the development of more efficient assessment tools will enhance the understanding of the development of psychopathy early in life. The assessment of the way different psychopathic dimensions relates to key external constructs of interest early in development, is of high priority. Research interest focuses on the debate between the central and more peripheral dimensions of psychopathy and the developmental trajectories of these traits can lead to more effective prevention and intervention programs early in life.

The distinction between affective and cognitive empathic concern

Empathy dysfunction is a common component of psychopathy construct (Blair, 2007; Cleckley, 1941; Dadds et al., 2009). Research emphasis is mainly focused on the identification of specific deficits experienced by individuals with psychopathic traits in cognitive and affective empathy. Cognitive empathy refers to the individual's ability to understand the affective state of others, while affective empathy is described as the ability to respond to the others' emotional expressions (e.g., Decety, Michalska, Akitsuki, & Lahey, 2009; Shamay-Tsoory, Aharon-Peretz, & Perry, 2009; Walter, 2012). Over the years, various studies have been conducted to assess the relationship between empathic concern and psychopathic traits, with an emphasis given in the affective dimension of psychopathy. However, prior work resulted in contradicting findings on whether individuals high on psychopathic traits, and specifically CU dimension, experience deficiencies in affective or cognitive empathy (e.g., Georgiou, Fanti, & Kimonis, under review). Arguing in favor of deficits in *affective empathy*, studies proposed that individuals high on CU traits show lower scores on affective empathy measures (Muñoz, Qualter, & Padgett, 2011), report fewer affective responses in emotionally evocating films (Anastassiou-Hadjicharalmbous & Warden, 2008), and indicate a decreased response rate to violent acts (Jones, Happé, Gilbert, Burnett, & Viding, 2010). On the other hand, substantial empirical research indicated a negative association between CU traits and individual's ability to identify and understand others' emotions, that describes *cognitive empathy* (e.g., Blair & Coles, 2000; Blair,

Colledge, Murray, & Mitchell, 2001; Dadds et al., 2006; Dadds, El Masry, Wimalaweera, & Guastella, 2008a). Specifically, research indicated a deficit of children high on CU traits in recognizing expressions of emotions such as fear (Dadds et al., 2006; 2008a) and sadness (Blair et al., 2001) due to some deficiencies in emotional processing, and the ability to "see others perspective" (Chabrol, van Leeuwen, Rodgers, & Gibbs, 2011; Pardini, Lochman, & Frick, 2003).

Despite the research emphasis given in the relation of affective dimension and empathic deficiencies in childhood and adolescence (Jones et al., 2010), research in adult populations have also considered impaired empathic processing as a core feature of narcissism (Baskin-Sommers, Krusemark, & Ronningstam, 2014). Narcissism is the term used in adult literature to describe grandiosity, sense of entitlement and self-admiration. Specifically, deficiencies indicated in empathic concern in relation to high grandiose enable the expression of manipulative, dishonest and deceitful behaviors in an attempt to exaggerate the sense of self and use others as a mean through which they can satisfy their personal needs (Rhodewalt & Peterson, 2009; Ritter et al., 2011; Wai & Tiliopoulos, 2012). These studies associate the emotional empathic deficiencies shown by this population with reduced emotional reactivity to a number of psychophysiological measures. Specifically, they supported a reduced deactivation of right anterior insula, an area of the brain that is engaged in the processing of others emotions, highlighting the self-centered character of these characteristics (Fan et al., 2011); decreased respiratory sinus arrhythmia, cardiac preejection period, and low electro-dermal reactivity in response to aversive emotional contexts (Kelsey, Ornduff, McCann, & Reiff, 2001; Sylvers, Brybaker, Alden, Brennan, & Lillienfeld, 2008). Other studies have supported deficiencies in individuals, high in the interpersonal dimension of psychopathy, recognition of emotion through facial emotional expressions (Marissen, Deen, & Franke, 2012) and empathic concern in emotional contexts (Ritter et al., 2011), and others supported a positive correlation between grandiosity and cognitive empathy (Pajevic, Vukosavljevic-Gvozden, Stevanovic, & Neuman, 2018). None of these findings can lead to definitive conclusions regarding the association of grandiosity with cognitive or affective empathy. Although, the relation between grandiosity and empathic deficiencies is increasingly important, in order to identify the mechanism that inhibit conscious development and favors the manifestation of behavioral problems early in development.

Based on the importance of the different associations indicated by psychopathy dimensions and empathic concern, Almeida and colleagues (2015) using the Triarchic model of psychopathy (Patrick et al., 2009), supported an opposite pattern of relations between impulsivity and empathy, a finding that proposes the greater propensity of this population to feel empathic concern (Seara-Cardoso, Neumann, Roiser, McCrory, & Viding, 2012). These findings propose a clearer relation between CU and grandiosity dimensions but not impulsivity and empathy deficits. However, it is not clear if these variables are differentially related to affective and cognitive empathy. The examination of the relationships between psychopathic dimensions and empathic concern will enable the development of a better understanding of their specific needs, which can inform research on the development, and implementation of more effective preventions and interventions early in development.

Social context: The importance of familial and peer relations

A prominent line of research in psychopathy has focused on the negative impact of psychopathic traits in children's social relations to peers and family (e.g., Fanti, Colins, Andershed, & Sikki, 2017; Muñoz, Kerr, & Bešić, 2008; Waller, Gardner, & Hyde, 2013). All the dimensions impose increased challenges for children's peers and family relations, highlighting the need to disentangle this relation early in development, in an attempt to prevent behavioral problems later in development. Based on the emphasis given to the affective dimension of psychopathy, research has well established the relation between CU traits and parenting practices (e.g., Waller et al., 2013; 2015). According to Waller and colleagues (2014), children with CU traits seem relatively insensitive to typical parental socialization efforts (i.e., effective discipline strategies), as indicated by their physiological hypo-arousal to cues of punishment or distress of others (Frick et al., 2014; Viding & McCrory, 2012). Specifically, children high on CU traits lack concern over punishment for their misbehavior, which can be attributed to their fearlessness temperament (Hawes & Dadds, 2005; Pardini & Byrd, 2012). Fearlessness and low sensitivity to punishment might lead parents to adopt less effective practices such as corporal punishment, inconsistent discipline, and poor monitoring (Barker, Oliver, Viding, Salekin, & Maughan, 2011). As a result, harsh and punitive discipline practices are associated with higher levels of CU traits that in turn predict conduct problems (Mills-Koonce, Willoughby, Garrett-Peters, Wagner,

& Vernon-Feagans, 2016; Pasalich, Dadds, Hawes, & Brennan, 2011) and attention-deficit behaviors (Waller, Shaw, & Hyde, 2017) later in development. Having a child who is lacking empathy concern and at the same time exhibits behavioral problems can be very distressing to parents (e.g., dissatisfaction with their role as a parent and in their parenting performance) (Fanti & Centifanti, 2014; Fite, Greening, & Stoppelbein, 2008). These feelings can be the result of their perception that their parenting practices are insufficient, they lack support, and parenting prevents their personal development. However, a limitation of prior work is that the majority of research has focused on the role of affective psychopathic traits (McDonald, Dodson, Rosenfield, & Jouriles, 2011; Waller et al., 2012), leaving a number of questions unanswered regarding the relation of the other psychopathic dimensions with parenting practices early in development, which is a focus of the current study.

A main limitation of the literature regarding the relation between grandiose dimension and parenting is that this relation is mainly evaluated retrospectively using adolescent and adult community or forensic samples (Horton, Bleau, & Drwecki, 2006; Vitacco, Neumann, Ramos, & Roberts, 2003). Research in adolescent community samples linked grandiose dimension of psychopathy with parental inconsistency, poor monitoring and supervision (Mechanic & Barry, 2015; Trumpeter, Watson, O'Leary, & Weathington, 2008). Findings that are also correlated with forms of narcissism in adult population (Maxwell, Donnellan, Hopwood, & Ackerman, 2011; Otway & Vignoles, 2006; Pincus et al., 2009). In response to impulsivity, research supports that the failure of the environment to provide external control through consistent parental monitoring increases the risk for severe and stable delinquent behavior, as it fails to compensate children's deficient internal regulatory competences (Lynam et al., 2000).

In contrast, high parental warmth, involvement and care serve as protective factors over the development of problems among individuals high on CU traits and impulsivity (Menting, van Lier, Koot, Pardini, & Loeber, 2016; Wall, Frick, Fanti, Kimonis, & Lordos, 2016). In relation to CU traits, longitudinal research has also indicated that mutual positive affect and cooperation between parents and children early in life can enhance internalization of social norms and lead to conscience development (Christian, Meltzer, These, & Kosson, 2017; Kochanska, Forman, Aksan, & Dunbar, 2005; Kiang, Moreno, & Robinson, 2004; Waller et al., 2017). A finding that was also supported in an adoption study where positive

parenting supported its effectiveness by mitigating the effects of fearless temperament on CU traits (Waller et al., 2016). While, positive parental practices and parental warmth can provide an external control and/or appropriate behavioral patterns model for children high on impulsivity in order to learn how to cope with self-control deficiencies and prevent behavioral problems (Matthys, Vanderschuren, Schutter, & Lochman, 2012; Menting et al., 2016). On the other hand, positive parenting is related with positive forms of grandiose, in terms of self-esteem that enable the healthy development of social competence and social interactions (Horton et al., 2006). However, all these findings were not consistently derived from research on children populations, creating many gaps in our understanding regarding the role of the three distinct but interrelated phenotypic dimensions of psychopathy early in development. In an attempt to advance our understanding regarding the crucial role of family context and parental practices early in development, the current study investigated the association of the distinct aspects of psychopathic traits with parental strategies, in order to inform prevention and intervention practices.

Psychopathic dimensions in childhood have been related to impaired peer relations and poor peer social support (e.g., Fanti, Demetriou, & Hawa, 2012). As we have already discussed, the literature mainly focuses on the important role CU traits play in children socialization. Lahey (2014) notes that individuals with CU traits are characterized by "a cold insensitivity to the feelings and needs of others" that lead to serious social functioning impairments. Mounting research findings indicate the association of CU traits with peer dislike (Piatigorsky & Hinshaw, 2004); lower perceived social competence (Barry, Barry, Deming, & Lochman, 2008); short-term relationships and reciprocated relations with deviant peer (Muñoz et al., 2008); and poor dyadic relationships resulting in non-significant relationships (Becker, Fite, Luebbe, Stoppelbein, & Greening, 2013); increased levels of peer impairments (Wascbusch & Willoughby, 2008) and low social support (Fanti, 2013). Research findings support that children with increased rates of impulsivity indicate behavioral dysregulation that may be challenging to their social relations, as their peers may experience a difficulty to tolerate it (Diamantopoulou, Henricsson, & Rydell, 2005; Hoza, 2007). In addition, their impulsive reactions and rule breaking can increase barriers in social interactions, and are frequently less socially connected than other children (Andrade & Tannock, 2012). According to Kerr and colleagues (2012), manipulative traits, which a

characteristic associated with grandiosity, can lead to increased peer problems, as these traits may enhance the influence on peers and lead to antisocial behaviors especially during adolescence. It is of great importance to understand the quality of relationships in childhood between children high on psychopathic traits and their significant others, as social relations can form moral and conscious development later in development. By supporting a unique contribution of each psychopathic dimension, you can develop of a better association of these traits with external constructs, such as family and peer relations in an attempt to understand their specific need early in development.

Current study

In accordance with recent research advances in the field of psychopathy assessment early in development, the current study aimed to investigate the unique associations of distinct psychopathic dimensions with a number of external constructs of interest, namely: externalizing problems (e.g., conduct problems, inattentive behavior, aggressions), empathic concern, and several contextual factors (e.g., peer and family relations). Using a multi-informant approach involving data collection from fathers, mothers and teachers, the current study aimed to have ratings regarding the children behavior from various settings where the behavior occurs. In addition, the assessment of the relation between psychopathic dimensions and external constructs of interest aimed to help us better understand the behavioral and social problems experienced early in development, and this population unique needs in order to inform prevention and intervention research.

In relation to *externalizing problems,* we hypothesized that all three psychopathy dimensions will be related with behavioral problem measures, including oppositional defiant, inattentive and hyperactive behavior, and conduct problems. INS dimension was hypothesized to show a stronger relation with impulsive, hyperactive and inattentive behavior (Drislane, Patrick, & Arsal, 2014), while GD dimension was expected to show a stronger relation with aggressive behavior and conduct problems. In terms of *empathic concern*, we hypothesized that GD and CU, but not INS dimension might relate to empathy deficits. Although, it was expected that CU dimension would be more strongly associated with affective empathy, in accordance with the affective nature of the difficulties described by these traits.

With reference to the *contextual factors* and *children's social relations*, it was expected that the all the CPTI dimensions would show a positive relation with peer problems and negative parental practices. A negative relation was expected between psychopathic dimensions and positive parental practices as parental involvement and care. In addition, the social deficiencies imposed by these traits, increase the distress experienced by parents. Between the three dimensions, the CU dimension was expected to impose more serious difficulties in parents' attempts for consistent parenting and increase warmth and care, based on the unemotional nature of these traits that prevents the development of affective relations and lead to increased parental distress. The INS dimension based on the seriousness of impulsivity indicated and the inability of children for behavioral control was expected to lead to higher rates of inconsistent discipline strategies. In response to positive parenting, parental involvement and care, it was hypothesized that the increased levels of psychopathic traits, as measured by all the three dimensions, will be significantly negatively correlated with the parents' ability to effectively manage their children's behavioral manifestation of psychopathic traits.

Method

Participants

The sample consisted of 1283 preschool and primary school children living in the Republic of Cyprus, and was divided evenly between boys (n = 638) and girls (n = 645). Children ranged in age between 3 and 9 years at the initial assessment (*M* age = 6.35, *SD* = 1.31). Children's teachers, fathers and mothers completed the battery of the questionnaires. The sample was diverse in terms of parental educational level: 7.4% of fathers and 4.5% of mothers did not complete high school, 32.5% of fathers and 25% of mothers had a high school education, and 49.5% of fathers and 60.9% of mothers has a university degree.

Procedure

Following approval of the study by the National Bioethics Committee and the Centre of Educational Research and Assessment (CERE) of Cyprus, Pedagogical Institute, Ministry of Education and Culture, 47 private and public nursery schools, and 69 primary schools in three provinces (Nicosia, Larnaca and Limassol) were randomly selected for participation.

Schools were contacted by phone and informed about the aims of the study. School boards that were interested to participate received details about the purpose and the procedure via email or fax. Parents/guardians were informed of the nature of the study and 81% consented to their participation. Teachers, fathers and mothers completed a battery of questionnaires, which took approximately half an hour for teachers and an hour for each parent.

Measures

Child Problematic Traits Inventory (CPTI; Colins et al., 2014a). First, the English version of CPTI was translated in Greek independently from the first author and another researcher. The two translations were compared and consensus was reached for the best, possible translation for each item. After that a second researcher, with English as first language translated the Greek version back into English. If the latest version differed from the English original, the first author and other researcher came to an agreement on the definitive Greek translation.

The CPTI was used to assess psychopathic traits. CPTI contains 28 items, and the response scale is *"Does not apply at all"* (1), *"Does not apply well"* (2), *"Applies fairly well"* (3), and *"Applies very well"* (4). Both teachers and parents assessed each item based on how the child typically behaves rather than how he or she behaves at the moment. CPTI total score was calculated (sum of 28 items), in addition to the three-factors scores: Grandiose-Deceitful (GD; 8 items; e.g., "*Thinks that he/she is better that everyone on almost everything*"), Callous-Unemotional (CU; 10 items; e.g., "*Never seems to have bad conscience for things that he/she has done*"), and Impulsive/Need for Stimulation (INS; 10 items; e.g., "*Provides himself/herself with different things very fast and eagerly*"). The Cronbach's alphas for the GD (α = .91), CU (α = .95), INS (α = .92) factors and the CPTI Total Score (α = .96) were high, evidencing excellent internal consistencies. Mother and father reported CPTI scores were combined at the item level by taking the higher rating between parents. Mother and father reports were highly correlated (r = .66 for GD, r = .60 for CU, r = .64 for INS, and r = .67 for the CPTI Total score). Alpha coefficients for subscale scores suggest high internal consistency (αs = .85 for GD, .88 for CU, .84 for INS, .92 for CPTI Total Score) for both parent and teacher reports (αs = .90 for GD, .94 for CU, .92 for INS, .95 for CPTI Total Score).

Inventory of Callous-Unemotional Traits (ICU; Frick, 2004). CU traits were also assessed using the 24-item preschool and parent version of ICU respectively as a validation measure. Parents and teachers rated children on a four point Likert scale (0 = *Not at all true*, 1 = *Somewhat true*, 2 = *Very true*, 3 = *Definitely true*) with total scores ranging from 0 to 72 as the items were summed to form an overall score. The ICU consists of 12 positive (e.g., *"He/she cares about homework"*) and 12 negative-worded items (e.g., *"He/she does not show his/her feelings"*), and captures three dimensions of CU traits: callousness (e.g., "He/she does not care who he hurts to get what he wants"), unemotional (e.g., *"He/she does not show his emotions to others"*), and uncaring (e.g., reverse scored items: *"He/she feels bad or guilty when he/she does something wrong"*). Previous research has verified the validity of ICU in a community sample of Greek Cypriot (Fanti, 2013). Alpha coefficients for ICU Total score evidencing good internal consistencies (αs = .85 for parents, .92 for teachers). Mother and father-reported scores were combined by taking the higher rating between parents (Frick & Hare, 2001). Their reports were highly correlated (r = .69).

Griffith Empathy Measure (GEM; Dadds et al., 2008b)**.** GEM, a 23-item parental scale measure, that uses 6 items for cognitive (e.g., *"Seeing another child sad makes my child feel sad"*) and 9 items for affective empathy (e.g., *"My child has trouble understanding other people's feelings"*) subscales, rated on a 9-point Likert scale (-4 = *"strongly disagree"* to 4= *"strongly agree"*). Affective empathy refers to appropriate affective response with other's situation than to one's own, whereas the cognitive empathy is the ability to take the role or perspective of others. GEM has been verified as a validated instrument for measuring total score of empathy, cognitive and affective subscales. Previous studies demonstrated good test-retest reliability and internal consistencies (Dadds et al., 2008a). In the present study, total GEM (αs = .74), affective (αs = .71) and cognitive scale (αs = .67) scores demonstrated acceptable internal consistency. Mother and father reports were correlated at .53 for cognitive empathy, .54 for affective empathy, and .55 for total empathy score, and combined at the item level by taking the higher rating.

Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997). Child social and behavioral problems were assessed by parents using 20-items of SDQ. The subscales contained was Prosocial Behavior (e.g., *"Considerate of other people's feelings"*), Peer Problems (e.g., *"Rather solitary, tends to play alone"*), Hyperactivity (e.g., *"Constantly*

fidgeting or squirming"), and Conduct Problems (e.g*., "Often has temper tantrums or hot tempers"*). Each subscale contains five items rated on a three-point Likert-type scale (0 = not true, 1 = somewhat true, or 2 = certainly true). A total score is calculated by adding the four subscales scores, with higher score reflecting greater difficulties. Previous research verified the internal consistency of SDQ in a community sample of Greek Cypriot (Georgiou, 2014). The Cronbach's alphas for the SDQ Total score (α = .84) was very good, and Hyperactivity (α = .64), Conduct Problems (α = 60) and Peer Problems (α = .67) were marginal. For the current study, alpha coefficients for parents ratings were marginal for the SDQ Total score (α = .66), prosocial behavior (α = .67), and hyperactivity (α = .71), Conduct and Peer problems (α = .57 for Conduct problems, .45 for Peer problems). Mother and father reports indicate strong positive correlations for conduct problems (r = .66), hyperactivity/inattention (r = .73), peer problems (r = .56), prosocial behavior (r = .56), and SDQ total difficulties (r = .73). Mothers and fathers scores were combined at the item level by taking the higher rating.

Eyberg Child Behavior Inventory (ECBI; Eyberg & Pincus 1999). The ECBI is a 36-item parent-rating scale of child behavior problems. Parents rate the intensity and the frequency of the child's behaviors on a 7-point scale (1= "never" to 7= "always"). The intensity score has a possible range between 36 and 252, and has demonstrated excellent internal consistency (α = 0.95, Eyberg & Pincus, 1999) and interrater (mother-father) reliability (0.69, Eisenstadt, Mc Elreath, Eyberg, & McNeil, 1994). In the present study, total intensity scores (α = .88), Oppositional Defiant behavior towards adults (α = .89) and inattentive behavior (α = .85) showed good internal consistency, when excellent was the internal consistency of the Total score (α = .90). Acceptable was the internal consistency indicated by the Conduct problems scale (α = .77). Mother and father reported scores were combined by taking the higher rating between parents. Mother and father reports were highly correlated for oppositional defiant behavior (r = .69), inattentive behavior (r = .68), conduct problems (r = .63), and total problems (r = .72).

Alabama Parenting Questionnaire (APQ; Frick, 1991). APQ contains 42-items, rated from 1 (never) to 5 (always), assessing parenting style. The APQ is composed of five subscales; Parental involvement (e.g., *"You have a friendly talk with your child"*), Positive parenting (e.g., *"You let your child know when he/she is doing a good job with something"*), Poor monitoring/supervision (e.g., *"You get so busy that you forget where your child is and*

what he/she is doing"), Inconsistent discipline (e.g., *"You threaten to punish your child and then do not actually punish him/her"*), and Corporal punishment (e.g., *"You spank your child with your hand when he/she has done something wrong"*). Parents rated 33 out of the 42 items, as some questions such as *"Your child fails to leave a note where he/she is going"* are not theoretically and/or empirically supported for being applicable and assessable in early childhood. The APQ scales generally show adequate internal consistency ranged from .80 to .85 (Fanti & Centifanti, 2014; Kyranides, Fanti, Katsimicha, & Georgiou, 2017). For the current study, alpha coefficients for subscale scores were .69 for Parental Involvement, .69 for Positive parenting, .25 for Poor monitoring/supervision, .69 for Inconsistent discipline, and .64 for Corporal punishment. Mother and father reports indicated a correlation of .21 for parental involvement, .21 for positive parenting, .35 for poor monitoring, .42 for inconsistent discipline, .52 for corporal punishment, and .47 for other discipline practices. Mothers and fathers reports were combined at the item level by taking the higher rating.

Parental Bonding Instrument (PBI; Parker, Tupling, & Brown, 1979). The PBI is a brief self-report designed to measure fundamental parental styles comprising by 25-items that contribute two sub-scales, parental care and parenting distress/overprotection. The items were rated on a 1 to 4 ordered–categorical, Likert-type scale ranging from *"Very like this"* to *"Very unlike this"*. The reliability of the PBI has been demonstrated in clinical and non-clinical samples over both brief intervals (Burbach, Kashani, & Rosenberg, 1989; Plantes, Prusoff, Brennan, & Parker, 1988) and prolonged periods of up to two decades (Lizardi & Klein, 2005; Wilhelm, Niven, Parker, & Hadzi-Pavlovic, 2005). Additionally, previous research has shown good reliability and validity, satisfactory construct and convergent validity (Parker, 1983). For the current study, only the items of parental care were included *"I speak to my child in a warm and friendly voice", "I appear to understand his/her problems and worries"*. Alpha coefficients for Parental care subscale scores was acceptable ($\alpha = .69$). Mother and father reports were significantly correlated ($r = .45$), and were combined at the item level by taking the higher rating.

Parenting Stress Index Short Form (PSI-SF; Abidin, 1995). The short form of the PSI is a 36-item questionnaire that consists of three subscales: Parental Distress, Parent-Child Dysfunctional Interaction, and Difficult child. For the purposes of the current study, and based on our interest in parent's characteristics, only the 12 items referring to parental distress

were included (e.g., *"Feel that I cannot handle things"*; *"Gave up my life for children's needs"*). Parents rated each item from *"Strongly disagree"* (1) to *"Strongly agree"* (5), with higher scores indicating increased levels of parental distress. This subscale assess the parents understanding of their ability to rear their child appropriately, the existence of social support, and the stress experienced by their role as a parent and its cost on other life roles due to demand of child-rearing. Cronbach's alpha from previous studies for maternal and parental distress ranged from .85 to .89 across time (Fanti et al., 2017). For the current study, alpha coefficients for Parental Distress subscale scores was good (α = .87), which was similar with a previous study conducted in Cyprus (Fanti & Centifanti, 2014). Mother and father-reported scores were combined by taking the higher rating between parents and were significantly correlated (r = .50).

