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The Moderating Role of Anxiety in the Associations of Callous-Unemotional Traits with Self-Report and Laboratory Measures of Affective and Cognitive Empathy

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Abstract In a sample of detained male adolescents (n = 107; Mean age = 15.50; SD = 1.30), we tested whether anxiety moderated the association of CU traits with self-report and computerized measures of affective (emotional reactivity) and cognitive (affective facial recognition and Theory of Mind [ToM]) empathy. Hierarchical regression analyses revealed that CU traits were negatively associated with self-reports of affective empathy and this association was not moderated by level of anxiety. Significant interactions revealed that CU traits were negatively associated with cognitive empathy (self-report) only at high levels of anxiety, whereas CU traits were positively associated with cognitive empathy on the ToM task only at low levels of anxiety. CU traits were also associated with greater fear recognition accuracy at low levels of anxiety. Implications for understanding and treating different variants of CU traits (i.e., primary and secondary) are discussed.

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Callous-unemotional (CU) traits (e.g., lack of empathy/remorse, shallow affect, callousness) constitute a core component of psychopathy (Cleckley 1976; Hart and Hare 1996) and are frequently studied in samples of children and adolescents as a downward extension of psychopathy (Frick 2009). Elevated CU traits demarcate a unique subgroup of antisocial youth whose behavior tends to be more severe and violent in nature and who differ from other antisocial youth on a large number of genetic, neurocognitive, emotional, personality, and social characteristics (see Frick et al. 2014a for a review). Given the extensive empirical evidence to support the utility of CU traits in designating an important subgroup of antisocial youth, the most recent revision of the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association 2013) has integrated this construct into the diagnostic criteria for conduct disorder. Specifically, the specifier 'with Limited Prosocial Emotions' designates youth with serious conduct problems who also show elevated rates of CU traits. In light of this recent change, further research is needed to understand the potential causes of CU traits, the characteristics of individuals with CU traits, and the implications of these causes and characteristics for guiding optimal assessment and treatment practices.

One especially important focus for research is to determine the potential role of anxiety in moderating the association between CU traits and important emotional and cognitive variables. This possibility is supported by an early and influential theoretical model proposed by Karpman (1941, 1948), who suggested that there are two distinct psychopathy subtypes differentiated by level of anxiety. Specifically, he theorized that a "primary psychopathy" variant is characterized by CU

traits and low to normal levels of anxiety and reflects an innate or heritable deficit in the person's ability to experience emotions. In contrast, "secondary psychopathy" is characterized by CU traits accompanied by elevated anxiety and reflects a traumatic reaction to serious environmental stressors, such as parental rejection or abuse. A substantial amount of empirical research supports many of the core assumptions of this theoretical model (Skeem et al. 2003). Most importantly, research in adult prison samples confirms that anxiety moderates the association between psychopathy and a number of theoretically important variables, as would be predicted by this theoretical model. For example, psychopathic traits are only related to deficits in laboratory tasks measuring passive avoidance (Arnett et al. 1997; Newman and Schmitt 1998) and responses to emotional stimuli (Hiatt et al. 2002; Newman et al. 1997; Sutton et al. 2002) at low levels of anxiety. In contrast, psychopathic traits are more highly related to child abuse and trauma at high levels of anxiety (Blagov et al. 2011; Poythress et al. 2010). Similar findings have emerged in adolescent samples using either measures of psychopathy more globally or measures specifically assessing CU traits. For example, CU traits are more strongly related to deficits in the processing of emotional stimuli at lower levels of anxiety (Kimonis et al. 2012). In contrast, CU traits are more strongly associated with child abuse and trauma (Kahn et al. 2013; Kimonis et al. 2011; Sharf et al. 2014; Tatar et al. 2012; Vaughn et al. 2009 and problems with emotional regulation (Kahn et al. 2013; Kimonis et al. 2012, 2011; Lee et al. 2010; Vaughn et al. 2009) at elevated levels of anxiety.