Preschool Social Behavior Scale – Teacher Form (PSBS-T; Crick, Cass & Mosher, 1997). The PSBS-T is a 25-item teacher-report measure of children's social behavior among peers. The Likert response scale for each item ranges from 1 ("*Never or almost never true*") to 5 ("*Always or almost always true*"). For the purpose of the current study three subscales were included relational aggression (e.g., "*When this child is mad at a peer, s/he gets even by excluding the peer from his or her clique or play group*"), overt/physical aggression (e.g., "*This child hits or kicks peers*"), and prosocial behavior (e.g., "*This child says supportive things to peers*"). Cronbach's alpha showed all four scales to be highly reliable; α= .96, .94, and .88, for the relational aggression, overt aggression, and prosocial behavior, respectively (Crick et al., 1997). Alpha coefficients for subscale scores were good (α = .90 for Relational Aggression, .92 for Overt/Physical aggression, .82 for Prosocial Behavior).

Plan of analyses

Cronbach's alpha assessed the internal consistency of the CPTI and the other measures used in this study. Alpha coefficients were interpreted as follows: <.60 = insufficient; .60 to .69 = marginal; .70 to .79 acceptable; .80 to .89 = good; and .90 or higher = excellent (Barker, Pistran, & Elliot, 1994). Descriptive information and correlations are presented for the main study variables, GD, CU, INS and the CPTI Total score for parents and teachers.

Zero-order correlations between the CPTI scores and several behavioral, emotional

and contextual variables were conducted in order to assess the external validation of the measure. The correlation coefficients were interpreted following the Cohen's guidelines as follows: ≤ .30 = weak; .30 to .50 = moderate; and ≥ .50 = strong (Cohen, 1988). We also conducted a series of multiple regression analyses with the external criterion variables as the dependent variable to test the unique, additive, and interactional effects of the three CPTI factors on concurrent behavioral, emotional and contextual factors. All the analysis was conducted in SPSS 24.0 with $p<.05$.

Results

The Cronbach's alpha for the three CPTI factors and the Total score showed excellent internal consistency. Specifically, α for the CPTI Total score was .92 for parents' rates and .95 for teachers scores, for the GD factor .85 and .90 for parents and teachers respectively, for CU factor .88 and .94, and for INS factor .84 and .92. Zero-order correlations were conduct between the main study variables, GD, CU, INS and the CPTI Total score for parents and teachers (see Table 1). The correlations varied for parents ratings between .51 and .85, and for teachers ratings between .11 and .23. For further analyses in combination to the use of the three CPTI factors, we created a total score of the CPTI, i.e., the 28 items (labeled CPTI Total, α in the total sample = .92). Additionally, with the aim to examine the role of the three CPTI factors in relation to the same constructs, a series of regression analyses were conducted using parents and teachers' ratings as the dependent variables. The findings for parents and teachers reports were discussed together.

Externalizing problems

All the three CPTI dimensions were positively correlated with behavioral problems measured by ECBI and SDQ subscales, with discriminant associations found more clearly in the context of regression analysis as seen in Tables 2 and 3. All CPTI dimensions were positively associated with Oppositional defiant, hyperactive and inattentive behavior. The INS dimension demonstrated the stronger association with these behavioral problems, whereas CU and GD contributed to the prediction of these behavioral problems to a weaker extend. The positive correlation of GD and hyperactive and inattentive behavior reduced to non-significance in the regression analysis, indicating that the zero-order association may be accounted by an overlap between the three factors. The GD dimension accounted for the

greatest proportion of variance on conduct problems, with INS showing a slightly weaker relation. By contrast, the CU dimension showed a weaker positive association with conduct problems. Total externalizing problems experienced by children indicated a positive association with all the three CPTI dimensions, although INS accounted for the greatest proportion of behavioral problems variance.

Table 3 also lists the relations between CPTI dimensions and measures of relational and overt aggressions assessed by teachers. Consistent with our hypotheses, all three dimensions showed a positive relation with both forms of aggressions, with GD accounting for the greatest proportion of variance of relational aggression. Despite the fact that the CU dimension was positively related with relational aggression at the zero-order level, this relation reduced to non-significance in the regression analysis. With reference to overt aggression, all three dimensions showed an equally high correlation and a significant relation as shown in regression analysis with this form of aggression, although GD showed a slightly higher regression coefficient than CU dimension.

Cognitive and affective empathy

It was hypothesized that all the CPTI dimensions scores would be inversely associated with measures of empathy. With reference to cognitive empathy, all dimensions were significantly negatively related with the children ability to understand the affective state of others, although only the CU and INS predicted cognitive empathy deficiencies after controlling for their covariance, with stronger regression coefficients for parents than teachers. Regarding affective empathy, only CU and INS correlated significantly and were able to predict children's ability to respond to others emotions according parents, as listed in Table 2. According to teachers' ratings, only the CU dimension correlated significantly with all the empathy dimensions (see Table 3). CU dimension indicated the strongest negative relation with cognitive, affective and general empathy for both parents and teachers' ratings and the variance in this factor as shown in Table 2 and 3. Consistent with our hypothesis, all CPTI dimensions were negatively related with prosocial behavior at zero-order level for both parents and teachers. The CU dimension predicted deficiencies in prosocial behavior after controlling for their covariance with references to parents' ratings. For teachers ratings both CU and INS accounted for a proportion of unique variance in prosocial behavior.

Callous-Unemotional traits

Consistent with our hypothesis, scores on each of the CPTI scales were positively correlated with the total score on ICU for parents (rs = .38 - .60) and teachers (rs = .57 - .82) (see Table 2 and 3). Each psychopathic dimensions predicted unique variance in ICU measure for both parent (βs = .15 - .50) and teacher (βs = .08 - .83) reports. However, the CU dimension accounted for the greatest amount of variance for parents (β = .50) and teachers (β = .83), when all the three CPTI dimensions were entered concurrently as predictors in the regression model.

Social context

All the three CPTI dimensions showed positive bivariate associations with peer relation problems, as shown in Tables 2 and 3, with discriminant associations found more clearly in the context of regression analyses. CPTI dimensions were positively associated with peer problems. In the context of the regression analysis, the CU dimension accounted for the greatest proportion of variance in children peer relations when all the three dimensions were entered concurrently. With reference to teachers' ratings, the relations between GD, INS and peers problems were reduced to non-significance in the regression analysis, indicating the important role of CU in predicting social relational problems.

With reference to children family environment and parenting practices, CPTI dimensions were negatively related with all the positive parenting practices in support of our hypothesis. Specifically, all the dimensions were negatively correlated at the zero-order level with parental involvement, positive parenting and care, although GD and INS reduced to a non-significant level in the regression analysis, indicating that the observed associations may be due to an overlap between the three factors. Moreover, in support of our hypothesis, all CPTI dimensions were positively related with negative parental practices (i.e., poor monitoring, inconsistent discipline, corporal punishment), as shown in Table 2. Despite the fact that all the CPTI dimensions showed a positive correlation with poor monitoring, CU dimension accounted for a greatest proportion of variance in this factor. Strong was also the association of the INS dimension with parents' inconsistent discipline practices. With reference to corporal punishment, CU and INS dimensions accounted for the greatest proportion of variance, where GD dropped dramatically. Notably, GD dimension indicated a positive relation to all the negative parental practices, although it demonstrated weak associations in the context of the regression analysis. Parental distress showed a positive

correlation with all the CPTI factors, although as with prior analysis, GD dropped to a non-significant level in the regression analysis.

Discussion

The current study, using a multi-informant approach, aimed to further examine the relation of distinct psychopathic dimensions assessed with CPTI with several constructs of interest, such as externalizing problems (i.e., conduct problems, oppositional defiant and inattentive behavior, aggression), empathic concern (i.e., cognitive and affective), and social relations (i.e., parents and peers). The focus of this study's in better understanding these relations early in development aimed to enhance research on early intervention and prevention strategies appropriate for this population's needs. In support of our hypothesis, the three CPTI factors were distinctively related to the external constructs, putting into question the literature treating psychopathy as a unitary construct or focusing on one dimension (e.g., Frick et al., 2014). The relation of psychopathic traits with deficiencies in the children's ability to identify the emotions of others, and the unique contribution of CU traits in understanding these difficulties in affective responding, extends the findings of previous research and further support the importance of CU traits in distinguishing those children with the most severe difficulties in emotional processing (Dadds et al., 2009). In addition, no previous studies investigated the unique association of CPTI dimensions with children's social contexts and relations, such as prosocial behavior, peer relations, and parenting responding in these traits. By indicating a unique relation of the three psychopathic dimensions with negative parenting practices, and peer relations this study highlights the importance of psychopathic traits in forming child's social environment (Waller et al., 2013; 2015).

Externalizing problems

Research investigating the causes of serious and stable externalizing problems, such as conduct problems, oppositional defiant, inattentive behavior, and aggression has supported the importance of psychopathic traits in understanding their developmental trajectories (see Frick & Viding, 2009; Hill, 2002; Moffitt et al., 2008 for reviews). By including all the psychopathic dimensions assessed by both parents and teachers, the present study aimed to

extend the findings of previous research on the importance of all the psychopathic dimensions early in development (Colins et al., 2014a; 2016). Specifically, by providing support for the unique relation of CU dimension to all the externalizing problems assessed, we further support the inclusion of a CU-based specifier in Conduct Disorder diagnosis of DMS-5 (APA, 2013). Although, the indication of a strong relation of GD and INS dimensions with distinct behavioral problems, comes to enhance the discussion of the importance of unique patterns of associations of psychopathy dimensions (Colins, Andershed, Salekin, & Fanti, 2018).

The INS dimension that refers to the child's impulsive need for stimulation, sensation seeking and proneness to boredom has proven to play a vital role in the prediction of behavioral problems, such as oppositional defiant and inattentive behavior, based on both parent and teacher reports. These results are in support of Colledge and Blair (2001) hypothesis that impulsivity may be an underlying mechanism for the development of externalizing psychopathologies, such as ADHD and ODD, and their co-occurrence (Mathias et al., 2007; Moeller, Barratt, Dougherty, Schmitz, & Swann, 2001), mainly because of the increased correlation indicated between hyperactivity and impulsivity components of these disorders (Frick et al., 2000). In addition, the GD dimension, but not the affective dimension, showed to be a stronger predictor of conduct problems regarding both parents and teachers, which is in accordance with previous findings (Frick & White, 2008). An important contribution of the current study is the replication of findings regarding the children's behavioral problems across environments based on different informants. A finding that extends the support for the pervasiveness of children's behavioral difficulties. According to Lau and Marsee (2013), individuals with an increased sense of grandiosity and glibness/superficial charm are threatened by perceived provocations regarding their self-worth, leading to antisocial and aggressive behavior in a way to regain and maintain their positive self-concept and their superiority over others (e.g., Thomaes, Bushman, Stegge, & Olthof, 2008). In this manner, their delinquent behavior aims to establish their dominance over others and interpersonal entitlement, which in turn make them more prone for serious antisocial and delinquent behavior (i.e., bullying) in order to "feel powerful" (Barry, Pickard, & Ansel, 2009; Kerig & Stellwagen, 2010; Washburn, McMahon, King, Reinecke, & Silver, 2004).

In relation to aggressive behavior, our findings indicated no clear differences for the three psychopathic dimensions with *overt aggression*. That is, the interpersonal, affective and behavioral dimensions seemed to show relatively similar association with overt aggression, a finding that comes in support of the importance of psychopathic dimensions in predicting aggressive behavior later in development (Dadds, Fraser, Frost, & Hawes, 2005; Dolan & Rennie, 2006; Kruh, Frick, & Clements, 2005; Marsee et al., 2005). As expected, the positive association of impulsivity comes to support individual's need for stimulation, sensation seeking and proneness to boredom as characteristics that can lead children to behavioral dysregulation that is beyond social rules in family and school. In addition, the association between grandiosity and maladaptive behavior is an area of interest regarding its importance in predicting behavioral problems (Lilienfeld et al., 2012; Lynam & Miller, 2012). The association of this dimension with behavioral problems early in development, extends previous findings, mainly from adolescent and adult populations, in the relation of these traits with others forms of antisocial behavior such as narcissism and aggression (Barry, McDougall, Anderson, & Bindon, 2018; Lobbestael, Baumeister, Fiebig, & Eckel, 2014), sensation seeking (Lynam & Miller, 2012) and fearlessness (Benning, Patrick, Salekin, & Leistico, 2005). As for the CU dimension, its relation to severe and violent aggressive behavior later in development is well evident (Enebrink, Anderson, & Langstrom, 2005; Frick et al., 2003). With reference to *relational aggression*, despite the fact that all the psychopathic dimensions have proven their strong relation with this type of aggression, ratings on GD dimension highlight what has been previously stated about this populations increased need to secure their social status over others (Czar et al., 2011; White, Gordon, & Guerra, 2015).

The distinction between affective and cognitive empathic concern

Adding in the debate regarding the relation of psychopathic dimensions with overt and relational aggression, the current study provides further support for the importance of the affective dimension of psychopathy in the prediction of deficiencies in children ability to respond to others' emotional expressions. In support of previous findings, the relation of CU traits and affective empathy may explain the difficulties in social interaction and the strong

association of these traits with severe behavioral problems (Frick & White, 2008; Kimonis et al., 2008). According to Blair and colleagues (2001), this emotional dysfunction in affective arousal early in development can explain the children's inability to withdrawal or inhibit a response based on the absence of a negative emotional arousal. In addition, present findings come in support of the literature proposing a number of difficulties in emotional processing of individuals high on CU traits early in development, as their decreased orientation of facial emotional expressions that prevents their moral and social development through reciprocal parent-child emotional engagement (Dadds et al., 2008a; 2012). With reference to interpersonal dimension, the positive relation with affective empathy comes in support of the greatest propensity of this population to feel empathic concern (Seara-Cardoso et al., 2012). This finding also extends previous findings by providing support for differing mechanism employed for this dimension to lead to behavioral problems (Almeida et al., 2015; Seara-Cardoso et al., 2012)

Slightly different were the findings regarding children's psychopathic traits associations with cognitive empathy. In support of our hypothesis, all three psychopathic dimensions were negatively related with cognitive empathy, although CU dimension showed a stronger relation with cognitive subcomponent of empathy in support of previous research in children populations (Georgiou et al., under review; Dadds et al., 2009). These results contradicted previous studies (e.g., Jones et al., 2010) reporting that children high on CU traits show impairments only on affective empathy. Our findings are in accordance with Dadds and colleagues (2009) model proposing that children high on CU traits experience deficiencies in response to cognitive empathy. According to Georgiou and colleagues (under review), the cognitive empathy deficiencies mediate the association between CU traits and externalizing problems, highlighting the importance of the affective dimension in children's inability to identify thoughts, intentions and understand feelings and emotions of others, which in turn partially explains their engagement in antisocial behaviors. Deficits that according to the same theoretical model might be overcome through a compensatory mechanism that enables children to learn how to identify and understand other's emotions, without sharing or experiencing those emotions. According to Mullins-Nelson and colleagues (2006), this mechanism may explain the adult psychopathic populations' improved cognitive empathy abilities, making the study of empathy early in development

even more important. This association is in line with studies examining the efficacy of intervention programs for preventing and improving psychopathic traits in children. Specifically, Dadds and colleagues (2012) findings revealed that intervention programs that aim to train children with increased levels of CU traits, on emotion recognition skills – a component related to cognitive empathy – lead to improvements in both conduct problems and empathy levels.

These findings are consistent with a growing body of research on the distinct causal mechanisms leading in the development of antisocial behavior in populations with psychopathic personality traits (Silverthorn & Frick, 1999). While the findings regarding the relation between CU dimension and deficiencies in both cognitive and affective empathy, suggest that empathy deficits extend beyond affective sharing and resonating with others, and encompass impairment in their ability to identify and understand emotions. A finding that is in line with studies examining the efficacy of programs aiming to improve children ability to identify through the enhancement of emotional skills, and respond to others' emotions in an attempt to improve CU traits and prevent behavioral problems later in development.

Social context: The importance of relations

An important contribution of the current study is the investigation of the unique associations between psychopathic dimensions and contextual factors such as children's peer relations and practices applied by parents. Extending previous findings on the importance of CU traits in forming social environment, current study provide further support for the significant relation of these traits with difficulties in social relations with peers and ineffective parenting practices. In relation to peer problems, our findings come in support of previous studies indicated the social burden of those around children with CU traits (Haas, Becker, Epstein, & Frick, 2017). Since CU traits are associated with externalizing problems and empathic concern deficiencies, it is not surprising that prior research has supported the relation of these traits with a range of social impairments (Frick et al., 2014; Gardner & Gerdes, 2015). Further, findings support the positive association of CU traits and negative parenting practices, such as corporal punishment (Pardini, Lochman, & Powell, 2007; Viding, Blair, Moffitt, & Plomin, 2005), inconsistent discipline (McDonald et al., 2011) and

poor monitoring (Barker et al., 2011; Waller et al., 2012). The children's insensitivity to typical socializing practices lead parents to adopt more negative and ineffective practices in order to encounter children's misbehavior (Pardini & Byrd, 2012; Pasalich et al., 2012), that can act as a basic contributor to the behavioral problems indicated by this populations (Waller et al., 2017). Thus, the support provided by our findings in the importance of the CU dimension and its relation to negative parenting practices, imposes some important questions regarding the ineffectiveness of intervention and prevention programs aiming to decrease behavioral problems, such as conduct problems in this population (e.g., Scott & Dadds, 2009). In addition, findings provide evidence for a promising area for effective intervention, as Kochanska and colleagues (2005) have shown that positive parental strategies such as parental involvement and care can act as protective factors for the development of externalizing problems in children high on CU traits. While, Pasalich and colleagues (2012) showed that children high on CU traits were more responsive to positive parenting and warmth that lead to the promotion of their affective response and the internalization of parental norms and values.

Notwithstanding the importance of affective dimension in the prediction of difficulties in children social relations, our findings also provided support for the relation of the behavioral dimension of CPTI and parents inconsistent discipline strategies. A closer review of the empirical research indicate that high impulsivity is a strong vulnerability factor for the development of externalizing behaviors in the implementation of harsh parenting practices (Slagt, Dubas, & Aken, 2016). Specifically, inattention and impulsivity are strongly associated with the loss of control and aggressive behavior that lead parents to adopt ineffective practice, which in turn prevents children from developing healthy prosocial behavior, such as helping or sharing (Centifanti, Meins, & Fennyhough, 2016). Because of these difficulties in parents and children relation, parents of children high on both CU and INS dimensions indicate increased levels of distress. Having a child who indicates externalizing problems who is also impulsive of deceitful lead parents to feel insufficient in their role, feelings that according to Fite and colleagues (2008) can be the result of parents' perception regarding the luck of support and personal development. The current findings provide further support for the importance of the different psychopathic dimensions in informing the research on the development of adequate prevention and intervention strategies

that target these populations' unique needs. By providing support for the difficulties in social relations the current study identify an area of importance for prevention and intervention practices early in development.

Strengths and limitations

There are several strengths of the current study. First, we included a relatively large community-based sample of children, with an equal proportion of boys and girls. Parents and teachers completed a battery of questionnaires aiming to assess the expression of these traits early in development. We also integrated information from both parents and teachers aiming to cover the full manifestation of the construct (van Baardewijk, Vermeiren, Stegge, & Doreleijers, 2011; Somma et al., 2016; Wang et al., 2018). In addition, this study aimed to extend the literature on the unique contribution of each psychopathic personality dimension in predicting psychopathology (i.e., oppositional defiant, inattentive, hyperactive behavior; conduct problems), social relations (i.e., parenting and peer relations), and empathy deficits, and the strong contribution of their overall score in the prediction of these discrepancies.

Despite the strengths, our study has several limitations that must be considered when interpreting the findings. Our assessment of the constructs of interest were based on parent and teacher reports, and future research may benefit from experimental measures of empathy that are less subject to bias such as physiological measurements and laboratory tasks (i.e., use of emotional videos and tasks). An experimental exploration of the individuals' empathic concern will also address the issue raised with the GEM measure of affective empathy. However, parents are a critical source for their children's behavior and teachers' for reporting on their students, especially in rating externalizing problems (De Los Reyes & Kazdin, 2005). Finally, we used a predominately community sample of children, with an underrepresentation of high-risk children that are likely to show higher levels of antisocial and aggressive behavior. Overall, more research is needed in order to extend the importance of the unique contribution of each psychopathic dimension in different aspects of children behavior and social interactions early in development.

Conclusion

In conclusion, to better understand the developmental precursors of severe antisocial and delinquent acts it is important to investigate the unique contribution of each psychopathic personality dimension in relation with children's behavioral problems (i.e., oppositional defiant and inattentive behavior, conduct problems), empathic concern and social relations early in development. While the three dimensions of psychopathic personality share similar qualities, findings from the current study indicated that they are associated with different levels of proneness to and severity of antisocial, delinquent and aggressive behavior. The present study replicated and substantially extended prior work on the different relations between the grandiosity and conduct problems, and the unique contribution of impulsivity to the increased difficulties experienced in hyperactivity and impulsivity parameters. The role of CU dimension remained significant in relation to most behavioral problems, with greater associations with empathic concern and social relations. The findings of the current study contribute in intervention and prevention planning, for children early in development with different levels of grandiosity, callousness and impulsivity, by focusing on the unique relation of these traits with behavioral problems, empathic concern deficiencies, and social impairments.

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Table 1 1: Descriptive Statistics and Correlations among psychopathic traits reported by parents and teacher.

	1	2	3	4	5	6	7	8
1. GD (parent)								
2. CU (parent)	.62							
3. INS (parent)	.55	.51						
4. CPTI total (parent)	.84	.85	.83					
5. GD (teacher)	.20	.11	.15	.18				
6. CU (teacher)	.16	.16	.15	.19	.70			
7. INS (teacher)	.13	.11	.23	.19	.64	.66		
8. CPTI tot (teacher)	.18	.15	.20	.21	.85	.89	.89	
Descriptives								
Mean	.58	.67	1.39	.90	.44	.55	1.03	.70
SD	*.50*	*.52*	*.52*	*.43*	*.59*	*.61*	*.68*	*.56*

Note. All correlations significant at the $p < .01$ level.

Table 1 2: Relations between Parents-Reported CPTI Subscales and Criterion Measures: Pearson Correlations and Regression Coefficients (N = 1120)

	GD	CU	INS	R^2	Total
	r / *β*	*r* / *β*	*r* / *β*		*r*
Externalizing problems					
ECBI (parents)					
Oppositional Defiant Behavior	**.44**/.10*	**.46/.18**	**.57/.42**	**.36**	**.58**
Inattentive Behavior	**.30**/-.01	**.32**/.10*	**.49/.44**	**.24**	**.45**
Conduct problems	**.51/.31**	**.42**/.09*	**.48/.26**	**.32**	**.55**
Total problems	**.53/.18**	**.51/.16**	**.64/.46**	**.47**	**.67**
SDQ (parents)					
Conduct problems	**.57/.38**	**.45/.10**	**.50/.24**	**.38**	**.60**
Hyperactivity/Inattention	**.35**/.04	**.33**/.05	**.56/.51**	**.31**	**.50**
Peer problems	**.25/.11**	**.26/.14**	**.23/.10**	**.09**	**.30**
Prosocial	**-.25**/-.05	**-.35/-.32**	**-.20**/-.01	**.13**	**-.32**
Total difficulties	**.48/.17**	**.45/.13**	**.58/.42**	**.39**	**.60**
Cognitive and Affective empathy					
GEM (parents)					
Cognitive empathy	**-.33**/-.01	**-.45/-.33**	**-.39/-.22**	**.24**	**-.47**
Affective empathy	-.01/.04	**-.14/-.28**	**.10/.22**	**.06**	-.02
General empathy	**-.26**/.00	**-.44/-.45**	**-.20**/.03	**.19**	**-.36**
Parenting					
APQ (parent)					
Parental involvement	**-.12**/-.03	**-.15**/-.10*	**-.13**/-.07	**.03**	**-.15**
Positive parenting	**-.08**/.03	**-.16/-.17**	**-.09**/-.02	**.03**	**-.13**
Poor monitoring	**.23**/.08*	**.25/.16**	**.22/.10**	**.08**	**.28**
Inconsistent discipline	**.27**/.01	**.31/.16**	**.38/.29**	**.16**	**.39**
Corporal punishment	**.27**/.08*	**.29/.17**	**.28/.16**	**.11**	**.33**
PBI (parent)					
Care	**-.29**/-.06	**-.37/-.29**	**-.26/-.08**	**.15**	**-.37**
PSI (parent)					
Parental distress	**.32**/.03	**.40/.26**	**.39/.25**	**.21**	**.45**
Callous-Unemotional Traits					
ICU (parent and teacher)					
CU traits (parent)	**.43**/.04	**.60/.50**	**.43/.15**	**.38**	**.59**
CU traits (teacher)	**.19**/.06	**.22**/.15*	**.16**/.05	**.05**	**.22**

Note. Bold font entries are significant at the $p<.01$ level. * entries are significant at $p<.05$. Zero-order correlations (*r*) reflect bivariate correlations. To index distinct contributions of each of the CPTI subscale scores to prediction of criterion measures after controlling for their shared variance, standardized regression coefficients (β) from regression models incorporating all three CPTI subscales as predictors are presented alongside zero-order correlations.

Table 1 3: Relations Between Teacher-Reported CPTI Subscales and Criterion Measures: Pearson Correlations and Regression Coefficients (N = 906)

	GD	CU	INS	R^2	Total
	r / *β*	*r* / *β*	*r* / *β*		*r*
Externalizing problems					
ECBI (parent)					
Oppositional Defiant Behavior	**.18**/.02	**.20**/.08	**.22/.16**	**.05**	**.23**
Inattentive Behavior	**.11**/-.09	**.17**/.09	**.22/.21**	**.05**	**.20**
Conduct problems	**.23/.16**	**.18**/-.01	**.22/.13**	**.06**	**.24**
Total problems	**.22**/.05	**.23**/.06	**.28/.20**	**.08**	**.28**
SDQ (parent)					
Conduct problems	**.26**/.08	**.29/.16**	**.27**/.14*	**.10**	**.31**
Hyperactivity/Inattention	**.18**/-.06	**.25/.14**	**.30/.25**	**.10**	**.29**
Peer problems	**.09**/-.04	**.15/.14**	**.12**/.05	**.02**	**.14**
Prosocial	-.04/.10*	**-.12/-.16**	**-.09**/-.06	**.02**	**-.10**
Total difficulties	**.20**/.01	**.25/.15**	**.26/.16**	**.08**	**.27**
PSBS (teacher)					
Relational Aggression	**.66/.53**	**.52**/.09	**.51/.12**	**.46**	**.63**
Overt aggression	**.56/.27**	**.56/.24**	**.54/.20**	**.40**	**.63**
Prosocial behavior	**-.47**/-.03	**-.62/-.42**	**-.57/-.27**	**.43**	**-.64**
Cognitive and Affective Empathy					
GEM (parent)					
Cognitive empathy	-.07*/.03	**-.13/-.17**	-.06*/.03	**.02**	**-.10**
Affective empathy	.00/.10	**-.08/-.17**	-.02/.03	.01	-.04
General empathy	-.05/.10	**-.16/-.27**	-.05/.06	**.04**	**-.10**
Callous-Unemotional Traits					
ICU (parent and teacher)					
CU traits (parent)	**.10/-.17**	**.24/.30**	**.18**/.11*	**.07**	**.20**
CU traits (teacher)	**.59**/-.08	**.82/.83**	**.57**/.08*	**.68**	**.75**

Note. Bold font entries are significant at $p<.01$ level. *entries are significant at $p<.05$. Zero-order correlations (r) reflect bivariate correlations. To index distinct contributions of each of the CPTI subscale score to prediction of criterion measures after controlling for their shared variance, standardized regression coefficients (β) from regression models incorporating all the three CPTI subscales as predictors are presented alongside zero-order correlations.

Study 2

Are children with "Limited Prosocial Emotions" emotionally blind?

Testing Eye-gaze differences

Abstract

Emotion processing is fundamental for normal socialization of children early in development, as it can elicit a number of evolutionary behavioral adaptations. A prominent line of research has supported a deficit of individuals high on callous-unemotional (CU) traits to fixate on the eye region of emotional faces that influence their ability to identify the emotion expressed and adapt their behavior accordingly. In the current study, we aimed to investigate the eye gaze behavior of children (n = 59) with varying levels of CU traits. The use of eye-tracker methodology (i.e., proportion of gaze duration), aimed to enable a better understanding of the processes, applied by children high on CU traits on facial emotional expressions. Our findings support a reduced fixation rate to the eyes region of emotional faces, irrespective of emotion expressed and age of individual, illustrated for both boys and girls early in development. By indicating an attentional neglect of the eye region, the current study provides further support for the attention allocation mechanism proposed for the deficits indicated by children high on CU traits in recognizing emotions. A failure to make eye contact that can lead to a number of cascading errors in children moral and emotional development. Furthermore, the different trends employed by boys and girls; with girls focusing more on peers' eyes than boys indicating a higher fixation on adults' eye region, advance prior work on the importance of gender differences in emotional processing and the behavioral problems.

Keywords: limited prosocial emotions, childhood, eye-gaze, Eye-tracker, CPTI, callous-unemotional traits

Introduction

Callous-unemotional (CU) traits refer to a constellation of traits characterized by callous use of others, lack of remorse or empathic concern, shallow or deficient emotions and lack of concern about performance (for a review see: Frick & Morris, 2004). The presence of CU traits designates a subgroup of individuals exhibiting continuous, severe and stable conduct problems (e.g., Frick, Cornell, Barry, Bodin, & Dane, 2003; Pardini, Obradovic, & Loeber, 2006). The relation of these traits to behavioral problems, indicated by children, led to their inclusion in the latest revision of the Diagnostic and Statistical Manual of Mental Disorders (DSM5; American Psychiatric Association, 2013) as a specifier for Conduct Disorder, named "with Limited Prosocial Emotions". In an effort to understand the development of CU traits, one prominent line of research has been focused on the ability of these individuals to attend and process information expressed through emotional faces. The ability to attend and accurately identify emotional expressions is vital for effective social functioning, as it elicits evolutionary adaptive behavioral modulations (e.g., Blair, 2003; Carlson & Reinke, 2014; Preuschoft, 2000). Specifically, facial emotional expressions, can elicit empathic concern among individuals, who correctly identified them (Hoffman, 1987; Marsh & Ambady, 2007; Nichols, 2001; Preston and de Waal, 2002), which, in turn, is associated with increased helping behaviors and decreased antisocial and delinquent acts (Eisenberg, Fabes, Guthrie, & Reiser, 2000). The low levels of emotional engagement can be explained as an attentional deficit to socially relevant cues (i.e., eyes) which leave the individual incapable of emotional reciprocity (Dadds et al., 2006; 2008; 2011). These findings are related with accounts suggesting that individuals with psychopathic personality traits show "poverty of emotion" (Cleckley, 1941/1988; Frick & Morris, 2004).

The main aim of the current study was to investigate how attention allocation to the eye region was related to CU traits in childhood. The current study was particularly interested in how children, differentiated on levels of CU traits (high vs. low), process facial emotional expressions. More precisely, if children's, deficits in recognizing emotions are direct to fear and sadness, then it will suggest a distress-specific mechanism, proposed by Blair (1995; 2006). However, if deficits are more pervasive, and children indicate a reduced attention to the eye, irrespective of emotion expressed, this would then be consistent with the idea of poor attention to the eye region as a mechanism, that can explain this population difficulties in

emotion recognition (Dadds et al., 2006). By providing support for the mechanism underlying the emotional deficiencies experienced by children high on CU traits, the current study aimed to inform research on the development of adequate intervention and prevention protocols. Before proceeding to specific hypotheses about children's ability to attend to emotional information, a brief review of the emotional processing strategies employed by individuals high on CU traits will be provided.

CU traits and visual processing of facial emotional expressions

Existing findings suggest that individuals high on CU traits show inability to recognize and respond adaptively to others' emotions, which gave rise to a number of theories that aim to explain their "emotional poverty". The association of CU traits with reduced attentional orientation and responsiveness to emotional information was supported with a number of stimuli, including emotional words (e.g., Frick et al., 2003; Loney, Frick, Clements, Ellis, & Kerlin, 2003), images (e.g., Gillespie, Rotshtein, Wells, Beech, & Mitchell, 2015; Kimonis, Frick, Fazekas, & Loney, 2006; Kimonis, Frick, Muñoz, & Aucoin, 2007; Kyranides, 2014), and dynamic scenes (Fanti, Kyranides, & Panayiotou, 2017). Findings support an attention abnormality that inhibit the processing of emotional information and lead to deficiencies in children normal socialization (Baskin-Sommers, Curtin, & Newman, 2013; 2015; Newman, Curtin, Bertsch, & Baskin-Sommers, 2010). This phenomenon, according to Baskin-Sommers and colleagues, can also be explained as an ability, of these individuals, to selectively attend information that are goal-relevant, and block other information that are not necessary. Based on Baskin-Sommers' model, all the information about the emotional state of others are treated as secondary to individuals' purposes, and filtered out as distractions (Newman & Baskin-Sommers, 2011). This model can explain individuals' effective filtering of distractions and concentrate to personal goal, which leave them incapable of processing important context-specific information (Zeier, Maxwell & Newman, 2009).

Dadds and colleagues, in an attempt to further understand this selective attention abnormality, shown by individuals high on CU traits, proposed an attentional deficit to socially relevant cues (i.e., eyes) that serve as the basis for the emotion recognition difficulties experienced by this population (Dadds et al., 2006; 2008; 2011; 2014). According

to Tinbergen (1972), eyes serve as "super-stimuli" that enable the activation of a number of complex autonomic and behavioral processes. This autonomic process allows infants to attend the emotional information expressed by eyes; develop a healthy attachment with their caregiver and become more socially competent (Skuse, 2003). Therefore, the inability of these individuals to attend to the emotional expressions of their caregivers lead to poorer emotional connections and reduced effectiveness of classical parenting practices (Dadds et al., 2006). According to Dodge and Price (1994), processing of information from parents' emotional faces enables conscious development, prosocial emotions, and prevents antisocial behavior. As a result, a poorer attachment relation between parents and children can further lead to a number of cascading errors related to the empathic concern and social interactions (Dadds et al., 2011).

Using an eye-tracking methodology, Dadds and colleagues (2008) indicated a positive association between CU traits and naturally occurring neglect, of the eye region, in a range of emotional expressions (i.e., anger, fear, sad, disgust, happy). The same deficiencies, regarding attentional neglect of the eye region were also evident in studies aiming to investigate this phenomenon in real-time allocation a child's attention to parents' facial expressions and the eye region (e.g., Bedford et al., 2015; 2017; Dadds et al., 2011; 2012). To be more specific, Dadds and colleagues (2011; 2012) recorded a brief interaction of children high on CU traits in a free play trial and in 'emotional talk' scenarios with their parents. Their findings indicated a negative relation between the levels of CU traits and eyes' contact towards parents, supporting consistent impairments in attentional allocation to the eye region. In this manner, the reduced attention to the eye region can explain the deficient fear recognition, because the eye region is particularly vital for the identification of emotional distress expressions (Adolphs et al., 2005; Calder, Young, Keane, & Dean, 2000).

Neurobiological studies linked the attentional neglect of salient emotional cues with amygdala hypo-activation (Blair, 2013; Herpers, Scheepers, Bons, Buitelaar, & Rommelse, 2014; Viding et al., 2012), suggesting a mediating role of amygdala between the level of CU traits and behavioral problems (Cardinale et al., 2017; Lozier, Cardinale, VanMeter, & Marsh, 2014). Adolphs and colleagues (2005) used eye-tracking in a sample of patients with amygdala damage, to support that difficulties in emotion identification arise from the inability to process information; gathered from eye region during free viewing. According to

Adolphs, these deficiencies can be ameliorated by refocusing individuals' attention to eye region of facial emotional expressions. Similarly, individuals high on CU traits overcame these deficiencies with a systematic manipulation of attention allocation to the eye region (Kyranides, 2014). Specifically, by instructing them to re-focus to the eye region, they showed a normal pattern of emotion identification (Dadds et al., 2006; 2008; Richell et al., 2003); an increase in their physiological reactivity (Domes, Heinrichs, Michel, Berger, & Herpertz, 2007; Gustella, Mitchell, & Dadds, 2008; Kyranides, 2014; Newman et al., 2010); and a reduction in their aggressive behavior (Baardewijk, Stegge, Bushman, & Vermeiren, 2009; Ciucci et al., 2017). Consequently, the manipulation of individuals high on CU traits, ability to attend to eye region and their ability to enhance emotion identification, can guide the ongoing development of prevention and intervention strategies early in development.

The current study, builds on prior research that investigates the eye gaze of individuals high on CU traits, by investigating attention allocation to the eye region of emotional expressions. Clearly, the current study assesses the total time children focus on eyes of emotional faces by measuring attention allocation in different affective expressions, using eye-tracking measures. By extending this construct to childhood, we aimed to advance the theory regarding the processing of affective stimuli and the role of a distress-specific or an attention-to-eyes mechanism that can explain children's deficiencies early in development. Besides enabling a better understanding of the mechanism underlying children deficiencies in emotional processing of facial expressions, the current study aimed to inform research on prevention and intervention.

Eye gaze: The role of gender and age of the object

A number of empirical studies have supported the differences between males and females high on CU traits in behavioral (e.g., Odgers, et al., 2008 Orue, Calvete, & Gamez-Guadix, 2016; Rogstad & Rogers, 2008; Stickle, Marini, & Thomas, 2012), and affective functioning (e.g., Yoleri, 2014). However, little empirical research has investigated in depth the specific gender role in eye gaze differences and processing of emotional faces. Developmental research has supported a small female advantage in the identification of happiness and anger emotional expressions with an increased accuracy rate (Lawerence, Campbell, & Skuse, 2016; Mancini, Agnoli, Baldaro, Bitti, & Surcinelli, 2013). This finding

indicates the ascendancy of females in empathic concern and emotion identification (e.g., Alaerts, Nackaerts, Meyns, Swinnen, & Wenderoth, 2011). For better understanding gender differences in children high on CU traits emotion recognition, research needs to investigate the interaction of gender and CU traits in attention allocation.

Supplementary, an important area of concern in the investigation of emotional processing and attention allocation, are the different processing strategies employed in response to emotions expressed by peers or adults. Research has supported the difficulties in attention allocation and emotion identification with facial expressions of both peers (e.g., Ciucci et al., 2017) and adults in experimental designs (e.g., Dargis, Wolf, & Koenings, 2018; Lawrence et al., 2016; Kyranides, 2014) and in vivo-interactions (Dadds et al., 2011; 2012; 2014). The inability of children, high on CU traits, to attend to emotion expressed by their parents' facial reactions can lead to deficiencies in conscious development (Dadds et al., 2011), whereas their inability to identify emotions expressed by peers is strongly correlated with their increased antisocial behavior. The present study aimed to advance prior knowledge on strategies employed in the processing of emotions through peers and adults faces. By employing a systematic experimental manipulation of these differences, this study aimed to provide a better understanding of processes employed in parent-child interaction. This can inhibit the normal emotional and moral development of children, and those indicated in peers' interactions that may explain the expression of antisocial behaviors. In addition, the investigation of these unique processes can lead to a clearer understanding of deficiencies that need to be the target of cognitive skills development.

Current study

The current study aimed to examine whether young children differentiated on CU traits (high vs. low) show fundamental deficits in emotion processing and allocation of attention to the eye region of emotional images (e.g., fear, sadness, happy, anger), using eye-tracker methodology. Research, examining emotional deficits in individuals, with increased levels of CU traits has been carried out with children, adolescents, and young adults (e.g., Fanti et al., 2015; 2016; Frick, Ray, Thornton & Kahn, 2014). Although, extending this construct in early childhood and providing support for reduced attention focus to eye region, this study aimed to advance the knowledge regarding the development of CU traits. A better

understanding of the underlying mechanism employed in the development of CU traits, can influence evidence based intervention programs that aim to reduce conduct problems and antisocial behavior.

Children scoring higher on CU traits (HCU) were expected to attend less to the eye region compared to children with low levels of CU traits (LCU). Specifically, we expected that children in the HCU group would focus less on the eye region of emotional faces, as measured by their total fixation duration in the eyes. These deficits in processing emotional cues were expected to be pervasive and not selective to distressing cues such as fear and sadness (Dadds et al., 2014). Finding general difficulties across emotions would come in support of Dadds' theory (2006; 2008; 2011) regarding this population's pervasive difficulties in attending to emotional information from facial expressions. We also expected that children high on CU traits would show similar deficiencies in focusing on the eye region of both adults and peers emotional expressions. Supporting these pervasive difficulties in emotional processing across stimuli, would explain this population poor parent-child attachment as well as poor peer relations. With reference to gender differences in children high on CU traits, we expected more effective emotional processing employed by females, in support of previous findings, with boys showing a lower rate of total fixation duration to the eye region.

The significance and originality of the current study lied on the use of eye-tracking methodology to examine the unique associations of CU traits, with the processing of emotional faces and attention allocation to the eye region in childhood. A better understanding of the deficits indicated by children in the processing of positive and negative valent emotions is essential to differentiate the mechanisms underlying CU traits in the early stages of development. Added, to our knowledge, no prior research has combined the study of attention allocation with the exploration of the role of gender in children high on CU traits, and the age of the stimuli illustrated. The differences expected in relation to gender of children, high on CU traits, aimed to lead to a better understanding of psychopathic behavior indicated by both boys and girls and their distinct intervention needs.

Method

Participants

The sample of the current study was selected from 1283 preschool and primary school children living in the Republic of Cyprus (638 males; *M*age = 6.35, *SD* = 1.31) whose both parents completed a battery of questionnaires during the screening phase. During the screening phase, parents were asked if the child had a history of epilepsy or any other serious mental or physical handicap that could preclude their participation. None were reported. Children who scored reliably high (above 1 SD) and low (below 1 SD) on CPTI CU dimension formed the sample for the experimental phase of the study, which investigated whether children differentiated on their levels of CU traits vary in their ability to attend to the eye region of facial emotional expressions. From a sub-sample of 178 children scoring high on CU traits (> 1 SD), 31 children (17 males) participated as the experimental group, where a group of 28 children (15 males) scoring low on CU traits (< 1 SD) formed the control group, were randomly selected by a group of 250 children. Children ranged in age between 5 and 10 years old (M*age* = 7.5, SD = 1.44). The sample included children with good knowledge of the Greek language. In return of their participation, each family received a small monetary reimbursement to cover their traveling expenses (10 €).

Screening procedure

Following approval of the study by the National Bioethics Committee, the Centre of Educational Research and Assessment (CERE) of Cyprus, the Pedagogical Institute, and the Ministry of Education and Culture, 47 private and public nursery schools, and 69 primary schools in three provinces (Nicosia, Larnaca and Limassol) were randomly selected for participation in the screening phase. Preschools and primary schools' principles were contacted via telephone and were informed about the aims of the study. School boards, that were interested to participate in the study, received details about the purpose and the procedures of the study via email. Parents/Guardians were informed via telephone, of the nature of the study and 81% of those consented to their child's participation. Mothers/female Guardians completed a battery of questionnaires, which took approximately half an hour.

Screening Questionnaire

Child Problematic Traits Inventory (CPTI; Colins et al., 2014). The CPTI was used to assess CU traits. This instrument contains 10 items assessing CU traits, and the response scale is *"Does not apply at all"* (1), *"Does not apply well"* (2), *"Applies fairly well"* (3), and *"Applies very well"* (4). Mothers were asked to assess each item based on how the child usually and typically behaves rather than based on child's current behavior. CU traits total score was calculated by combining ratings of the ten items measuring lack of remorse or guilt and callousness/lack of empathy (sum of 10 items; e.g., "*Never seems to have bad conscience for things that he/she has done*"). For the current study, alpha coefficients for subscale scores indicate a relatively high interval consistency (αs = .88 for CU) for mothers' questionnaire.

Experimental Materials

For the purposes of the Eye-tracking experiment, static images depicting angry, sad, feared, and happy faces of adults were extracted from the Montréal Pain and Affective Face Clips (MPAFC) database (see Simon, Craig, Gosselin, Berlin, & Rainville, 2008), which includes a number of standardized stimuli of dynamic prototypical facial expressions. Specifically, the MPAFC database includes a number of one-second colored dynamic scenes of eight adult actors (50% females) mimicking six basic emotions (happiness, disgust, fear, anger, sadness and surprise), pain and a neutral facial expression. The actors of the MPAFC were all Caucasians, as the sample of the current study. For the purpose of the current study, four basic emotions (e.g., fear, anger, sadness, and happiness) of four adult actors (50% females) were selected (4 actors x 4 emotions x 2 snapshots) and 32 static images were extracted from the video clips at the point of apex expression and used for validation. Although dynamic presentations are likely to evoke more vivid impressions of facial affections, snapshots were believed to be a better choice for the present study and the current population. An increased number of studies, evaluate attention and emotional processing, require the use of static images with definite stimulus (e.g., Dadds et al., 2008), and as one of our aims was to compare findings reflecting explicit facial emotional processing with the findings of such paradigms, static images were used.

An independent sample of 45 children (M*age* = 6) categorized static images to one of the four different affective states rating also the intensity of the expressions (high vs. low).

A ranking of the static images was made according to valid-rate (e.g., a happy face is correctly categorized as happy), invalid-rate (e.g., an angry face is not categorized as any of the four emotions), and the intensity of the expression. Sixteen images of adult actors were included in the current study (4 actors x 4 emotions x 1 snapshot). In addition, 32 static images of children expressing the same emotions were selected to match the adult images used. A validation procedure was also employed for this pool of children images, and 16 of them were included in the final experiment. 32 static images of four adult and four children (50% females) depicting 4 emotional expressions (e.g., fear, anger, sadness, and happiness) (8 actors x 4 emotions x 1 snapshot) were presented in a pseudo-randomized order to avoid sequential repetition.

Apparatus. For the *Eye-tracker experiment,* the evaluation of real time attention allocation was made during an emotion processing task with the use of Tobii X120 eye-tracking software (Tobii Technology, Inc. Washington, USA). The accuracy of this software is 0.5 degrees and the sampling frequency is 120 Hz. Tobii X120 is a bright-pupil eye tracker that employs a high resolution camera and large fields of view to capture images of participants' eyes. The eye-tracker illuminates the individual's eyes with two near infrared diodes to generate reflection patterns on the corneas. The high-resolution video camera collects the reflex ion pattern as well as the location of the individual corresponding to the screen. Digital images processing is carried out by extracting the individual pupil's location from the video signal. Eye pupils' locations can be mapped to gaze locations on the screen by a 5-point calibrating system. The timing of the events, such as the presentation of the visual affective stimuli, and the tracking of eye gaze behavior in real-time were developed on the Tobii Pro Studio 3.4.3. (Tobii Studio User's Manual 3.4.3). For the areas of interest we defined the area around the eyes and the mouth by using two rectangles fitted to the lower and upper, left and right outside edge of the eyes and the mouth (see Figure 1). The size of the two areas of interest was consistent across all the emotional faces stimuli. The outcome measures were the total duration of fixation in the two different areas of interest (i.e., eyes and mouth). Total Fixation duration was defined as the total amount of time eye gaze remained 1^{o} visual angle for 100ms or greater into the area of interest (e.g., eyes or mouth). These measures were averaged across areas and faces were grouped to the different emotions. A mean number of total duration of fixations was calculated, for each child and group of

pictures shown a specific emotion, under a free gaze condition. Pictures were displayed on a 22-inch computer screen, with a maximum resolution of 1680 x 1050 pixels. Recordings were processed offline using automated Tobii X120 eye-tracking software.

Experimental procedure

Upon their arrival at the Developmental Psychopathology Lab at the University of Cyprus, a researcher welcomed the families and explained the consent form in detail, answered any questions that came up. Once signed consent was given, parents and children were provided with detailed information about the experiments. They were informed that they (1) would be seated in front of the computer screen and watch a number of pictures, and (2) their gaze behavior would be recorded. Children assent was also received prior to their participation in the experimental phase. Children were seated in front of the desktop computer in a well-lid room, in a height-adjustable chair, which was adapted to the point at which children were looking directly towards the screen where their gaze was most accurately recorded. The chair was placed approximately 60 cm from the computer monitor. The children were instructed to restrain from moving their heads or covering their faces, and an eight-point calibration process was completed. During eye-tracker calibration children had to follow the gaze of a green circle moving around the screen. This procedure was repeated until calibration outcomes were adequately supported a gaze with high accuracy.

Participants viewed 40 pictures, in which happiness, sadness, anger, and fear expressions were displayed by forty images of twenty adults and twenty children. Emotions were presented in pseudo-randomized order for three seconds. Adult and peer's pictures were alternately shown during the free gaze condition. Each trail consisted of (1) one-second fixation cross appearing in the center of the screen, and (2) three-seconds presentation of the static facial expression. The task took approximately 15 to 20 minutes to be completed and after the completion of the experimental phase families were informed about the objectives of the study.