Thus, research on correlates to CU traits needs to consider the role of anxiety in potentially designating different pathways leading to CU traits in both adults and adolescents. Specifically, these differing characteristics are consistent with theories suggesting that CU traits with low levels of anxiety (i.e., primary variant) are a result of a temperament that a) is characterized by hypo-responsiveness to cues for punishment and the distress of others and b) can interfere with the development of empathy, guilt, and other aspects of conscience (Frick et al. 2014b). However, existing theories are less clear in specifying what might lead to CU traits in those with elevated levels of anxiety (i.e., secondary variant) and other problems regulating emotions. One possible explanation is that the two groups differ in terms of how strongly they may experience different components of empathy. Broadly speaking, empathy is composed of several complex processes that interact to produce an empathic response (Zaki et al. 2008). More specifically, it is widely accepted that empathy includes both affective and cognitive components that differ in their developmental trajectories (e.g., Davis 1980; Decety and Jackson 2004). Affective empathy is defined as arousal to or resonation and congruence with another's emotional state (Blair 2005; Singer and Lamm 2009) and cognitive empathy is defined as the ability to take the perspective of another in order to understand what he or she may be feeling (Davis 1980; Decety 2010). Additionally, the cognitive component of empathy is closely related to the construct of Theory of Mind (ToM; Blair 2005; Decety 2010) that is defined as the ability to differentiate between one's self and other's mental states, including intentions, beliefs, emotions, and knowledge (Premack and Woodruff 1978).

While cognitive and affective components are *both* involved in a person's empathetic concern for others, their developmental trajectories differ in course and complexity. In terms of developmental sequence, there is strong evidence that affective components of empathy begin to develop prior to the cognitive components (Decety 2010). For instance, signs of affective empathy can be seen at very early ages, with infants as young as 12 months of age providing comfort to others in distress (Warneken and Tomasello 2009) or emotional contagion as they become distressed and cry when exposed to other crying newborns (Dondi et al. 1999). Importantly, this developmental sequence shows that the ability to perceive and respond appropriately to other's affective expression occurs early in development, even prior to the development of a sense of self, which is necessary for the process of cognitive empathy. Unlike affective empathy, cognitive empathy can begin to be measured by the age of four, when children start to use perspective taking processes to understand that the way a person feels about an event depends upon that person's particular perception of that event (Decety 2010; Wellman et al. 2001). Although children have knowledge about mental states and can attribute them to others by the age of two (Bretherton et al. 1981), they have not yet acquired the ability to understand representational states in order to infer what others might think or believe until approximately four years of age (Perner 1991). Identification of facial affect is one way in which mental states are attributed to others and past research has found that facial affect recognition is present by pre-school (Reichenbach and Masters 1983) with the level of accuracy improving into adolescence (Kolb et al. 1992; Tonks et al. 2007).

Importantly, there is evidence that CU traits may show somewhat different associations with these two components of empathy. Past research has consistently linked CU traits to affective empathy deficits in samples of children and adolescents (Chabrol et al. 2011; Dadds et al. 2009, 2012; Pardini et al. 2003), whether it is assessed by self-report of empathic concern (e.g., Pardini and Byrd 2012) or through laboratory tasks assessing emotional arousal to the distress of others (e.g., Cheng et al. 2012). In contrast, research testing the link between CU traits and measures of cognitive empathy has reported mixed findings. For instance, some studies have shown that youth with high levels of CU traits show deficits in cognitive empathy when measured by affective facial recognition tasks (Dadds et al. 2009), self-reports of perspective-taking (Chabrol et al. 2011; Pardini et al. 2003), or performance

on ToM tasks (Sharp and Vanwoerden 2014). However, other studies employing emotion recognition (Dadds et al. 2012; Schwenck et al. 2012) or cognitive perspective-taking tasks (Anastassiou-Hadjicharalambous and Warden 2008; Cheng et al. 2012; Jones et al. 2010) have reported no significant associations with CU traits.

To date, however, no study has considered whether these mixed results are due to the potential moderating role of anxiety. Specifically, it is possible that CU traits are negatively related to affective empathy among individuals with low levels of anxiety, due to a failure to become aroused to the cues of distress in others (Frick et al. 2014b). In contrast, it is possible that CU traits are negatively related to cognitive empathy among individuals with high levels of anxiety due to the experience of trauma. That is, abused children often develop a bias in cognitive processing in which they become hypervigilent towards threatening stimuli at the expense of being able to adequately detect other important aspects of the environment, such as accurately identifying non-threatening emotional facial expressions in others (Camras et al. 1983; Camras et al. 1990; During and McMahon 1991; Pears and Fisher 2005). In addition, abuse and trauma can lead to problems in emotion regulation, and heightened arousal in emotionally charged situations, that can interfere with the development of perspective-taking skills (Pollak 2008; Shields and Cicchetti 1998).