Plan of analyses

Data were assessed for outliers prior to conducting the main study analyses using the IBM SPSS 24.0 statistical software. Separate repeated analyses of variance (ANOVA) were

conducted with the CU groups and gender, as the between subject, and the areas of interest in the different emotional faces and the age of the person indicated in the image (adults vs. peers) as the within subject variable. Specifically, for total fixation duration, we conducted 2 groups (HCU and LCU) x 2 areas of interest (eyes vs. mouth) x 2 ages of individuals (adults vs. peers) x gender (male, female) x 4 emotional expressions (i.e., happy, sad, angry, fear). Greenhouse-Geisser corrected effects, Cohen's *d* effects sizes (<.40 small effect size, >=.40 and <.75 medium effect size, >=.75 large effect size), and eta square (<.01 small, <=.06 medium, >=.14 large) were reported in the text.

Results

Fear expression. Findings from the repeated analyses of variance (ANOVA) with fear expression, as the outcome suggested, a significant main effect of area of interest (eyes vs. mouth) on total fixation duration, $F(1, 54) = 72.51$, $p < .001$, $\eta^2 = .57$. Contrasts revealed that the total fixation duration on the eye region was longer ($M = 1.37$, $SE = .07$) compared to the mouth area ($M = .68$, $SE = .04$). A significant area of interest and CU group interaction, $F(1, 54) = 6.28$, $p < .05$, $\eta^2 = .10$, was also found. As shown in Figure 2, participants in the high CU group focused less to the eye region ($d = .56$), and more to the mouth region ($d = .47$) in relation to the low CU group. Significant was also the interaction between area of interest and the age of the individual in the figure, $F(1 , 54) = 22.21$, $p < .001$, $\eta^2 = .28$. Participants fixated longer on the eye region of peers than adults ($d = .27$) as shown in Figure 3.

Sad expression. This analysis yielded a significant main effect of the area of interest (eyes vs. mouth) on total fixation duration, $F(1, 53) = 51.78$, $p < .001$, $\eta^2 = .49$. Comparisons indicated that on average the total fixation duration on the eyes was longer ($M = 1.35$, $SE = .07$) than on mouth area ($M = .65$, $SE = .04$). The interaction between the area of interest and the CU groups was also significant, $F(1 , 55) = 4.11$, $p < .05$, $\eta^2 = .07$, as shown in Figure 4. Children high on CU traits payed less attention to the eye region ($d = .45$) in expressions of sadness, and tended to focus more on the mouth region ($d = .48$). Significant was also the interaction between the area of interest and gender, $F(1, 53) = 5.0$, $p < .05$, $\eta^2 = .86$, as shown in Figure 5 were boys fixated longer in the eye region ($d = .38$) than girls, and payed less attention to the mouth ($d = .72$).

Angry expression. The repeated ANOVA suggested a significant main effect of area of interest (eyes vs. mouth) on total fixation duration, $F(1, 52) = 79.80$, $p < .001$, $\eta^2 = .61$. Similar to prior analysis, the total fixation duration on the eyes area was longer ($M = 1.48$, $SE = .08$) than the mouth area ($M = .57$, $SE = .05$). A significant area of interest and CU group interaction, $F(1, 52) = 5.03$, $p < .05$, $\eta^2 = .09$, was also found. As shown in Figure 6, participants from the high CU group attended less to the eye region ($d = .59$), and more to the mouth region ($d = .97$) in relation to low CU group. Significant was also the interaction between the area of interest and the age of the individual in the stimuli, $F(1, 52) = 7.09$, $p < .05$, $\eta^2 = .13$, as individuals indicated a longer fixation on the eyes area of peers than in adults ($d = .19$) as shown in Figure 7. Further, the interaction between the area of interest and gender, $F(1, 52) = 5.59$, $p < .05$, $\eta^2 = .09$ (Figure 8), suggested that boys fixate longer in the eye region ($d = .40$) than girls.

Happy expression. Findings from the analyses with happy expressions as the outcome suggested a significant main effect of area of interest (eyes vs. mouth) on total fixation duration, $F(1, 55) = 13.08$, $p < .001$, $\eta^2 = .19$. Contrasts revealed that the total fixation duration on the eyes area was longer ($M = 1.09$, $SE = .07$) than on mouth area ($M = .78$, $SE = .05$). A significant area of interest and CU group interaction, $F(1 , 55) = 7.80$, $p < .05$, $\eta^2 = .13$, was also found. As shown in Figure 9, participants from the high CU group attend equally to the eyes and mouth areas in expressions of happiness, although those in the low CU group attend more to the eyes ($d = .55$) than mouth ($d = .61$).

Discussion

The current study aimed to investigate the relationship between varying levels of CU traits and attention allocation to the eyes in response to emotional facial expressions. This is the first study aiming to extent this construct early in development, and provided support for deficiencies in the level of emotional functioning. Dadds and colleagues (2006; 2008) supported that attentional deficits to socially relevant cues (i.e., eyes) underlie individuals high on CU traits emotion recognition difficulties. To the authors' knowledge, there is a limited number of studies investigating the eye gaze behavior of children high in CU traits using an eye-tracking methodology. Moreover, a unique contribution of the current study was the examination of different strategies employed by boys and girls in the processing of

emotional faces, taking into account theories proposing that girls indicate a small advantage in recognition of some facial expressions (e.g., Lawrence et al., 2016). Furthermore, this was the first study that combined stimuli of different ages, as for the age of the individuals illustrated in the pictures used, in order to investigate the patterns employed in the processing of emotional expressions of adults and peers. The need to distinguish between the patterns applied on emotional processing in different stimuli's ages (adults vs. peers) arise from prevention and intervention research. The efficacy of one prevention and intervention program is based on the generalizability of their gains, to the children's everyday interactions; as such, we need to be certain about the effectiveness of agents used (peers vs. adults). In support of our main hypotheses, children high in CU traits showed lower rates of total fixation duration in the eye region and an increased concentration to the mouth region for all the emotional expressions in both adult and peer pictures, a finding that comes in support of a potential mechanism explaining the development and stability of these traits. Important differences were identified regarding boys and girls, in total duration fixation in the eyes and the mouth in expressions of sadness and anger, supporting a different pattern of emotional processing across genders.

CU traits and visual processing of facial expressions

The current study advances prior research on the eye gaze behavior of children high on CU traits, by indicating a lack of spontaneous allocation to the eye region of facial emotional expressions early in development. These deficiencies were equally distributed across all facial emotional expressions irrespective of child's gender or the age of the individual illustrated in the stimuli used. The fact that these impairments are equally distributed across all facial emotional expressions, come in support, of the pervasive nature of the deficient attentional cueing shown by individuals high on CU traits, as proposed by prior work (Dawel, O'Keayrney, McKone, & Palermo, 2012).

The support provided by the current study for impairments in processing of facial emotional expressions as early as the age of 5 years advances the knowledge regarding the developmental nature of CU traits and the need for early prevention and intervention. According to Dadds and colleagues (2006), this attentional neglect places children's emotional development in increased danger, as their inability to adequately attend to

emotional information can lead to a poorer emotional connection and a reduced effectiveness of classical parenting practices. Particularly, attention allocation to the eye region and eye contact early in life facilitates the development of attachment with caregivers enabling the internalization of parental norms and the development of prosocial behavior and consciousness (Dadds et al., 2011). On the other hand, the inability to develop a healthy eye contact with attachment figures may lead to a number of cascading errors in the processing of emotions and the development of effective behavioral patterns, and at the same time making traditional parenting practices less effective (Hawes, Dadds, Frost, & Hasking, 2011). Current findings can also explain the ineffectiveness of traditional parent children intervention and prevention programs employed with this population (Hawes, Price, & Dadds, 2014). In addition, these findings can provide further support for the increase of negative parenting practices and emotional distress experienced by parents in the early stages of child's development (Fanti & Centifanti, 2014).

The decreased attention to the eye region, shown by children high on CU traits, may account for the robust observation that these individuals experience more difficulties in recognizing distressing cues in others expressions. Research findings have supported the importance of eye region in the processing of distress cues, as sadness and fear are mainly expressed by this part of other's facial emotional expression. These findings are consistent with the distress-specific hypothesis described by Blair (1995, 2006). Blair's "Violence Inhibition Mechanism" (1995, 2006), supports that the cold and unremorseful behavior shown by individuals high on CU traits is a result of their inability to identify distress cues (i.e., fear, sadness) in others' emotional expressions. A theory that is also extended in early developmental stages, by the ineffective pattern of emotional processing that was characterized by a longer fixation to the mouth area. Therefore, individuals high on CU traits not only show a shorter fixation period at the eyes during the expression of fear, but they also show an ineffective pattern in processing distressing cues by showing a longer attention to the mouth area. Specifically, research has supported that cues of distress, indicated by facial expressions, can possess perceptual properties that can elicit empathic responding and inhibit aggressiveness; although individuals with CU traits are unable to recognize correctly these cues and process them as aversive (Blair et al., 2001; 2005; 2010; Marsh & Blair, 2008; Muñoz, 2009). Consequently, individuals, high in CU traits, inability to attend to facial

emotional expressions, and especially fearful faces, can enhance their behavioral problems and social non-adjustment (Dadds et al., 2012; Dargis et al., 2018). Unfortunately, since the current study did not include any measures of the emotional recognition accuracy, it is not possible to decipher clearly, if children indicate also difficulties in recognizing distressing cues in an attempt to verify the deficiencies in identification of emotion.

The lower rate of total fixation duration in the eye region also mirror the deficiencies supported by patients with amygdala lesions who visually neglect the eyes of facial emotional expressions (Cardinale, et al., 2017; Dotterer, Hyde, Swartz, Hariri, & Williamson, 2017). Cumulative research findings have supported the engagement of amygdala in emotional processing and its' abnormal functioning and structure in both children and adults with CU traits (e.g., Blair, 2010; Dawel et al, 2012; DeLisi, Umphress, & Vaughn, 2009; Weber, Habel, Amunts, & Schneider, 2008). Specifically, research in CU traits associated the impairments in amygdala with individual's inability to identify emotions expressed through facial reactions and eye gaze (Jones, Laurens, Herba, Barker, & Viding, 2009; Marsh & Blair, 2008). Primarily, these difficulties can be reversed in by simply asking them to fixate to the eyes area in experimental and real-life situations (e.g., Dadds, et al., 2006; 2008; Kyranides, 2014; Newman et al., 2010). Consequently, by providing further support for this potential mechanism leading individuals with increased CU traits in emotional processing deficiencies, the current study may indicate a potential area of prevention and intervention.

Eye-gaze behavior: The role of gender and age of the stimuli

The current study provides further support for a specific difference in the processing of sad and anger facial expressions across gender. Pointedly, the longer fixation of boys in the eye region of angry and sad faces, and the slightly longer total duration of attention allocation to the mouth, irrespective of the severity of CU traits, indicate an important area of interest in gender differences. Although, the increased attention payed by boys contradicts prior research on gender differences that argued in favor of girls' superiority in decoding facial expressions, may shed light in the differences supported in the manifestation of aggressive behavior shown by boys and girls (Lawrence et al., 2016; Mancini et al., 2013). The existence of a distinct mechanism underlying emotional processing employed by boys and girls, may offer a different perspective in the way they process negative emotions

expressed by others during the manifestation of delinquent and antisocial acts. By supporting a differentiation in the level of attention allocation to the eye region and emotional processes employed in negative expressions across gender, the current study highlights the need for more gender specific prevention and intervention strategies.

The absence of any significant interaction between CU group and gender regarding the children's eye gaze behavior contradict our hypothesis regarding the small advantage of females in emotional processing (e.g., Lawrence et al., 2016; Montirosso, Riccardi, Molteni, Borgatti, & Reni, 2010). These findings provide new evidence in understanding facial emotional processing strategies employed by children high on CU traits, using Eye-tracker methodology. By indicating the universality of emotional processing difficulties in both sexes, the current study provides support for the pervasive nature of these individuals' difficulties in emotional processing and suggests that they might be influenced by the same developmental mechanism leading to emotional impairments and CU traits (Ciucci et al., 2017). A finding that adds to the existing literature aiming to reverse attention neglect of the eye region by targeting parent-child emotional engagement through eye gaze early in development (Dadds et al., 2016), supporting a new prevention and intervention goals. Although, prior studies have not included any measure of gender differences in attention allocation patterns of emotional faces using eye-tracker methodology, our findings are novel and additional work is needed to test for gender differences.

An additional contribution of the current study is the identified difference in total fixation duration in response to negative emotional expressions of adults and peers. Specifically, we found a longer fixation to the eyes area of peers' expressing fear and anger than in adults. A finding that supports the implementation of different emotional processing strategies in favor of peers expressions of negative emotions, irrespective of child's gender or CU traits. This finding highlights the need to distinguish between stimuli of different ages, and suggests that children may apply different strategies in processing negative emotions expressed by peers than adults. Despite the fact that there are no prior studies investigating eye gaze differences when viewing images of peers and adults, these findings may poses an important question regarding the development and implementation of family intervention programs and their generalizability in children's. Further, this finding opens up a completely new perspective in the way the different findings from other researchers' studies regarding

attention allocation and emotional processing of facial expressions could be interpreted. This finding highlights the importance of the age of the stimuli in response to the strategies employed in emotional processing with reference to children's social relations with peers and adults. Also, this finding may have some important implications regarding the development and implementation of intervention programs that need to take the context into account and use peers as an adjunctive component in the practicing of new skills developed (Webster-Stratton & Taylor, 2001).

Strengths and Limitations

A major strength of this study is the fact that a very large community sample of children with varying levels of CU traits was screened in order to identify a sub-group of individuals to participate in the current study. In addition, findings from this study are reinforced by the use of eye tracking methodology that enables a better understanding of the processing of emotional expressions and the allocation of attention in a passive viewing experiment. The use of eye-tracking assessment aimed to differentiate the attention allocation deficiencies indicated by children high on CU traits on facial emotional processing. Fanti (2016) in his review highlighted the importance of emotional processing in informing about children at risk for antisocial behavior, and the importance of these markers in the assessment of emotional processing deficiencies. By replicating previous research findings of attention to the eyes and extending attention hypothesis early in development, the current study lead to a new area of interest regarding the emotional deficiencies, indicated by this population, and the development of new intervention goals. Findings are important for both psychopathy research, facial affect processing and recognition, and attention research in general. Which at the same time, has a lot to offer to the prevention and intervention literature of children scoring high on CU traits only (Webster-Stratton & Taylor, 2001).

However, these findings must be considered in light of several limitations. While this study represents a good starting point for investigating the processing of negative emotional expressions by children high on CU traits early in development, there is a need to replicate these findings using a larger sample as it would increase power to detect smaller effects and interactions. A useful direction of future studies may include, in relation to eye-tracker methodology, longer presentation times of different emotional stimuli. This longer

presentation will enable the examination of time-course visual scanning patterns of eye gaze behavior (i.e., prioritization, shifting patterns in different areas, disengaging from one stimulus to another) in order to further examine the differences between the ages of stimuli provided (peers vs. adults). Distinct viewing pattern may help us better understand the developmental characteristics and the emotional deficits shown by individuals high on CU traits, and identify the most important processes that can inform the development of more effective interventions protocols.

Conclusion

In conclusion, this is the first study aimed to extend previous research on emotional processing by supporting an impaired attention to eye region in all facial emotional expressions, using eye-tracker methodology, among children high on CU traits early in development. By supporting the pervasive nature of the attention difficulties of this population in the processing of facial emotional expressions, the current study provides further support for theories proposing that the attention to the eyes is a potential mechanism by which psychopathic traits and antisocial behavior develop (Dadds et al., 2006). The importance of these deficiencies, early in development also highlight the importance of prevention and intervention programs that focus on the development of adequate emotional and cognitive skills that lead to the enhancement of emotional processing strategies. In addition, this is the first study applying eye-tracking methodology in the investigation of the role of gender and the age of the individual illustrated in experimental stimuli. Girls were more likely to show shorter fixations on the eyes area of negative emotions irrespective of their level of CU, a finding that contradicts findings from the emotional processing research that supports a small advantage of girls in emotion identification. In addition, a preference of peers' eyes may indicate the level of familiarity with these stimuli, and support the importance of intervention in social relationships and the generalizability of the advances gained. Based on no prior evidence why this phenomenon occurred, further research is needed to explore the differences in this mechanism underlying gender differences and age of the individual illustrated.

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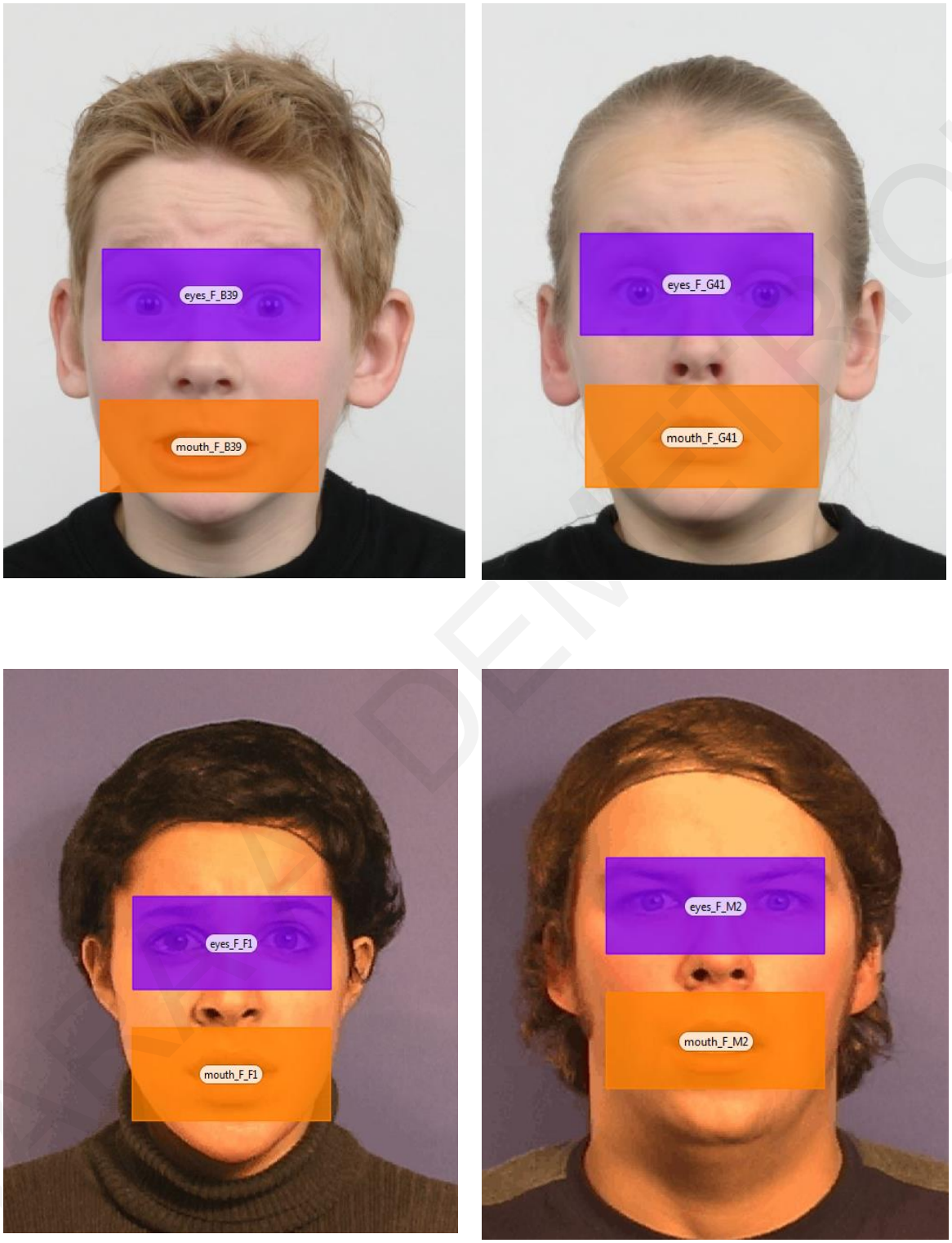

Figure 2 1: Areas of Interest used in the Facial Expression Recognition Task – Examples from the expression of fear by children and adults.

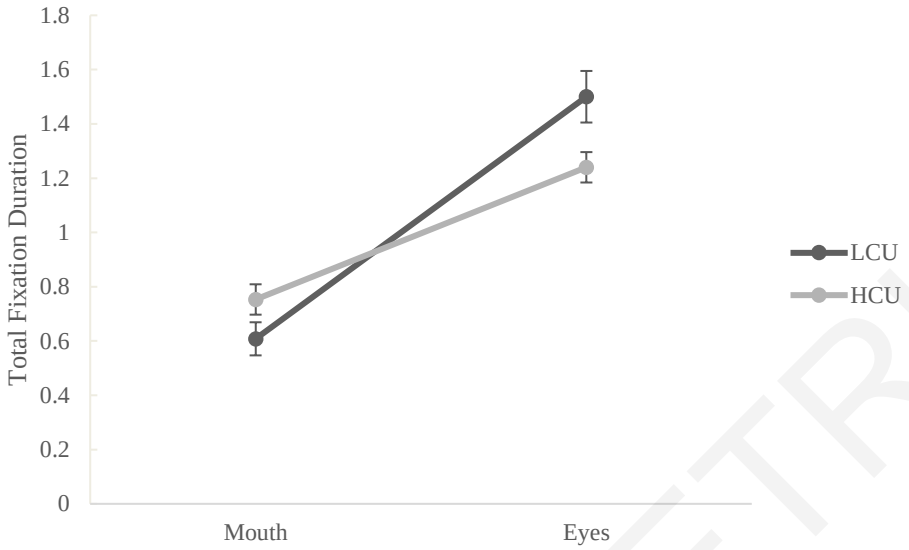

Figure 2 2: Area of interest by CU group interaction predicting total fixation duration to the eyes and mouth area during fear emotional expressions.

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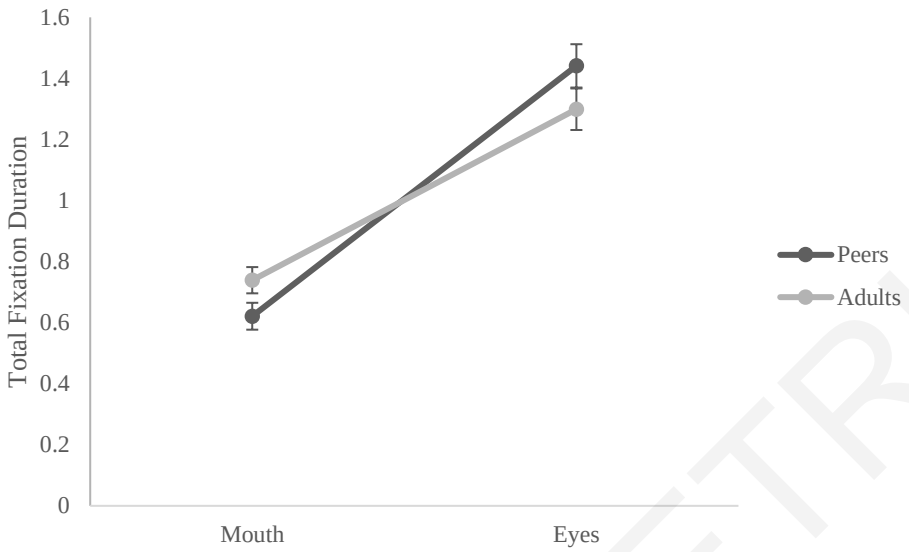

Figure 2 3: Area of interest by age of the individual predicting total fixation duration during fear emotional expressions.

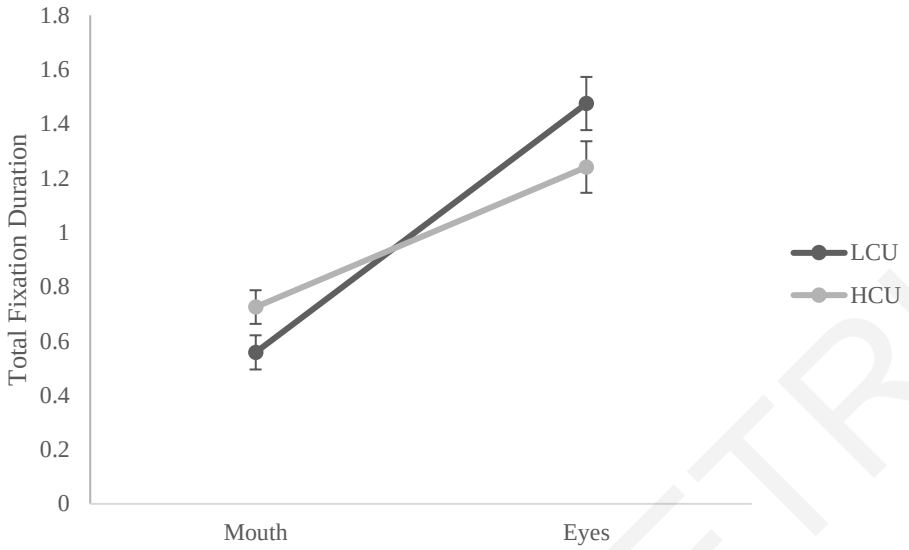

Figure 2 4: Area of interest by CU group interaction predicting total fixation duration to the eyes and mouth area during sad emotional expressions.

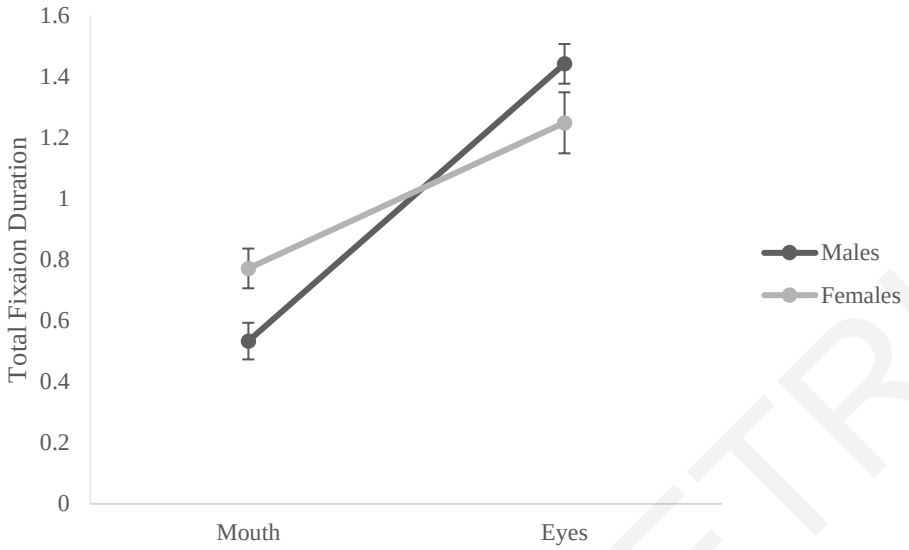

Figure 2 5: Area of interest by Gender interaction predicting total fixation duration during sad emotional expressions.

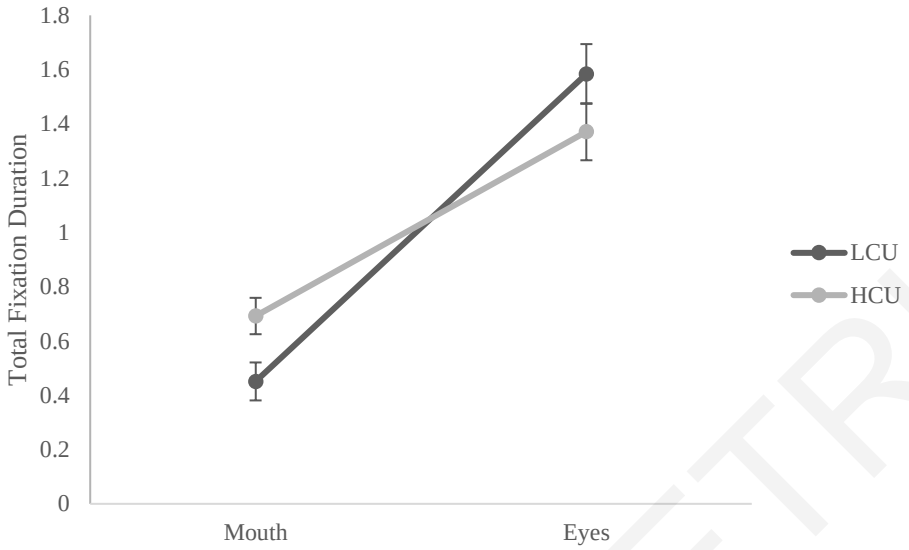

Figure 2 6: Area of interest by CU group interaction predicting total fixation duration on the eye and mouth area for angry emotional expressions.

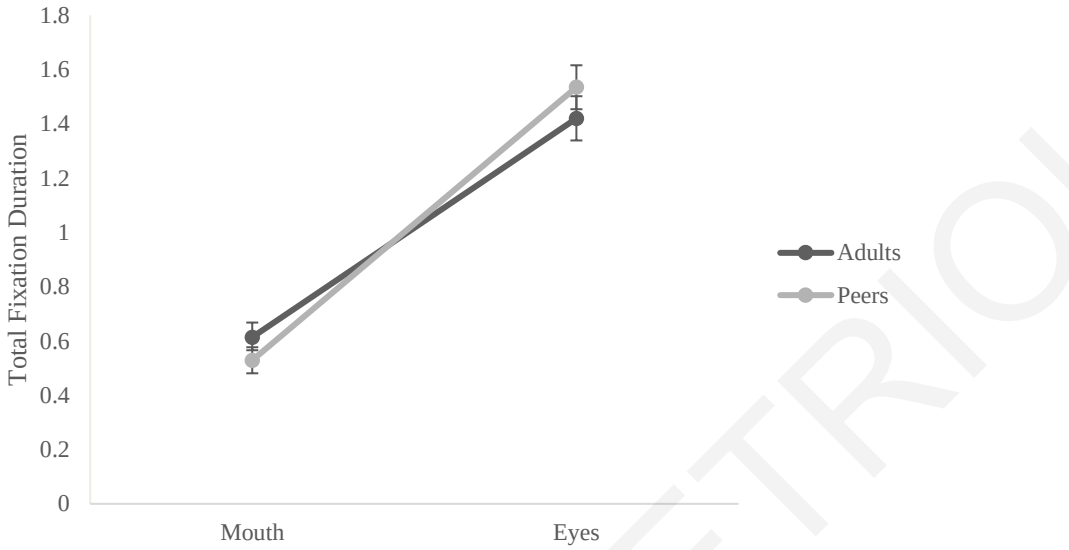

Figure 2 7: Area of interest by age of the individual in the figure interaction predicting total fixation duration on the eye and mouth area for angry emotional expressions.

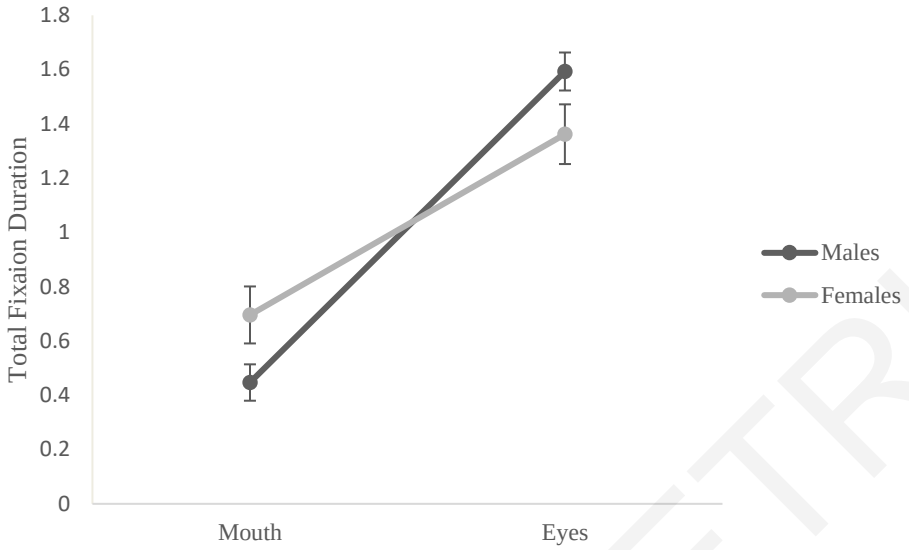

Figure 2 8: Area of interest by gender interaction predicting the total fixation duration on the eye and mouth area angry emotional expression.

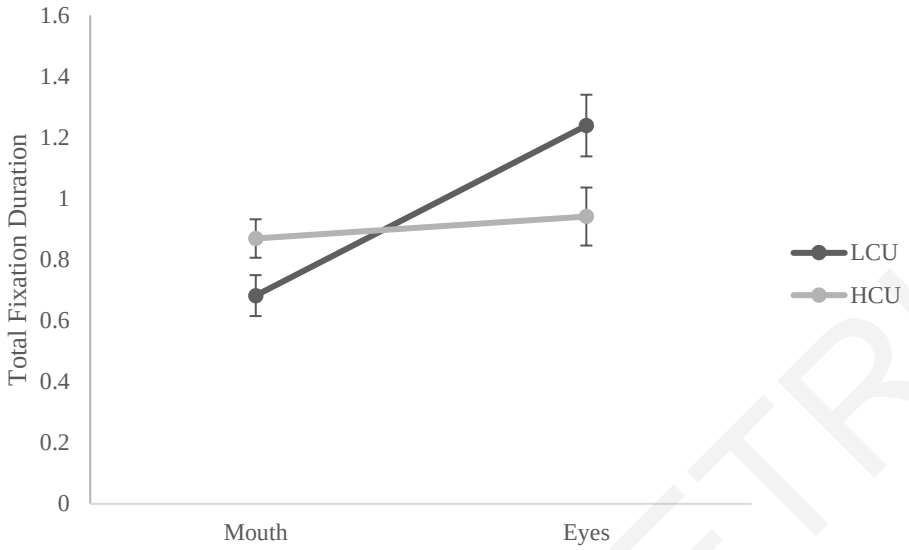

Figure 2 9: Area of interest by CU group interaction predicting total fixation duration on the eye and mouth area for happy emotional expressions.

Study 3

Are children with "Limited Prosocial Emotions" emotionally blind? Emotional processing and facial emotional expressions in response to three intervention programs

Abstract

The processing of emotions expressed by others have been supported as an important factor in children's moral and social development. Research indicated that the inability of individuals high on Callous-unemotional (CU) traits to recognize emotions might explain their reduced empathic reaction and increased antisocial behavior. This is believed to be the first study applying FaceReader methodology to assess the children's high on CU traits emotional processing and responding to different emotional contexts (i.e., happy, angry, sad, fear, and neutral). By combining measures of facial emotional expression with socialization practices that enhance parental warmth and cognitive skills (i.e., identification of micro-expressions of different emotions) development, the current study aimed to assess the effectiveness of three different intervention programs (PCIT-CDI-CU, CARES, EE) in children's ability to respond adaptively to emotional contexts. Specifically, the present study investigated the facial emotional expressions of children high on CU traits (n = 53), prior, immediately after and in a three-months period after the completion of the intervention. Our findings provide support for the amenability of emotional deficiencies related to empathic responding among children high on CU traits. Specifically, we identified an increase of sadness expression in response to distressing cues, and especially in expressions of fear, that can be attributed to an enhancement in children's ability to identify fear and share this emotional expression. The enhanced emotional engagement of children is also supported by an increase in anger and a decreased in surprised emotional expression. Expression of anger serves as an indication of the children response to provocation. Our findings draw research attention in the important influence of the family context and cognitive strategies employed in emotional processing in shaping the emotional functioning of children high on CU traits.

Keywords: limited prosocial emotions, facial reactions, FaceReader, Parent-Child Interaction Therapy (PCIT-CDI-CU), Coaching and Rewarding Emotional Skills (CARES), Emotional Engagement (EE)

Introduction

The experience and expression of emotions are key components of social interaction and can influence social and emotional adjustment. Facial emotional expressions are part of an evolutionary and autonomic response to others emotional cues (Dimberg, 1997; Tomkins, 1992). According to Dimberg, facial expressions describe an individual's ability to emotionally resonate with others emotional state (de Vignemont & Singer, 2006; Mavratzakis, Herbert, & Walla, 2016), and serve as readout system for emotional reactions in social interaction. Despite the fact that individuals are predisposed to distinct facial reactions in response to different emotional stimuli, there are a number of individuals that do not show a context-appropriate emotional reaction (e.g., Fanti, Kyrianides, & Panayiotou, 2017). Impaired emotional awareness and disturbances in emotion recognition and reaction can cause a number of errors in individual's emotional and social development.

The "poverty of emotion" of individuals high on CU traits (Cleckley, 1941/1988; Frick & Morris, 2004), has lead research interest in the investigation of this population's inability to understand the actual or expected emotions expressed by others (Fanti, Panayiotou, Lazarou, Michael, & Georgiou, 2016a). On the other hand, mounting research findings indicate these individuals ability to use emotional cues to manipulate, mislead, and charm others, putting this emotional "poverty" into question (Book, Quinsey, & Langford, 2007; Wheeler, Book, & Costello, 2009). Sandvik and colleagues (2014) describe this as an "emotional paradox" that poses an important question about individuals' high on CU traits ability to identify and respond to others' emotional expressions.

The proposition of an affective deficit mechanism by which callous and manipulative psychopathic traits develop has led research interest in the investigation of more effective intervention and prevention strategies. A number of experimental studies have indicated that individual deficits in recognizing emotions can be reversed (Adolphs et al., 2005; Dadds et al., 2006; 2008a; Domes, Heinrichs, Michel, Berger, & Herpertz, 2007; Gustella, Mitchell, & Dadds, 2008; Kyranides, 2014). An improvement that was also supported in children by a number of clinical studies aiming through intensive parenting interventions, applied to mother-child interaction, to develop emotional cognitive skills (e.g., Datyner, Kimonis, Hunt, & Armstrong, 2016; Fleming, Kimonis, Datyner, & Comer, 2017). The current study aims to advance the knowledge on the effectiveness of enhanced parental warmth employed by a

number of parent-child interaction strategies and cognitive skills enabling the accurate identification of emotions expressed by others, in children's facial emotional expressions. Before proceeding to more specific hypotheses about children's ability to respond to emotional expressions, and how socialization practices can enhance processing of emotion, a brief review of the emotional processing and intervention practices for children high on CU traits will be provided.

CU traits and emotional processing

Callous-unemotional (CU) traits refer to a constellation of traits characterized by callous use of others, lack of remorse or empathic concern, shallow or deficient emotions and lack of concern about performance (for a review see: Frick & Morris, 2004). Experimental studies aiming to understand the deficiencies in emotional processing shown by individuals high on CU traits supported a reduced physiological and behavioral reactivity to distressing cues such as fear and sadness. Previous studies have supported a decreased bias of attention to distressing cues (Kimonis, Frick, Fazekas, & Loney, 2006) and in emotional stimuli in general (Dadds et al., 2011; 2014); a difficulty in recognizing fearful and sad facial emotional expressions (Blair, Colledge, Murray, & Mitchell, 2001a); a lower rate of eye-blink startle potentiation and amygdala dysfunction in response to fearful imagery scenarios and facial expressions (Fanti et al., 2016a; Viding et al., 2012), and reduced facial reactions, measured with facial electromyography (EMG) when exposed to violent and sad scenes (Fanti, Panayiotou, Lombardo, & Kyranides, 2016b; de Wied, van Boxtel, Matthys, & Meeus, 2012).

In response to their reduced electromyography reactivity, individuals with increased levels of CU traits were less likely to imitate yawn and laugh (Hagenmuller, Rössler, Endrass, Rossegger, & Haker, 2012); were less able to respond to anger, but not happy expressions (de Wied, van Boxtel, Zaalberg, Goudena, & Matthys, 2006); and showed a low corrugator muscle activity, which is an indication of displeasure, in response to the distress expressed by victims (Fanti et al., 2017). These deficits are less evident in positive emotional expressions, as individuals with elevated CU traits tend to show normal reactivity levels as expressed by their adequate zygomatic activity, a facial muscle that is involved in smiling (Fanti et al., 2017; McManis, Bradley, Berg, Cuthbert, & Lang, 2001; Sonnby-Borgström,

2002). However, additional work by de Wied and colleagues (2012), suggested reduced reactivity to both negative and positive emotions among youth high on CU traits, compared to healthy controls. This finding was also supported by Herperzt and colleagues (2001) who used the IAPS images to indicate that individuals high on CU traits did not showed adequate emotional response in negative, positive and neutral emotional expressions. More recently, Künecke and colleagues (2018) used dynamic angry, happy, neutral and sad facial expressions to show no significant mean difference between psychopathic and non-psychopathic groups of participants in their facial emotional expressivity. These findings support a reduced sensitivity of individuals high on CU traits to expressions of sadness and fear, although contradicting findings point to the need for further experimental investigation in relation to positive emotions.

In an attempt to overcome the difficulties imposed by facial electromyography research, Fanti and colleagues (2017) employed for the first time FaceReader methodology to compare individuals low and high on CU traits. Their findings built on prior studies and supported reduced facial reactions of sadness and disgust to violent emotional scenes. A pattern that is in accordance with these individuals low empathic concern in response to victims' distressing emotional expressions. Their restricted expression of disgust may support their diminished distress and affection when viewing a scene where the main character is feeling sad or threatened (Bowen, Morgan, Moore, & van Goozen, 2014; Kosson, Suchy, Mayer, & Libby, 2002). The same facial reactions were also shown in response to comedy scenes, supporting a reduced emotional reactivity of individuals high on CU traits. The limited expression of emotion in occasions where people indicate signs of distress or pain is, according to Blair and colleagues (2004), an explanation why they are more prone to abusive, aggressive and manipulative behavior while they do not care about the consequences of their behavior.

Targeting children's emotional difficulties

The emotional deficits shown by children high on CU traits have recently been the focus of research in terms of the need for more effective interventions that can enhance children's emotional processing and inhibit behavioral problems. A limited number of studies has examined intervention outcomes and findings to date have shown mixed results with

reference to the effectiveness of interventions for children high on CU traits (Hawes, Price & Dadds, 2014). Parent Child Interaction Therapy (PCIT) is among the most well supported interventions that aims through the improvement of parenting skills to enhance parent-child warmth and affection (Eyberg, Nelson, & Boggs, 2008). Mounting research findings have supported the importance of healthy attachment style in children's moral and behavioral development, with meta-analytic findings indicating that securely attached children show significantly lower levels of behavioral and emotional problems (Fearon, Bakermans-Kranenburg, Van IJzendoorn, Lapsley, & Roisman, 2010). Although, the mechanism underlying the relation between healthy attachment and children emotional responding is not clear, it is hypothesized that a warm and mutually responsive parent-child interaction can enhance children's healthy emotional processing through the acceptance and compliance with parents values and requests (Guttmann-Steinmetz & Crowell, 2006). Additionally, through the development of specific cognitive skills, like the identification of facial micro-expressions and mutual eye contact, Coaching and Rewarding Emotional Skills (CARES) and Emotional Engagement (EE) adjunctive modules aim to enhance children's ability to accurately identify information regarding others emotional state and respond adaptively through their facial emotional expressions. This is believed to be the first study aiming to assess the effectiveness of these intervention programs in children facial emotional expression as an indication of their enhanced emotional development and empathic concern. Before proceeding to more specific hypotheses regarding the influence of these interventions to children's facial expressions, a brief review of these intervention programs for children high on CU traits will be provided.

The lack of empathy, remorse and guilt of individuals high on CU traits, are developmentally related to fearlessness and low distress (Cleckley, 1941/1988; Fanti et al., 2016a; Frick, Ray, Thornton, & Kahn, 2014). Blair and colleagues (2004; 2005) indicated that, in typically developing children, distressing cues, such as fear or sadness, act as aversive stimuli or punishment cues that elicit empathic concern and responding, and lead them to withdraw their antisocial acts. Therefore, by showing low reactivity to threatening and distressing cues as part of a reduced responding pattern and an impaired fear conditioning (Flor, Birbaumer, Hermann, Ziegler, & Patrick, 2002), children become unable to experience negative emotions caused by these cues or feel bad in parent-child relation, and adjust their

behavior appropriately. Kochanska and colleagues (1997; 2005) proposed the importance of social factors, with an emphasis in the role of parenting, as parental practices could potentiate the expression of biological vulnerabilities, such as psychopathic traits. Major progress have been made from the formation of Kochanska's theory, as parenting process can be conceptualized as a basic contributor to the behavioral adjustment and emotional development of children with CU traits and the way these characteristics are expressed across time (Datyner et al., 2016; Hawes et al., 2014; Waller et al., 2012; 2013; 2014; 2015).

Adopting from the social learning theory the use of positive reinforcement and avoiding ineffective discipline strategies (Bjørseth & Wichstrøm, 2016; Comer, Chow, Chan, Cooper-Vince, & Wilson, 2013; Ollendick & King, 2007), Parent Child Interaction Therapy' Child Directed module for children high on CU traits (PCIT-CDI-CU) aims to respond to reward-dominance and insensitivity to punishment temperament of children with CU traits (Hawes, Dadds, Frost, & Hasking, 2011). PCIT-CDI-CU practices aim to enhance positivity and warmth in the child-parent relationship which lead to the internalization of parental values (Frick, Kimonis, Dandreaux, & Farell, 2003; Pardini, et al., 2007); and parental involvement in child's everyday life with consistent supervision and monitoring (Hawes et al., 2011). These strategies and the increased expression of affection have be proven to play a vital role in children's conscience development in under aroused and fearless children (Kochanska et al., 2005); enhance positive socialization (Hawes & Dadds, 2007; Kochanska & Thompson, 1997; Pardini et al., 2007); and affective responses (Pasalich, Fleming, Oxford, Zheng, & Spieker, 2016). Although, as noted earlier, the mechanism through which PCIT-CDI-CU can lead to an increase in children emotional expression is unclear, cumulative research has supported the importance of attachment in the manifestation of disruptive behavior as insecured or disorganized parenting styles and interactions can lead to increased levels of externalizing problems (Groh, Pasco Fearon, van IJzendoorn, Bakermans-Kranenburg, & Roisman, 2016; Pasalich et al., 2016). What can be hypothesized by the limited studies testing the efficacy of PCIT-CDI-CU in children with CU traits is that the positive interaction between parents and children enable the processing of their emotions in a safe and loving environment. A low frustration tolerance environment that is based on an intensive reward token economy system may enhance children's experience of positive emotions, that in turn reinforce positive behaviors and social interactions, which enable these

experiences (Fleming et al., 2017; Kimonis & Armstrong, 2012; Kimonis et al., 2014). In addition, their mutual respective and warm relation can act as a healthy role model for children's social interactions and emotional responding in different occasions.

However, the serious deficiencies indicated in emotional engagement by children high on CU traits, may form a reason why some of the evidenced-based interventions are not proven effective for this population. The inability of this population to process effectively emotional information highlight the need for more specific prevention and interventions strategies that target individuals' cognitive skills employed in emotional processing. Therefore, the development of cognitive skills that enable the identification of emotion expressed early in development may enable the enhancement of qualitative attachment with caregivers, and lead to more appropriate emotional responses (Carlson & Reinke, 2014; Kyranides, 2014; van Baardeqijk, Stegge, Bushman, & Vermeiren, 2009). Specifically, by simply asking participants to focus on the eye region individuals became more effective in recognizing signs of distress through facial expressions (Adolphs et al., 2005; Dadds et al., 2006; 2008b). In a randomized control trial Dadds and colleagues (2012a) showed an increase in individuals ability to "feel the pain of others" and a decrease in the level and severity of conduct problems in two distinct mixed diagnostic samples with high CU traits, by implementing a computerized emotional training and an emotional recognition training.

Coaching and Rewarding Emotional Skills (CARES) is a brief adjunctive intervention module that aims to enhance emotional development of children (Datyner et al., 2016). The key intervention objective of CARES is the redirection of children focus on facial emotional cues through micro-expression training (i.e., eyes, mouth) (Ekman, 2002; 2014; Kimonis & Hunt, 2014). CARES through a number of activities aims to refocus children attention to facial expressions of emotional pictures and in-vivo parent-child interactions in order to increase children awareness of others emotional state and engagement in empathic and prosocial behavior. For the current study, the increase in children emotional engagement through the processing of emotions expressed by them and their parents in their everyday life was expected to lead to a higher level of emotional responsivity, as indicated by their facial reactions to emotional context. This mechanism may be employed by CARES in the advancement of children emotional engagement and responding. Datyner and colleagues (2016) supported the efficacy of CARES in a case study of a 7-year-older with conduct

problems and high CU traits. After the completion of CARES module, the boy showed a significant improvement in recognizing and responding appropriately in his own and other's emotional expressions, an effect that maintained three months after the completion of the program. These improvements in empathy were also supported in another case study of a 5-year-old boy by Fleming and colleagues (2017), who became more affectionate to other's emotional state through an increase in his emotion recognition skills and a decrease in his CU traits levels.

In this line of research Dadds and colleagues (2006; 2008c) highlighted the importance of refocusing the attention to the eyes by developing a treatment module aiming to improve the child's focus on the eyes of caregivers. According to Dodge and Price (1994), processing of information gathered from parents' emotional faces enables conscious development, prosocial emotions, and prevents antisocial behavior. The *Emotional Engagement* module (EE; Dadds & English, 2012) is directed towards strengthening parent and child relationship through the increase of parental warmth experienced by the child and promote emotional processing through healthy eye contact. The importance of eye behavior and the improvement of emotional engagement through the identification of emotional cues is supported by experimental designed studies where researchers used instructions to help children refocus to the eyes (Dadds et al., 2006). In these experiments probes were used to modulate individuals focus to the mouth or the eye area respectively (Dadds et al., 2008a); and in a dot-probe experiment where an asterisk appeared in either the top or bottom of the picture location immediately after the offset of the emotional stimuli (Kyranides, 2014). Through the implementation of EE and a brief "love-task", the current study aimed to increase reciprocated eye contact/love, which would mediate and enhance children's emotional processing of caregivers emotions in the context of a positive parent-child interaction, and increase children emotional engagement supported their facial emotional reactivity.

Consequently, the current study aimed to advance prior knowledge regarding the effectiveness of a well-supported intervention program, PCIT-CDI-CU, in children high on CU traits emotional engagement and responding as shown by their facial emotional reactions. In addition, the implementation of CARES and EE aimed to investigate how an enhancement in children ability to focus to signs of emotions in caregivers facial expressions, can

normalize deficiencies identified in children's emotional processing over the long term (Shaw et al., 2004; Skuse, 2003). This is the first study to employ facial reactivity, as an indication of their ability to respond to the affective state of others, in different emotional contexts, to assess the effectiveness of different interventions, employing parent warmth and affection in order to develop children's abilities to process emotion effectively.

Current study

The current study aimed to build on prior research that investigated facial electromyography to different emotional scenes, by focusing on the facial emotional expressions of young children (*Mage* = 7.49, *SD* = 1.42) high on CU traits. By the implementation of three different interventions, the current study aimed to assess facial reactivity during the exposure of children to a number of emotional scenes prior, immediately after, and in a three-months follow-up period. The purpose of this pilot study was to examine whether emotional deficiencies indicated in emotional processing, as in facial expression of emotion, can be ameliorated through three different intervention modules: (1) Parent Child Interaction Therapy, Child-Directed Interaction (PCIT-CDI-CU), (2) Coaching and Rewarding Emotional Skills (CARES), and (3) Emotional Engagement (EE). It is important to note that all previous studies implementing interventions referred to children high on conduct problems and CU traits, while this was the first study aiming to examine the efficacy of these protocols in children scoring high only on the affective dimension of CU traits. In addition, previous studies used CARES module as an additive to the PCIT intervention, when also the EE module was developed as an adjunctive treatment component. By implementing CARES and EE modules alone, this study aimed to develop a more clear understanding of their effectiveness in developing cognitive skills that enable the effective processing of emotions. By developing a better understanding of how these modules can enhance emotional processing among children high on CU traits, the current study aimed to advance the knowledge in terms of prevention and intervention among this difficult to treat group of children.

Specifically, the present study aimed to investigate whether the ability to respond to the emotion expressed by others through facial expressions could be enhanced by the participation of children and their mothers in one of the three interventions (i.e., PCIT-CDI-

CU, CARES, EE). Thus, we aimed to compare these intervention modules in terms of the children's level of emotion expressed (i.e., sadness, happiness, anger, surprised, scared, and disgust) in a number of emotional scenes (i.e., angry, sad, fear, happy). One of the main hypothesis of the current study was the increase of emotional expressivity by all the intervention groups across time.

Although all the intervention protocols aimed to improve emotional processing, it was *hypothesized* that the three interventions would differentially affect the children's facial emotional reactions. Since CARES and EE modules' tasks serve as probes or fixations to the facial emotional cues indicating emotion, we expected that they would lead to higher improvements in children facial emotional expressions. Specifically, as both interventions aimed to increase identification of distressing cues, it was *hypothesized* that they would lead to an increase in expression of sadness toward the main character in threatening and fearful emotional scenes. In addition, increase in disgust expression was expected as an indication of their enhanced emotional engagement to main characters distressing experience. We expected that these differentiations in individuals' level of emotion expressed would sustained across time. For the EE group, the increase on healthy eye contact between children and mothers and their refocus in the eye region was expected to enable the more accurate identification of distressing cues in negative emotional scenes, which it would lead to a higher increase in the level of sadness indicated by their facial expressions. CARES module, which aimed to improve children's cognitive abilities through the manipulation of micro-expressions signaling distress, was also *hypothesized* to lead to an increase in sadness expressed by facial expressions. PCIT-CDI-CU group was *hypothesized* to show a smaller improvement in the level of sadness expressed in relation to the other modules, as it did not contain any cognitive skills training. Although, the emotional warmth and attachment experienced by this group in their mother-child relation was *hypothesized* to lead to an increase in sadness responsiveness. Regarding the other emotional expressions (i.e., happiness, fear, surprised, and anger) no changes on the level of emotion expressed were expected, as previous studies did not support any difference.

To our knowledge, no prior studies have combined the implementation and assessment of three intervention modules using facial expressions in different emotional contexts. Thus, the significance and originality of the current study lays on the use of

FaceReader methodology to examine the unique association of CU traits, with emotional processing and facial expressions of emotion in childhood, and the effectiveness of three different intervention modules to ameliorate these deficiencies. FaceReader technology enables the assessment of children facial expressions, at it classifies them into the six basic emotions (i.e., happy, sad, angry, surprised, and disgust). The understanding of the deficiencies indicated in the processing of emotions, assessed with physiological reactions, can lead research to the development of intervention and prevention programs that are more effective for this population.

Method

Participants

The sample of the current study was selected from 1283 preschool and primary school children living in the Republic of Cyprus (638 males; *M* age = 6.35, *SD* = 1.31) whose parents completed a battery of questionnaires during the screening phase. Before the screening phase, parents were asked if the child had a history of epilepsy or any other serious mental or physical handicap that could preclude their participation. None were reported. Based on data collected for screening phase, 13.87% of children met the cut-off criteria for high severity CU traits using the CPTI for parents and classified as High-CU traits group (High CU). Children scoring 1 standard deviation below the mean on CU traits, were classified as Low-CU traits group (Low CU). Seventy-five children (41 males) high on CU traits were selected to participate in the intervention phase: 16 (9 males) children participated in the PCIT-CDI-CU intervention (*M*age = 7.19, *SD* = 1.47); 16 (7 males) participated in the CARES module (*M*age = 7.19, *SD* = 1.47); and 21 (10 males) were the participants of the EE module (*M*age = 7.24, *SD* = 1.48). The wait-list group (*n* = 22, 15 males; *M* age = 8.32, *SD* = 1.25) was formed by children high on CU traits who completed the same assessment as the children assigned to the three intervention groups prior (pre), six weeks (post), and three months (follow-up) after the completion of the intervention. After the completion of the baseline assessment, this group was also assigned to an intervention module for ethical reasons. The sample included children with good knowledge of the Greek language.

Screening

Following approval of the study by the National Bioethics Committee and the Centre of Educational Research and Assessment (CERE) of Cyprus, Pedagogical Institute, Ministry of Education and Culture, 47 private and public nursery schools, and 69 primary schools in three provinces (Nicosia, Larnaca and Limassol) were randomly selected for participation. Preschools and primary schools were contacted by telephone and informed about the aims of the study. School boards that were interested to participate in the study received details about the purpose and the procedure of the study via email. Parents/guardians were informed of the nature of the study and 81% of those consented to their child's participation. Mothers completed a battery of questionnaires, which took approximately half an hour.

Screening Questionnaires

Child Problematic Traits Inventory (CPTI; Colins et al., 2014). The CPTI was used to assess CU traits. This instrument contains 10 items assessing CU traits, and the response scale is *"Does not apply at all"* (1), *"Does not apply well"* (2), *"Applies fairly well"* (3), and *"Applies very well"* (4). Mothers were asked to assess each item based on how the child usually and typically behaves rather than based on how the child behaves now. CU traits total score was calculated by combining ratings on the ten items measuring Lack of remorse or guilt and callousness/lack of empathy (sum of 10 items; e.g., "*Never seems to have bad conscience for things that he/she has done*"). For the current study, alpha coefficients for subscale scores indicate a relatively high interval consistency (αs = .88 for CU) for mothers questionnaire.

Experimental Materials

To ensure that scenes relate to specific emotions, an initial pool of 33 films from six different Disney movies were validated by an independent sample of 45 children (*Mage* = 6). Children categorized the emotion expressed by the main character to one of the four different emotions (i.e., happiness, fear, sadness, anger) and the neutral expression using emoticons, which were age appropriate. A ranking of the scenes was made according to valid-rate (e.g., a happy emotional state expressed by the main character is correctly categorized as happy), invalid-rate (e.g., an angry emotional state is not categorized as any of the four

emotions). Additionally, the same scenes were rated by two independent samples of children (*Mage* = 6) on the following emotions: surprise, happiness, anger, fear, disgust, and sadness (1 = *"Not at all"* to 7 = *"Very much"*) in order to ensure that they elicit these basic emotions (Ekman, 1970). Based on children's ratings, 21 scenes, each of one-minute duration, were selected as the best representatives of each category.

Scenes were excerpts from cinematic productions and included video segments from two classic Disney movies, "The Lion King" (Disney Animation Studios, 1994) and "Hercules" (Disney Animation Studios, 1997). From each Disney film, four scenes were chosen to induce the following emotions: fear, sadness, anger, happiness and neutral. Established suggestions were used in the sampling procedure of the emotional stimuli for this study (Wells & Windschitl, 1999). All the scenes were in Greek and included music and some dialogue or commentary of approximately equal duration across categories. Because individuals with CU traits show a deficit in their ability to recognize fear (e.g., Dadds et al., 2008a) we used more fear stimuli with a number of different fear reactions in an effort to induce aversive mood. The selection criteria of happy scenes were (1) no acts that could be considered aggressive were included and (2) that a happy mood spanned across the 60 seconds of the scene. Video soundtracks were reduced in volume such that the mean volume across each scene was 70-dB. For the current study, 11 scenes, 2 scenes for each emotions and 3 for fear expression, where included.

Apparatus. For these experiments the timing of events, the presentation of visual and acoustic stimuli, and the logging of participant's responses to the rating questions were run by an E-Prime script (E-Prime 2.0; Schneider, Eschman, & Zuccolotto, 2012). Auditory stimuli were presented binaurally (both ears) using a portable sound bar speaker (LG NP3530 6w 2ch) in order to produce a room-filling sound and mask background noise. Scenes were displayed on a 22-inch computer screen, with a maximum resolution of 1680 x 1050 pixels.

Participants' facial expressions were filmed with a camera (Logitech Webcam C600, 2-megapixel still image capture, 720p HD video recording) mounted on the computer screen in front of the participant. An important requirement of FaceReader technology is the good illumination of the participant's face in order to produce reliable results, and because of that we used two desk lamps in order to light more children's faces. Facial emotional reactions were coded using the the Noldus FaceReader software. FaceReader 6.0 (Noldus Information

Technology, Wageningen, the Netherlands) is a facial coding software that automatically and programmatically detects a face in the image, identifies key landmark points and classifies the image according to how likely the emotion is presented in the participant's face. More specifically, the first step is for FaceReader to detect a face in the image, next it analyzes facial emotional expressions and compares them with a database of face models synthesized from facial emotional behavior prototypes (Ekman, 1993; Ekman, Friesen, & Ellsworth, 2013; Loijens et al., 2011). Subsequently, it identifies 500 key landmark points in the participant's faces and the texture of the area entangled by these points, to make a three-dimensional reconstruction of the face. In the final step, FaceReader classifies the emotion into one of the six basic emotions of happiness, anger, sadness, surprise, scare and disgust (van Kuilenburg, Wiering, & den Uyl, 2005) according to how likely the emotion is present in the participant's face. FaceReader is an effective tool to measure instant emotions (Zaman & Shrimpton-Smith, 2006) with accuracy of 88–89% (Lewinski, den Uyl, & Butler, 2014; van Kuilenburg et al., 2005).

Experimental Procedure

Upon their arrival at the Developmental Psychopathology Lab of the University of Cyprus, a researcher thanked the families, answered any questions that came up, and explained the consent form in detail. Children assent was also taken prior to the participation in the pre-treatment assessment phase. Once informed consent was provided parents and children were given detailed information about the experiments. More specifically, they were informed that they (1) would be seated in front of a computer screen and watch different cartoon scenes (i.e., happiness, sadness, anger, and fear), and (2) their facial expressions will be recorded. Children were seated in front of the desktop computer in a well-lid room, in a height-adjustable chair, which was adapted to the point at which children were looking directly towards the screen were their facial reactions were most accurately recorded. The chair was placed approximately 60 cm from the 22-inch computer screen, with a maximum resolution of 1680 x 1050 pixels. Children were instructed to restrain from moving their heads or covering their faces, and a calibration process was completed. This procedure was repeated until calibration outcomes were adequate supporting a face recording with high accuracy.

Children were administered the eleven scenes, in which happiness, sadness, anger, fear or neutral expressions were displayed by the main characters of the two Disney movies. Recordings of facial expressions were saved as AVI files and were analyzed frame by frame during the presentation of affective scenes using the Noldus FaceReader software 6.0 (Noldus Information Technology, Wageningen, The Netherlands). For each participating child, the edited recordings (11 scenes) were uploaded to the software and analyzed using batch analysis. For all the participants, the "General I" face model was used as it is identified by the manufacturers as producing the best results under normal filming circumstances. Continuous calibration was also used to correct for participants facial bias (e.g., appearing angry or feared in general), as participants' facial expressions were not available prior the initial assessment. FaceReader software scales the six basic and neutral emotions from 0 (not present at all) to 1 (maximum intensity of the fitted model). The task took approximately 15 to 20 minutes to complete and families were not informed about the objectives of the study. The same experimental procedure was repeated after the completion of the intervention (post-intervention), and three months after (follow-up).

Targeted Interventions

Parent-Child Interaction Therapy: Child Directed Intervention for CU traits (sessions 1-6) (PCIT; Eyberg et al., 2008; Thomas & Zimmer-Gembeck, 2007). The program began with a Teach session (parents only) during which parents were given an overview of the program aims and rational as well as the way the sessions were coached (see Table 1). CDI-CU teaches the importance of learning the focused parenting-skills that aim to build positive parent-child interactions. The skills are comprised of five CDI -CU 'Do skills', namely Praise, Reflections, Imitation, Description and Emotional Expression (or expressions of warmth), also known as the PRIDE skills. The fifth CDI-CU "Do" skill has been adapted by training and coaching parents to express greater warmth/affection, increase eye contact and label emotions in interactions with the child to improve the child's recognition and response to distress cues (i.e., emotional expression and identification skill). These skills are practiced for the remaining 4 sessions while the parent plays with the child through in-vivo coaching. While the treatment is usually applied through a wireless headset whereby the

trainer coaches the parent through a two-way mirror, due to technical difficulties, this study used in-vivo training whereby the trainer sat in the corner of the room and whispered to the parent. Progress of the 5 'Do skills' was monitored through weekly behavioral coding using the adapted Dyadic Parent-Child Interaction Coding System (DPICS). Coding took place during the first 5 minutes of each coaching session to identify session goals with the target of achieving mastery of CDI-CU skills. The last session involved graduation from the program whereby the parents, child and trainer discussed progress throughout the program.

Coping and Rewarding Emotional Skills (CARES) (sessions 1 - 6). This 6-session novel adjunctive module is designed to (a) teach parents to better identify and describe their child's distress-related emotions, (b) teach children to recognize distress cues and engage in empathic and prosocial behavior using several parent-implemented strategies including modeling, role-playing and social scripts, and refocusing attention to the eye region of the face (Dadds, et. al., 2008c), (c) encourage prosocial behavior and motivate compliance with activities using positive reinforcement (praise, token system), and (d) teach developmentally appropriate cognitive-behavioral strategies to the child to cope with frustration-based anger that arises when reward driven behaviors are thwarted and that might lead to reactive aggression. The first session began with an overview of the CARES program, whereby the parent and trainer discussed the importance of emotion labelling and modeling during everyday interactions and the importance of emotional literacy in everyday language (see Table 2). The remaining 4 sessions were centered on activities (e.g. stories, games, role-play) that are aimed at developing, 1) emotion recognition in others, 2) practice of emotion recognition between parent-child dyads, 3) link between emotion and context and 4) learning to cope with emotions like anger and frustration. The last session progressed into graduation whereby a review of learned skills was discussed.

*Emotional Engagement (sessions 1 - 6) (*EE; Dadds & English, 2012*).* The treatment aims to increase the two factors that are most important in the development of CU traits, namely, parental warmth and eye contact. An initial pre-intervention video-recording in which the parent and child engaged in Free Play was interpreted by the trainer and was presented at the first session of the program (see Table 3). Therapists looked at the interactions between parents and children and the parent's ability to let the child lead play, comment on the child's play, let the child take the lead and refrain from giving instructions;

while the child's reactions were also taken into account. The Pre-intervention session also involved the 'I Love You' task whereby the parent was asked to express affection in a natural manner, make eye contact and engage with the child. The therapist selected positive moments from both activities to show and discuss with parents during the first treatment session whereby the parents were introduced to the rational and content of the program. During the video review parents were informed about a technique called the 'Video Based Guidance' which aids the parents in increasing the frequency of their positive interactions with their children as they reviewed their positive and successful interactions only. The program consisted of two more videotaped sessions (sessions 2 and 4) as well as two review sessions whereby parents viewed the positive interactions and discussed with the therapist strengths and positive aspects of their communication (Sessions 3 and 5). The final session consisted of a review session whereby the family discussed their progress throughout the intervention process. The treatment process was supported by daily homework exercises involving positive parenting and eye gaze.

Plan of analyses

Data were assessed for outliers prior to conducting the main study analyses that were conducted in the IBM SPSS 24.0 statistical software. Repeated measures analyses of variance (ANOVA) were performed after the completion of the intervention phase to investigate how facial expressions changed from pre-intervention assessment to a three-months follow-up period, and test the main and interactive effects of intervention groups. Specifically, a separate repeated measures analysis of variance (ANOVA) was conducted with emotional scenes (i.e., fear, happy, angry, sad) and the six facial emotional expressions (i.e., happy, sad, angry, surprised, scared and disgusted) as the within-subject variables. Specifically, for facial emotional expressions, we conducted 4 groups (PCIT-CDI-CU, CARES, EE, and a wait-list group) x 3 time points (pre-intervention, post-interventions, three-months follow-up assessment) repeated measures ANOVA. Cohen's *d* effects sizes (<.40 small effect size, >=.40 and <.75 medium effect size, >=.75 large effect size), and eta square (<.01 small, <=.06 medium, >=.14 large) were reported in the text.

Results

Fear scenes. Findings from the repeated measures ANOVA suggested that children differed in their levels of emotional expression, $F(5, 275) = 22.96$, $p < .001$, $\eta^2 = .29$. Comparisons revealed that children expressed more anger and surprise in feared scenes, as seen in Table 4. A significant facial expression by time was also found, $F(10, 550) = 8.16$, $p < .001$, $\eta^2 = .13$ (see Figure 1). Children showed a high decrease of their surprised expression in scenes depicting fear across time ($d_{\text{pre to post}} = 1.02$, $d_{\text{pre to fu}} = .94$). A significant facial expression by time by intervention group was also found, $F(30, 550) = 2.26$, $p < .001$, $\eta^2 = .110$ (see Figure 2 and Table 5). Comparisons revealed an increase in expression of *sadness* by all the intervention groups, with PCIT-CDI-CU indicating the higher increase ($d_{\text{pre to post}} = 3.38$, $d_{\text{pre to fu}} = 3.84$) across time. EE groups indicated a higher increase in sadness expressions ($d_{\text{pre to post}} = .71$) immediately after the completion of the intervention, than CARES ($d_{\text{pre to post}} = .42$), but it was not sustained. In addition, comparisons revealed a decrease in *surprise* expressed by children across time. The effect was higher for PCIT-CDI-CU ($d_{\text{pre to post}} = 1.72$, $d_{\text{pre to fu}} = 1.66$) and CARES group ($d_{\text{pre to post}} = 1.55$, $d_{\text{pre to fu}} = 1.39$) than for EE group ($d_{\text{pre to post}} = .47$, $d_{\text{pre to fu}} = .40$). Wait-list group showed no significant differences in emotional expressions in fear scenes.

Sad scenes. When sadness was the dependent variable, findings printed to different levels of emotional expression, $F(5, 275) = 26.85$, $p < .001$, $\eta^2 = .33$. Comparisons revealed that children expressed more anger and surprise in sad scenes, as seen in Table 4. As shown in Figure 3, a significant facial expression by time was found, $F(10, 550) = 9.89$, $p < .001$, $\eta^2 = 152$. Children expressed less *surprise* in scenes depicting sadness across time ($d_{\text{pre to post}} = 1.15$, $d_{\text{pre to fu}} = 1.01$), although they expressed higher sadness. As with fear scenes, a significant facial expressions by time by intervention group was also found, $F(30, 550) = 9.89$, $p < .001$, $\eta^2 = .152$, which is depicted in Figure 4. Comparisons revealed an increase in expressions of *sadness* only for the EE group immediately after the completion of the intervention ($d_{\text{pre to post}} = .74$). A decrease in *surprised* expressed by children was indicated for all the intervention groups, with PCIT-CDI-CU indicating the highest decrease ($d_{\text{pre to post}} = 1.80$, $d_{\text{pre to fu}} = 1.64$), than CARES ($d_{\text{pre to post}} = 1.86$, $d_{\text{pre to fu}} = 1.86$), and EE group ($d_{\text{pre to post}} = .58$, $d_{\text{pre to fu}} = .41$) (see Table 5).

Angry scenes. Repeated measures ANOVA in response to angry scenes suggested

different levels of emotional expression, $F(5, 270) = 25.69$, $p < .001$, $\eta^2 = .32$. Comparisons revealed that children expressed more anger and surprise in sad scenes, as seen in Table 4. As shown in Figure 5, a significant facial expression by time was found, $F(10, 540) = 8.36$, $p < .001$, $\eta^2 = .13$. Children showed a decrease in *surprised* ($d_{\text{pre to post}} = 1.06$, $d_{\text{pre to fu}} = .97$) and *scared* ($d_{\text{pre to post}} = .54$) emotions expressed, while a decrease of *disgust* was supported only in follow-up assessment ($d_{\text{pre to fu}} = .44$). A significant facial expressions by time by intervention group was also found, $F(30, 540) = 1.83$, $p < .01$, $\eta^2 = .09$. As depicted in Figure 6, an increase in *anger* expression for the PCIT-CDI-CU group ($d_{\text{pre to post}} = .53$) immediately after the completion of the intervention, and a decreased of *scared* expressions for both PCIT-CDI-CU ($d_{\text{pre to post}} = .51$) and CARES group ($d_{\text{pre to post}} = .67$) were evident. Both CARES ($d_{\text{pre to post}} = .41$) and EE ($d_{\text{pre to post}} = .59$) resulted in increases in *sadness* expressed immediately after the completion of the intervention. A decrease of *surprised* expression was indicated by all the intervention groups across time (see Table 5), but not the wat-list group.

Happy scenes. Finally, findings suggested that children expressed different levels of emotions during happy scenes as well, $F(5, 275) = 21.46$, $p < .001$, $\eta^2 = .28$. Comparisons revealed that children expressed more anger and surprised in happy emotional scenes, as seen in Table 4. The decrease was higher after a three-month period ($d_{\text{pre to fu}} = 1.10$) than immediately after the intervention ($d_{\text{pre to post}} = .63$). As shown in Figure 7, a significant facial expression by time interaction was found, $F(10, 540) = 10.54$, $p < .001$, $\eta^2 = .16$. Children indicated a decrease in *surprise* ($d_{\text{pre to post}} = 1.04$, $d_{\text{pre to fu}} = 1.12$), scared at post-assessment ($d_{\text{pre to post}} = .42$), and *disgust* at follow-up ($d_{\text{pre to fu}} = .61$). A significant facial expression by time by intervention group was also found, $F(30, 540) = 2.19$, $p < .001$, $\eta^2 = .11$, which is depicted in Figure 8. PCIT-CDI-CU group showed a decrease in *anger* ($d_{\text{pre to post}} = .41$) and *scared* ($d_{\text{pre to post}} = .66$) emotions expressed immediately after the completion of the intervention. An increase was supported for the EE group for *sadness* ($d_{\text{pre to post}} = .48$) and *anger* ($d_{\text{pre to post}} = .58$) expressed, while all the intervention groups indicated a decrease in surprised emotion (see Table 5).

Discussion

The current study might be the first aiming to examine the effectiveness of intervention programs among children high on CU traits in relation to their facial emotional

expressions, assessed with FaceReader. A unique contribution of the current study was the support provided for a differentiation in empathic responding by all the intervention groups, supporting theories suggesting that intervening in child's environment can result in changes in empathic concern and emotional processing (Raine et al., 2001). According to Blair and colleagues (2006; 2006; 2007), impaired emotion recognition and autonomic responding to distress cues (i.e., sadness and fear) underlie individuals high on CU traits emotional processing deficiencies. The differentiation indicated by all the intervention groups in facial emotional expressions support the importance of a systematic improvement of parenting skills (Eyberg et al., 2008) and emotional cognitive skills (Kimonis & Armstrong, 2012), that can lead to an adequate emotional responding (Adolphs et al., 2005; van Baardeqijk et al., 2009; Kyrianides, 2014). In support of our main hypothesis, children participating in all the interventions showed an increase in sadness expression in relation to distressing cues, with a higher increase by the PCIT-CDI-CU group. By supporting an increase in sadness expression, the current study provides support for an enhancement in children experience and expression of emotional sharing. Additionally, the differentiation in relation to other emotional expressions such as anger, surprise and disgust serves as an indication of the children enhanced emotional processing. Specifically, these advances may provide support for the children's increased ability to focus and accurately identify others' emotional expressions, which lead to an enhanced emotional engagement shown by their facial responsivity.

Targeting children's emotional difficulties: An enhanced empathic concern in response to distressing cues

The increase in display of sadness by all the intervention groups and across negative emotional scenes, come in support of the amenability of emotional deficiencies indicated by this population early in development. The reduced response to negative emotions has long been supported as a mechanism for the development of CU traits by Blair and colleagues (2001b; 2008). Emotional processing, early in development, enables the identification of emotions expressed by others and facilitates the development of quality attachment with caregivers, prosocial behavior and the internalization of parental norms. The increase in expression of sadness in response to negative emotions may act as an indication of children

more accurate recognition of distress expressed and prevent the cascading errors in socialization practices and behavioral problems characterizing children high in CU traits (Fleming et al., 2017).

The surprisingly great improvement in PCIT-CDI-CU group's expression of sadness with reference to emotional stimuli of fear comes in support of the long history of this intervention as the most well supported parent management-training program that reduces child's behavioral problems and improves parenting skills (Thomas, Abell, Webb, Avdagic, & Zimmer-Gembeck, 2017). This is the first study providing support for the increase of emotional reactivity of children, high on CU traits, participating in PCIT-CDI-CU, highlighting the importance of a more positive emotional interaction and involvement between parents and children (Gurwitch, Pearl-Messer, & Funderburk, 2017). CDI developed based on the attachment theory, and highlights the importance of consistent respond with warmth and sensitivity, which leads to the promotion of a more secured attachment between parents and children (Kimonis et al., 2014). Mounting research findings have supported the importance of secure emotional attachment in promoting emotional and moral development and preventing disruptive behavior and externalizing problems (Fearon et al., 2010; Madigan, Brumariu, Atkinson, & Lyons-Ruth, 2016). Despite the fact that the underlying mechanism explaining the relationship between secure attachment and empathic concern is unclear, Guttamann-Steinmetz and Crowell (2006) supported that a warm, mutually responsive parent-child relationship lead children to adopt and conform to parents' values and requests. As a result, the increased expression of sadness in response to fear scenes across time, suggest an increased ability of this group to identify distressing cues, and share this negative emotion with others'. Specifically, an enhanced sadness facial expression may support an increased concern and distress towards the negative feelings of the scenes' characters that is sustained across time. By subverting the poor recognition of distress in others, these findings may provide support, for the elicitation of adequate empathic responses and appropriate facial reactions.

In support of the effectiveness of PCIT-CDI-CU in enhancing emotional processing, an increase was also shown in expression of anger in both fear and anger scenes immediately after the completion of the intervention. This increased expression of anger indicate an enhanced emotional engagement in expressions of negative affect that are quite distressing

to most people, and may suggest an enhanced emotional affection. At this point, it is important to note that anger arousal needs to be considered independently, and not as part of aggression, as can indicate psychological stress experienced by individuals (Kleinginna & Kleinginna, 1981). More specifically, Novaco (1975) in an attempt to answer the question regarding the nature of anger supported that anger arises as a response to feelings of insecurity, which cannot be experienced without any feeling to stress and anxiety. As a result, arousal of anger can be described as an affective response to provocation that has physiological, behavioral and cognitive components, which aims to help individuals orient adaptively to the environment, and induce experience of security and personal control in response to fear stimuli. Consequently, the increased expression of anger in scenes of fear and anger can be served as an indication of the anger's adaptive functions and the ability of children to share in a more accurate way main character's emotional state.

CARES and EE groups resulted in the same trends in sadness expression as PCIT-CDI-CU group, highlighting the amenability of emotional processing deficiencies, through the development of cognitive skills, such as attention allocation and focus of children's eyes gaze to the salient emotional cues of other's emotional expressions (i.e., eyes), employed in emotion identification. Research has previously provided support for the effectiveness of allocation of attention to emotional cues in increasing sensitivity to distress cues in children high on both conduct problems and CU traits (Datyner et al., 2016; Fleming et al., 2017). More specifically, by refocusing children's interest to relevant facial micro-expressions both protocols aimed to ameliorate empathy-related deficiencies in processing of negative emotions and improve socio-emotional competence (Dadds et al., 2006; Ekman, 2002). The improvements in affective reactivity to others' emotional expressions, such as distress, lead current study to provide further support for the attention to the eyes deficit shown by this population. Specifically, emotional processing deficiencies are described by the children's inability to attend and process information expressed through emotional faces. Thus, by extending experimental studies' findings on the amenability of empathic deficiencies (Adolphs et al., 2005; Dadds et al., 2006; 2008b; Domes et al., 2007; Gustella et al., 2008; Kyranides, 2014), the current study provides further support for the importance of attention to emotional stimuli (i.e., emotional faces). More specifically, facial emotional expressions can elicit empathic concern in individuals who can identify them (Marsh & Ambady, 2007),

which in turn is associated with increased helping behaviors and decreased antisocial and delinquent acts (Eisenberg, Fabes, Guthrie, & Reiser, 2000).

Although, it is of great importance to note that both CARES and EE, were developed and applied as additive modules to an evidence-based parenting management treatment. This may explain the medium effect sizes indicated in sadness expressions across time for the CARES module and the absence of sustained improvements for the EE module. The current study's findings provide support for the importance of cognitive skills in ameliorating emotional deficiencies of children high on CU traits, although may also suggest the importance of attachment context and parental warmth (Eyberg et al., 2008; Hawes et al., 2014). In addition, the absence of sustainability of increased sadness expression across time for EE group, may suggest that the higher effect sizes were the result of the intensive nature of the training methods and the feedback provided to parents, indicating the need for a long-term training of parents and children. Giving the lack of previous studies examining the effectiveness of EE in enhancing emotional processing and empathic responding through the promotion of mutual parent-child eye gaze behavior further study of targeted interventions is needed.

The current study's findings regarding the effectiveness of the intervention programs in increasing children's expression of sadness in fear scenes are also supported by the level of emotion expressed by the wait-list group. The wait-list group's sustained expression of sadness across time, provide support for the stable character of children's deficits in processing distress cues and deficient empathic concern, and also highlights the importance of early intervention in an attempt to prevent behavioral problems later in life. In addition, these findings further support the importance of a warm emotional context that enhance the child's sense of safety, and enables the increase of salience of emotional stimuli through their everyday social interactions. Moreover, the increase in sadness in response to fearful expressions indicated by all the three interventions are highly consistent with the improvements indicated by previous trials of the same interventions (e.g., Fleming et al., 2017; Hawes & Dadds, 2007; McDonald, Dodson, Rosenfield, & Jouriles, 2011). The current findings come in support of the intensity and theory-driven strategies applied in this study and extends previous research by indicating an increase in physiological reactivity to emotional signs of distress to others.

Differentiating children emotional processing

An interesting finding regarding the emotional processing applied in different emotional scenes is the decrease of surprised expressed by all the intervention groups across emotions and time. A decrease that cannot be attributed to the repetition of the experimental procedures and the familiarization of children with the emotional scenes shown, as such a decreased was not indicated by wait-list group. Surprise is a brief emotional reaction to an unexpected event that can have any valence, as it can be positive/pleasant or negative/unpleasant. In terms of physiological reactivity, this response interrupts the individuals' ongoing behavior in order to refocus the attention to this event and produces a number of autonomic nervous system activation responses (Kreibig, 2010). Despite the fact that a reduced startle reflex has been supported as a characteristic of individuals reduced emotional engagement (Fanti, 2016), Reisenzein and colleagues (2006) proposed that the exposure to surprising events may not produce the surprising feelings expected, as other strong emotions or facial expressions interfere. A finding that comes to support the increased sadness expression, mainly in negative emotional scenes, which may had produced an imbalance in children's emotional processing strategies applied prior the intervention and lead surprised expression to a reduction. The reduction of surprised expression across time may also propose a differentiation in children's emotional processing, in an attempt to investigate the most effective emotional strategies.

Although there are multiple studies showing a link between sadness, fear and ineffective emotional processing in individuals high on CU traits (Blair, Jones, Clark, & Smith, 1997), Fanti and colleagues (2016a) extending the findings of previous studies (Bowen et al., 2014; Kosson et al., 2002; Levenston, Patrick, Bradley, & Lang, 2000), also showed low facial reactions of disgust. The low expression of disgust can be interpret as a reduced distress and emotional engagement of individuals high on CU traits, in violent scenes. Disgust is a primary emotion elicited either by stimuli of contamination and pollution or mutilations, injuries and by blood (Kreibig, 2010). This reaction is characterized by an autonomous nervous system reactivity, that aims to interrupt individuals' ongoing behavior make them able to deal effectively with these challenges and protect themselves (Levenson, 2014; Wicker et al., 2003). Contrary to our expectations, no important differences indicated regarding the expression of disgust by the intervention groups. A possible reason is primarily

the neglect of the importance of this emotion by the literature, which lead to the exclusion of this emotion from the emotional strategies employed by the intervention programs (Philips, Gahy, & David, 1998). In addition, prior studies used particularly tough images and videos in order to elicit this emotional reaction in adult populations, which could not be used with children population for ethical reasons (Fanti et al., 2016a; Kosson et al., 2002). As a result, it is hypothesized that the selected animated scenes included in the current study may not produce the strong feelings of disgust that could be assessed across time. In addition, as in the case of expression of surprise, may the absence of any enhancement of disgust expressed, support the increase of sadness that interfere with other emotional expressions. Interventions in general, placed a heavy emphasis in enhancing children's emotional engagement and processing in response to the basic negative emotions, and these findings may indicate the transitional period where children try their new emotional strategies mainly on emotional expressions of fear, indicating the need for a longer follow-up assessment period. In support of this explanation, comes the higher decrease of disgust expressed by wait-list group, which in combination with their familiarization of the children with the scenes shown may support their reduced distress and emotional engagement in all the emotional expressions of the main character.

Strengths and Limitations

A major strength of this study is the fact that a very large community sample with varying levels of CU traits was screened in order to identify a sub-group of children to participate in interventions. In addition, findings from the study are reinforced by a new technological methodology such as FaceReader that aims to enable a better understanding of facial emotional reactivity in a number of different emotional contexts. Fanti (2016) in his review highlighted the importance of facial electromyography in informing about children at risk of antisocial behavior, and the importance of these biomarkers in the assessment of the process indicated through interventions. The combination of FaceReader methodology and the implementation of three intervention programs aiming to differentiate the facial emotional reactivity to emotions expressed helps in advancing the importance of new methodological techniques in the assessment of treatment gains. Specifically, this study highlights the potential for facial emotional measures, depicting empathic deficiencies, to be

used to investigate precisely operationalized outcomes and mechanisms pertaining parenting targets in the context of family interventions. In addition, by replicating previous research findings of emotional enhancement with reference to physiological measures, lead to a new area interest regarding the assessment of the effectiveness of interventions applied to children high on CU traits. Findings are important for both psychopathy research, and facial emotional response. When at the same time, have a lot to offer to the prevention and intervention literature of children scoring high on CU traits only. Unfortunately, because the current study did not include any measures of the emotional recognition accuracy, it is not possible to decipher clearly, if children became more accurate in recognizing distressing cues and respond to them adequately.

Although, these findings must be considered in light of several methodological issues. While this study represents a good starting point to investigate the processing of negative emotional expression and the effectiveness of interventions in enhancing children emotional processing strategies, it is just a pilot testing of these studies using a small number of families. A larger sample would increase the power to detect bigger effect sizes and important improvements through interventions. In addition, the subclinical nature of the sample may explain the small effect sizes indicated across time for some emotional expressions, and affect the generalizability of the findings to clinical populations. Further, findings were not validated by a multi-method assessment of children emotional expression such as facial electromyography and emotion recognition, which could verify the FaceReader findings. Future studies must include additional measures that might clarify the enhancement in children perception and reaction to emotional contexts. Moreover, the stimuli used in the current study were dynamic expressions of cartoon characters compared to human emotional reactions, and it is possible that the animated characters elicited weaker and less specific reactions. In addition, the complexity of scenes included made it difficult to distinguish whether the emotional expressions were a result of the main character's emotional experiences or the perpetrators behavior.

With reference to the intervention protocols, the use of an evidence-based intervention such as PCIT-CDI-CU, with an adjunctive module (CARES, EE) may lead to a higher increase in children's facial emotional responsivity and empathic concern, as they can combine all the effective elements identified separately for each intervention.

Conclusion

In conclusion, the current study aimed to extend previous research on intervention effectiveness in emotional processing of children high on CU traits using facial emotional expression measurements. The increase indicated by PCIT-CDI-CU group in sadness and anger expressions in scenes of fear come in support of the importance of attachment context and social learning in the enhancement of children's emotional development. The enhanced emotional expression of sadness indicated by children high in CU traits, further support the importance of early intervention in preventing behavioral problems and antisocial behavior. The same trends also indicated by CARES and EE groups, provide support for the importance of attention allocation to salient emotional cues shown by others facial emotional expressions that enable the identification of others emotional expressions, although highlight their adjunctive nature to evidence-based intervention protocols. In our knowledge, this was the first study that tried to combine facial emotional expressions measures of empathic responding with intervention applied in mothers-child interactions. By highlighting the importance of a more comprehensive intervention process that combines both the importance of the parent-child quality attachment and the enhancement of attention allocation to facial emotional cues, this study contribute to the implementation of more effective intervention programs for children early in development. We hope the current study's findings will further advance the research on the ongoing development of new prevention and intervention programs for children high on CU traits early in development.

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Table 3 1: Outline of Parent Child Interaction Therapy- Child Directed Intervention (PCIT-CDI-CU).

Session	Goal	Content	Activity
1	Provide an overview of CDI intervention program	Teach parent the CDI PRIDE skills and provide rationale for each skill	Psycho-education of parent in the absence of the child
2	CDI Coaching Session 1	Code and coach parent and child interaction in CDI activities	Orient child to CDI practices Review summary sheet data Introduce ECBI graph
3	CDI Coaching Session 2	Code and coach parent and child interaction in CDI activities	Review homework Review summary sheet data and ECBI graph
4	CDI Coaching Session 3	Code and coach parent and child interaction in CDI activities	Review homework Review summary sheet data and ECBI graph
5	CDI Coaching Session 4	Code and coach parent and child interaction in CDI activities	Review homework Review summary sheet data and ECBI graph
6	Graduation session	Review new skills learned, progress/success Planning for future maintenance of treatment gains	Review all the activities used

Note. CDI = Child Directed Intervention.

Table 3 2 Outline of Coaching and Rewarding Emotional Skills (CARES) module.

Session	Goal	Content	Activity
1	Provide an overview of CARES intervention program	How to use emotion recognition and labeling in everyday to increase emotion recognition skills	Psycho-education of parent in the absence of the child
2	Teach how to identify and understand others' emotions	How to look for signs that indicate different emotions (i.e., eye and mouth region)	Images with different facial expressions to guess the emotion shown Discuss the salient facial cues (e.g., smile) Identify relevant micro-expressions
3	Teach how to recognize each other emotions	How to look for signs that indicate different emotions like muscle change	Facial expression configurations (e.g., happy face) by fill in blank faces Flash cards game with parents and children taking turns and making emotional expressions for the other to guess
4	Teach how to link each emotion with context	Teach the child how others feel in different occasions	Discuss about different emotions in different situations Social stories about prosocial behavior and making amends following transgressions
5	Teach how to cope with frustration	Teach child coping skills for negative emotions (e.g., anger, distress)	Social story – "Stop, Breathe, Think" (SBT) Scenarios with SBT and role-playing in order to practice these skills
6	Graduation session	Review new skills learned, progress/success Planning for future maintenance of treatment gains	Review all the activities used

Note. CARES = Coaching and Rewarding Emotional Skills.

Table 3 3: Outline of Emotional Engagement module.

Session	Goal	Content	Activity
1	Provide an overview of EE intervention program	Presentation of rationale and intervention content	Psycho-education of parents in the absence of children Video Based Guidance (VBG): Watching positive moments of Pre-assessment free play session
2	Practice session 1	Combine parental warmth and eye contact	Emotional Engagement exercises
3	Review video session 1	Video Based Guidance (VBG)	Parent and therapist discussion on positive moments of practice sessions and identify of the progress made
4	Practice session 2	Combine parental warmth and eye contact	Emotional Engagement exercises
5	Review video session 2	Video Based Guidance (VBG)	Parent and therapist discussion on positive moments of practice sessions and identify of the progress made
6	Graduation	Review new skills learned, progress/success Planning for future maintenance of treatment gains	Review all the activities used

Note. EE = Emotional Engagement.

Table 3 4: Main effect of facial emotional expressions across time.

	Emotional Expression							
	Happy	Sad	Angry	Surprised	Scared	Disgusted		
Emotional Scenes	*M* (SE)	*M* (SE)	*M* (SE)	*M* (SE)	*M* (SE)	*M* (SE)	F	η^2
Fear	.014 (.002)	.032 (.007)	.131 (.018)	.066 (.007)	.044 (.007)	.016 (.003)	22.96	.29
Happy	.034 (.006)	.018 (.003)	.089 (.009)	.060 (.006)	.034 (.004)	.018 (.002)	21.45	..28
Angry	.011 (.001)	.028 (.005)	.154 (.022)	.070 (.008)	.042 (.006)	.021 (.003)	25.69	.32
Sad	.016 (.002)	.039 (.006)	.121 (.014)	.075 (.008)	.039 (.006)	.017 (.002)	26.85	.33

Table 3 5: Effect sizes for the level of emotion expressed across time for all the interventions.

Emotional Scenes	Change over time	Interventions	Effect sizes of the level of emotion expressed					
			Happy	Sad	Angry	Surprised	Scared	Disgusted
Fear	Pre to Post	PCIT-CDI-CU	(+) .26	(+) **3.38**	(+) .38	(-) **1.72**	(-) .29	(-) .32
		CARES	(-) .05	(+) **.42**	(-) .14	(-) **1.55**	(-) .37	(-) .10
		EE	(-) .22	(+) **.71**	(+) .08	(-) **.47**	(-) .06	.00
		WAIT-LIST	(+) .17	(-) .12	(+) .02	(+) .15	(-) .22	(+) .22
	Pre to FU	PCIT-CDI-CU	(+) **.70**	(+) **3.84**	(+) **.40**	(-) **1.66**	(+) .17	(-) **.41**
		CARES	(+) .23	(+) **.57**	(-) .04	(-) **1.39**	(-) .38	(-) .14
		EE	(-) .12	(+) .33	(+) .29	(-) **.40**	.00	(-) .27
		WAIT-LIST	(-) .12	(+) .07	(+) .06	(+) .12	(-) **.71**	(-) **.65**
Happiness	Pre to Post	PCIT-CDI-CU	(+) .05	(+) .10	(+) **.41**	(-) **1.73**	(-) **.66**	(-) .28
		CARES	(-) **.42**	(+) .07	(+) .23	(-) **1.53**	(-) .28	(-) .07
		EE	(-) .31	(+) **.48**	(+) **.58**	(-) **.45**	(-) .29	(-) .18
		WAIT-LIST	(-) .11	(-) .12	(-) .13	(-) .04	(-) .25	(-) **.72**
	Pre to FU	PCIT-CDI-CU	(+) .24	(-) .22	(-) .05	(-) **1.71**	(-) .07	(-) .07
		CARES	(-) .28	(+) .38	(+) .01	(-) **1.50**	(-) **.46**	(-) .19
		EE	(-) .39	(+) .30	(+) .14	(-) **.64**	(-) .22	(-) .26
		WAIT-LIST	(-) .25	(+) .19	(-) **.76**	(-) .18	(-) **.52**	(-) **1.32**
Anger	Pre to Post	PCIT-CDI-CU	.00	(+) .15	(+) **.53**	(-) **1.86**	(-) **.51**	(-) .20
		CARES	(+) .07	(+) **.41**	(-) .15	(-) **1.29**	(-) **.67**	(-) .33
		EE	(-) .38	(+) **.59**	(+) .17	(-) **.66**	(-) .14	(-) .21
		WAIT-LIST	(-) .25	(-) .05	(+) .06	(+) .01	(-) **.54**	(-) .13
	Pre to FU	PCIT-CDI-CU	(+) .29	(-) .21	(-) .31	(-) **1.72**	(+) .11	(-) .21
		CARES	(+) **.40**	(+) .33	(+) .32	(-) **1.20**	(-) .20	(-) .26
		EE	.00	(+) .38	(+) .08	(-) **.64**	(-) .03	(-) .30
		WAIT-LIST	(-) .19	(+) .15	(+) .18	(+) .04	(-) **.43**	(-) **.66**
Sadness	Pre to Post	PCIT-CDI-CU	(+) .23	(+) .26	(+) .13	(-) **1.80**	(-) **.60**	(-) .12
		CARES	(+) .33	(+) .18	(-) .14	(-) **1.86**	(-) .18	(-) .32
		EE	(-) .36	(+) **.74**	(-) .22	(-) **.58**	(-) .13	(-) .27
		WAIT-LIST	(-) .36	(-) .16	(+) .01	(+) .03	(-) .21	(+) .17
	Pre to FU	PCIT-CDI-CU	(+) **.56**	(+) .20	(+) .16	(-) **1.64**	(+) .16	(+) .04
		CARES	(+) .26	(+) **.57**	(-) .09	(-) **1.86**	(-) .12	(-) .12
		EE	(-) .30	(+) .30	(+) .03	(-) **.41**	(+) .05	(-) .29
		WAIT-LIST	(-) .33	(+) .23	(-) .07	(+) .09	(-) **.57**	(-) **.65**

Note. Pre for pre-intervention assessment, Post for post-intervention assessment, FU for follow-up assessment 3 months after the completion of the intervention. **Bold** are all the medium and large effect sizes.

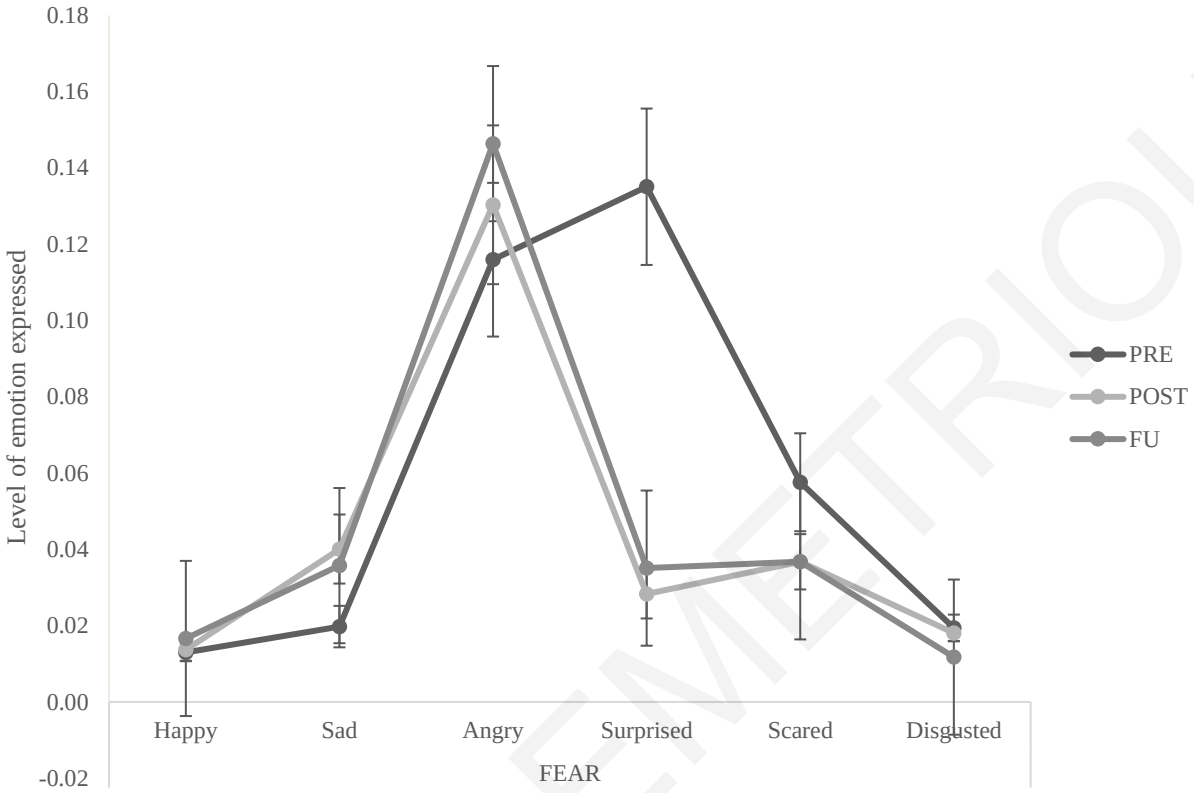

Figure 3 1: Emotional expressions by assessment time with the level of emotion expressed for fear scenes.

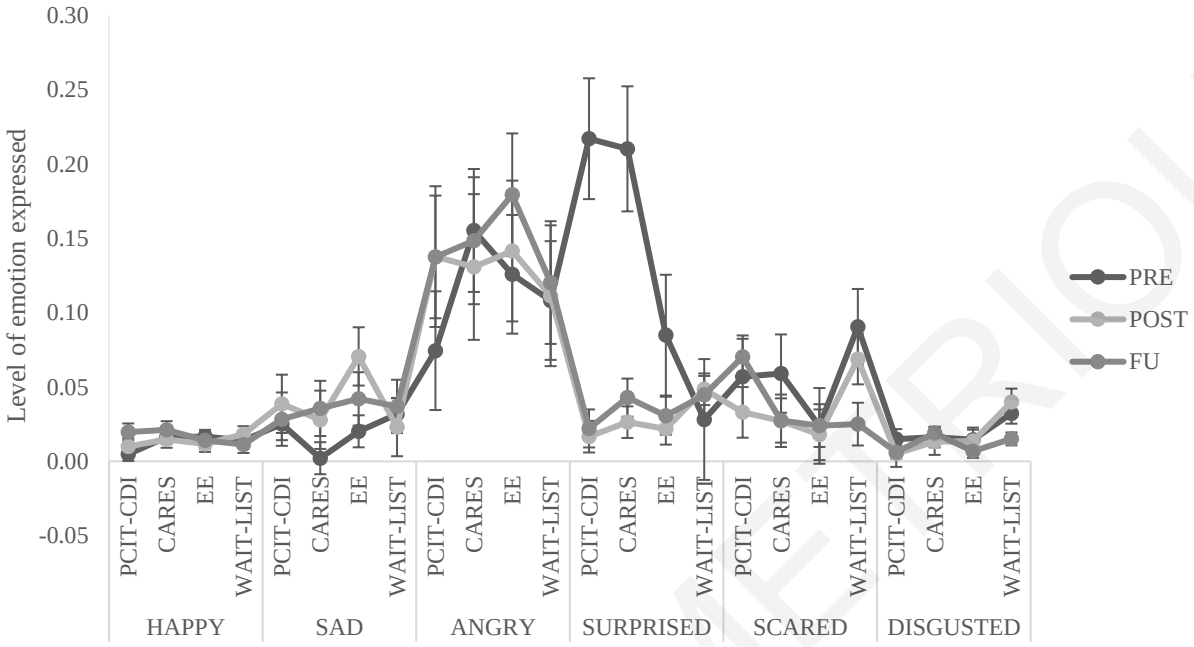

Figure 3 2: Emotional expressions by assessment time by intervention groups with the level of emotion expressed for fear scenes.

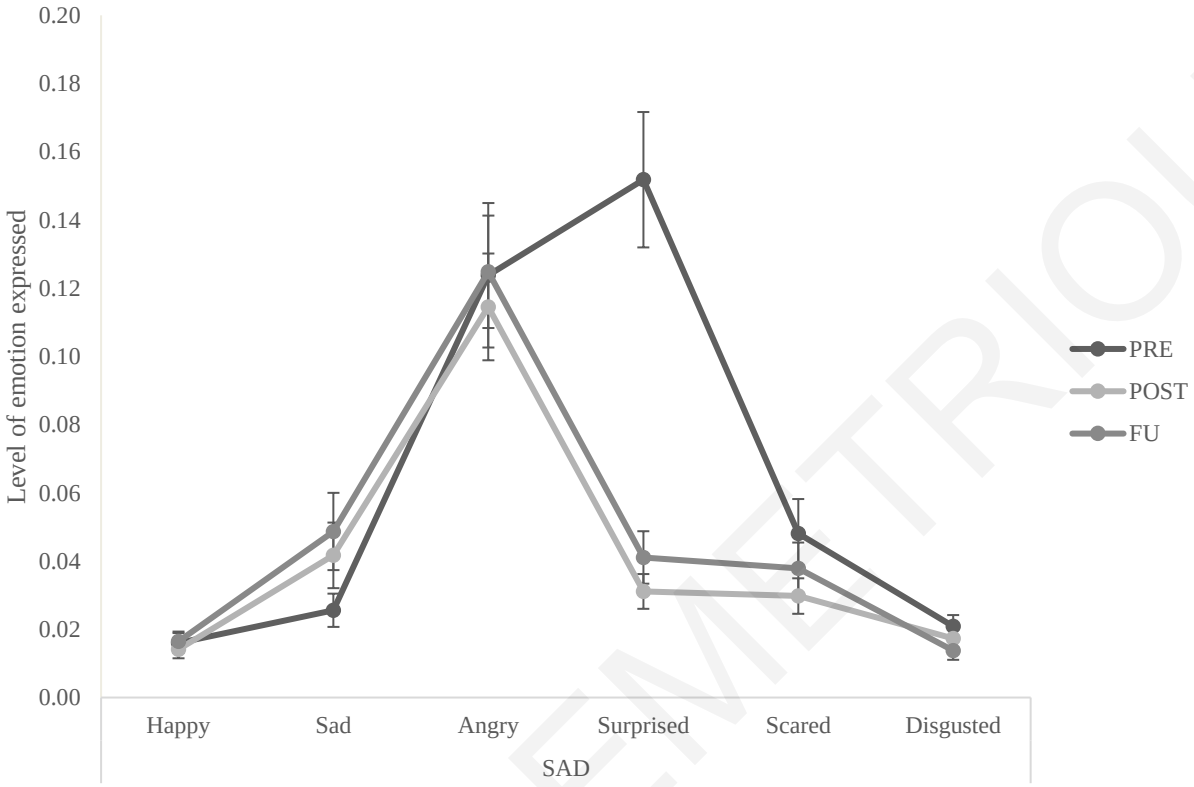

Figure 3 3: Emotional expressions by assessment time with the level of emotion expressed for sad scenes.

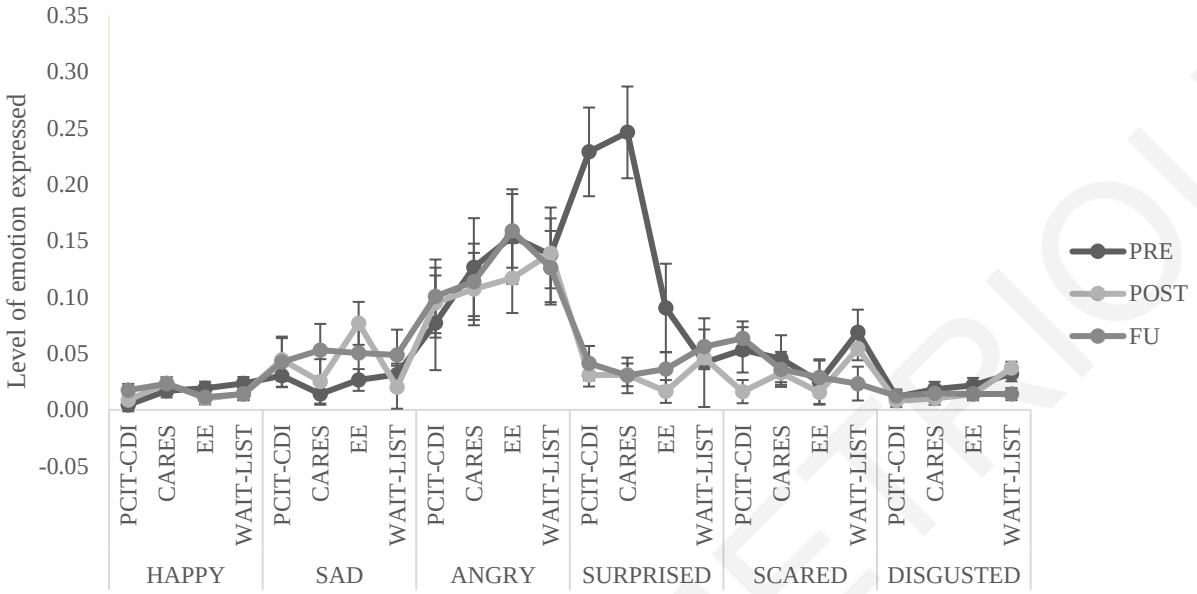

Figure 3 4: Emotional expressions by assessment time by intervention groups with the level of emotion expressed for sad scenes.

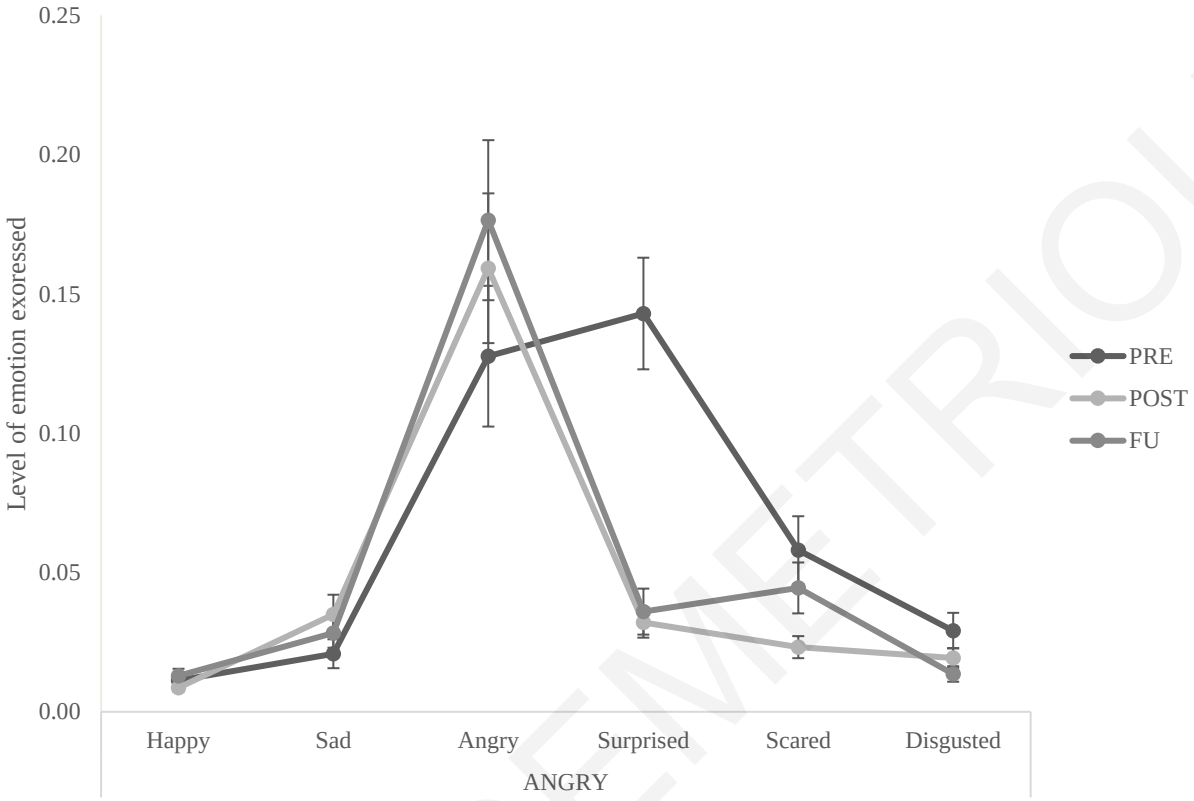

Figure 3 5: Emotional expressions by assessment time with the level of emotion expressed for angry scenes.

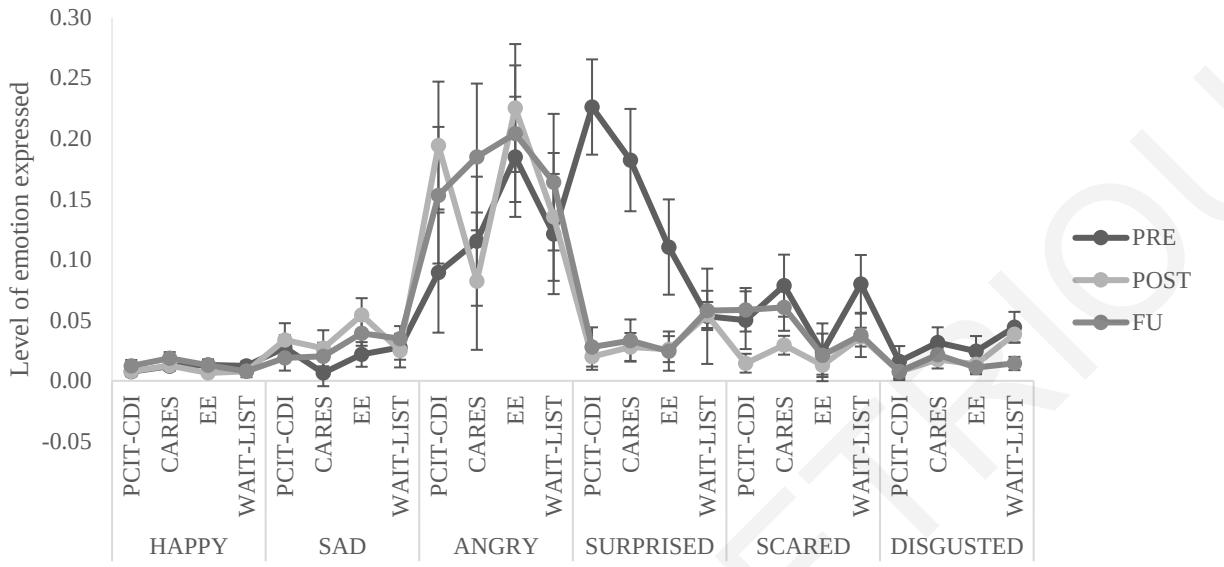

Figure 3 6: Emotional expressions by assessment time by intervention groups with the level of emotion expressed for angry scenes.

Figure 3 7: Emotional expressions by assessment time with the level of emotion expressed for happy scenes.

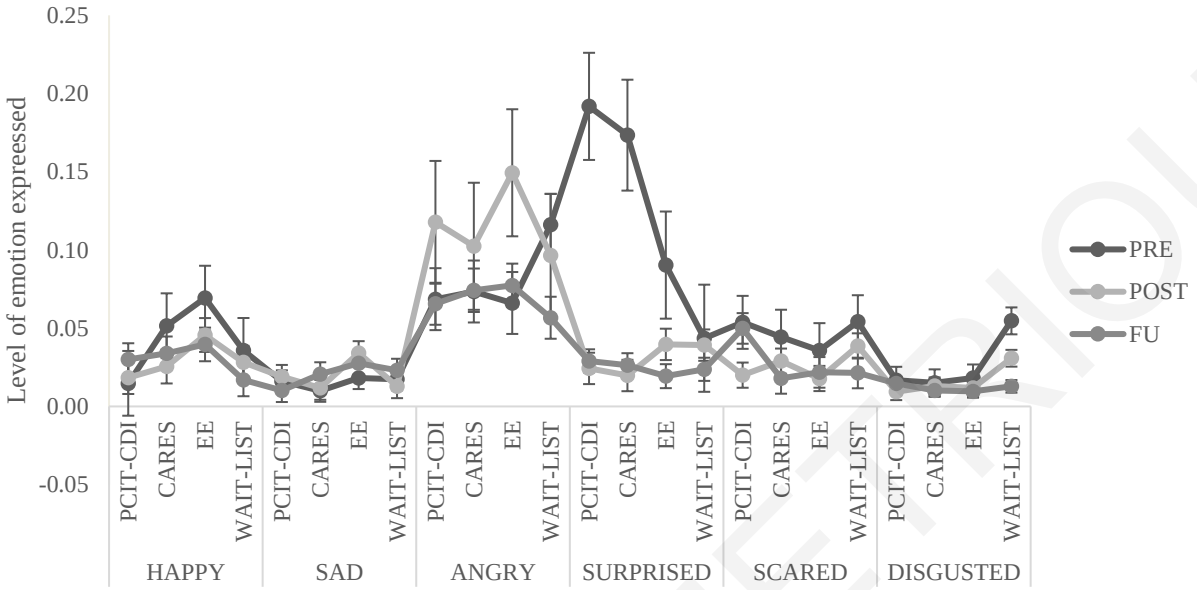

Figure 3 8: Emotional expressions by assessment time by intervention groups with the level of emotion expressed for happy scenes.

GENERAL DISCUSSION

In summary, the current study aimed to investigate the unique associations of the three psychopathic dimensions early in development with a number of theoretically supported external constructs of interest such as conduct problems, empathic concern deficiencies and family and peer relations. Specifically, the study provided further support for the importance of all the three psychopathic dimensions, Grandiose-Deceitful, Callous-Unemotional, and Impulsivity/Need for Stimulation, early in development (Colins et al., 2014a; 2016a). The need to better understand the developmental precursors of severe and stable behavioral problems indicated by children high on psychopathic traits, lead to the investigation of the unique contribution of each psychopathic personality dimension (Colins, Andershed, Salekin, & Fanti, 2018). While the three dimensions of psychopathic personality share similar qualities, findings from the current study indicated that they are associated with different levels of proneness to and severity of antisocial, delinquent and aggressive behavior (Marsee et al., 2005; Marsee & Frick, 2007). The present study replicated and substantially extended prior work on the different relations between the grandiosity and conduct problems, and the unique contribution of impulsivity to the increased difficulties experienced in hyperactivity and impulsivity parameters. The role of CU dimension remained significant in relation to most behavioral problems, with greater associations with empathic concern and social relations (Frick & White, 2008).

Furthermore, by extending previous research on emotional processing the current study indicated support for an impaired mechanism of attention to eye region in all facial emotional expressions (Dadds et al., 2006; 2008), using eye-tracker methodology, among children high on CU traits early in development. By supporting the pervasive nature of the attention difficulties in the processing of facial emotional expressions (e.g., Lawrence et al., 2016), the current study provided further support for theories proposing that the attention to the eyes is a potential mechanism by which psychopathic traits and antisocial behavior develop (Dadds et al., 2006). The importance of these deficiencies early in development also highlight the importance of prevention and intervention programs that focus on the development of adequate emotional and cognitive skills that lead to the enhancement of emotional processing strategies (Dawel, O'Keayrney, McKone, & Palermo, 2012). In

addition, this was the first study applying eye-tracking methodology in the investigation of the role of gender and the age of the individual illustrated in experimental stimuli. Girls were more likely to show shorter fixations on the eyes area of negative emotions irrespective of their level of CU, a finding that contradicts findings from the emotional processing research that supports a small advantage of girls in emotion identification. In addition, a preference of peers' eyes may indicate the level of familiarity with these stimuli, and support the importance of intervention in social relationships and the generalizability of the advances gained. Based on no prior evidence why this phenomenon occurred, further research is needed to explore the differences in this mechanism underlying gender differences and age of the individual illustrated.

In addition, with reference to the emotional expressivity of children high on CU traits, the current study extended previous research on intervention effectiveness in emotional processing of children high on CU traits using facial emotional expression measurements (Raine et al., 2001). The increase indicated by PCIT-CDI-CU group in sadness and anger expressions in scenes of fear come in support of the importance of attachment context and social learning in the enhancement of children's emotional development (Kimonis & Armstrong, 2012). The enhanced emotional expression of sadness indicated by children high in CU traits, further support the importance of early intervention in preventing behavioral problems and antisocial behavior Adolphs et al., 2005; van Baardeqijk et al., 2009; Kyrianides, 2014). The same trends also indicated by CARES and EE groups, provide support for the importance of attention allocation to salient emotional cues shown by others facial emotional expressions that enable the identification of others emotional expressions (Fleming et al., 2017), although highlight their adjunctive nature to evidence-based intervention protocols. In our knowledge, this was the first study that tried to combine facial emotional expressions measures of empathic responding with intervention applied in mothers-child interactions. By highlighting the importance of a more comprehensive intervention process that combines both the importance of the parent-child quality attachment and the enhancement of attention allocation to facial emotional cues, this study contribute to the implementation of more effective intervention programs for children early in development (Gurwitch, Pearl-Messer, & Funderburk, 2017). We hope the current study's findings will further advance the research on the ongoing development of new prevention

and intervention programs for children high on CU traits early in development.

Emerging research findings regarding the specific emotional processing deficiencies indicated by individuals high on CU traits and the promising intervention programs that aim to manipulate these difficulties in emotion recognition that could be used for further advances of the intervention literature. The support provided for the importance of parent-child healthy interactions and warmth relation and the need for training targeting cognitive skills were supported as beneficial for children, especially with the active involvement of mothers. Considering the specific attentional and affective deficiencies in children high on CU traits and tailoring prevention and intervention programs around their specific needs and difficulties the current study aimed to provide further support for improvements particularly early in development.

Moreover, all the studies, taken together as a whole have demonstrated the importance of co-investigating the relations of all psychopathic dimensions early in development, as they can provide us with more information regarding the profiling of children with these traits. Behavioral problems were evident among children scoring high on Grandiose and Impulsivity dimensions, while Callous-Unemotional dimensions indicated significant relation with children inability to identify and respond to others emotional expressions. Furthermore, the support provided for the "Attention-to-the-eyes" mechanism proposed by Dadds and colleagues suggest a pervasive deficiency in emotional strategies employed by children high on CU dimension, and lead the way for more effective intervention programs. Consequently, a parent-child warm and affective interaction combined by a psychoeducational training aiming to enable the development of children emotional processing strategies have proven effective in enhancing their emotional experience and expressivity.

The current project provides a clear understanding of the clinical utilization of each study's findings, and how they can enhance the assessment and the intervention strategies employed in the prevention of severe and stable behavioral problems from children high on psychopathic traits early in development. Firstly, regarding the scope of the clinical assessment in case of behavioral and emotional problems in childhood, findings from *Study*

1 would indicate the need to go beyond the conceptualization of Conduct Disorder, as provided by the 5th edition of the Diagnostic and Statistical Manual of Mental Disorders, American Psychiatric Association (APA, 2013), to include assessment of all psychopathic dimensions, especially early in development. This is important to ensure the correct classification of children indicating psychopathic personality traits early in development, which will enable the allocation of the most effective intervention program. Furthermore, findings from *Study 2* provide further support for a mechanism underlying the severe and stable antisocial behavior indicated by children high on CU traits later in development. By providing support for a reduced spontaneous focus on the eyes region of others indicated by children, the current study leads the way for more effective psychoeducation training programs that will aim to help children develop all those emotional processing skills that will enable the accurate identification of others emotional state. Finally, findings from *Study 3* raise the prospect of including parents' warmth and affection to enhance secure attachment, conscience and moral development. Undoubtedly, the suggestions provided by the current project, are still premature as the methodologies used in this project still need to undergo further investigation, and future studies need to replicate current findings. In the long term, however, the clinical benefits from using this "Attention-to-the-eyes" as the underlying mechanism leading children high on Callous-Unemotional traits to severe and stable behavioral problems, should be evident through the development of more effective prevention and intervention programs. The whole discussion regarding the importance of parents-children warm and sensitive interaction comes in support of a long research history on the importance of this relation in children's social and emotional development.