In the current study, we tested these predictions that anxiety would moderate the association between CU traits and different types of empathy, which would be consistent with theories on the differential causes of primary and secondary psychopathy/CU traits. Specifically, we predicted that CU traits would be more highly negatively associated with measures of affective empathy among individuals with low levels of anxiety than among those with high levels of anxiety but would be more strongly negatively associated with measures of cognitive empathy among individuals with high levels of anxiety than among those with low levels of anxiety. Importantly, we employed laboratory and self-report measures of both types of empathy, to test these predictions across different methods of assessment. Further, we tested these predictions in a sample of detained adolescents in which there are likely to be a larger number of individuals with elevated CU traits than would be found in non-referred community samples.

Methods

Participants

One hundred twelve male participants, ages 12 to 20, were recruited from three secure detention facilities in the Southeastern United States. Youth in all facilities had been arrested and judged to be in need of secure placement prior to being adjudicated for the offense. Participants were selected for inclusion based on parental consent/youth assent, availability to fill out questionnaires, and availability of their juvenile justice charts for review. A total of $n = 5$ participants were excluded from the analysis due to low IQ scores (IQ < 65). This led to a final sample of $n = 107$ with a mean age of 15.50 ($SD = 1.30$) years. The primary ethnic category was African American (79 %) with the remaining sample identifying as Caucasian (14 %), Hispanic (5 %), and Other (2 %). A measure of family income or socioeconomic status was not collected from these youth. Sample size was determined using G*power (Version 3.1; Faul et al. 2009). We assumed a moderate effect size ($f^2 = 0.15$), based on effect sizes produced in previous research examining interactions between CU traits and anxiety (e.g., Kimonis et al. 2012). This effect size indicated that a sample size of 107 was required to have 90 % power to detect an interaction effect with an alpha level of 0.05.

Measures

Inventory of Callous Unemotional Traits (ICU; Frick 2004) The ICU is a 24 item self-report scale designed to assess callous unemotional traits. Derived from the Callous-Unemotional subscale of the Antisocial Process Screening Device (APSD; Frick and Hare 2001), the ICU was developed to provide more items assessing CU traits to overcome problems with low internal consistency of the items on the APSD (Poythress et al. 2006). The current study utilized the total ICU score by summing all 24 items. Items are rated on a 4-point scale ranging from 0 (*not at all true*) to 3 (*definitely true*). The use of the total score has been supported in factor analyses conducted with both detained (Kimonis et al. 2008b) and community (Essau et al. 2006; Fanti et al. 2009) samples of adolescents. Further, the ICU correlates positively with antisocial behavior and is negatively associated with prosocial behavior (Essau et al. 2006; Fanti et al. 2009; Kimonis et al. 2008b; Roose et al. 2010). The internal consistency in the current sample for the ICU total score was $\alpha = 0.72$.

The Revised Child Anxiety and Depression Scales (RCADS; Chorpita et al. 2000) The current study used the total anxiety score from the RCADS. It consists of 37 items assessing symptoms of each anxiety disorder (except PTSD and Specific Phobias) based on DSM-IV criteria (American Psychiatric Association 2000) and was designed to assess trait anxiety, not anxiety during the testing. This methodology was used because the theoretical model for secondary psychopathy specifies the importance of anxiety that persists across time and situation. Indeed, recent research indicates the RCADS captures stable or persistent symptoms of anxiety across adolescence (Mathyssek et al. 2013). Items are rated on a 4-point scale (i.e., *Never*, *Sometimes*, *Often*, or *Always*) corresponding

to how frequently the symptom was experienced. This total anxiety score has demonstrated good internal consistency ($\alpha = 0.95$) in previous studies of children and adolescents (Daughters et al. 2009). The RCADS anxiety score has demonstrated good cross-informant, convergent, and predictive validity among both community and clinic-referred samples (Chorpita et al. 2005). For instance, the RCADS anxiety score is significantly positively correlated with other self-report measures of trait anxiety such as the Revised Children's Manifest Anxiety Scale (Chorpita et al. 2005). The internal consistency in the current sample for the RCADS anxiety score was $\alpha = 0.95$.

Basic Empathy Scale (BES; Jolliffe and Farrington 2006) The BES is a 20-item self-report inventory measuring cognitive and affective empathy. The cognitive empathy subscale is composed of nine items (i.e., "When someone is feeling down I can usually understand how they feel."), whereas the affective empathy subscale is composed of 11 items (i.e., "After being with a friend who is sad about something, I usually feel sad."). All items are rated on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). In a community sample of adolescents, confirmatory factor analysis of the BES supported a two factor solution with item loadings ranging from 0.43 to 0.62 for the cognitive items and 0.41 and 0.71 for the affective items (Jolliffe and Farrington 2006). There is a moderate correlation ($r = 0.41$) between the cognitive and affective scales in non-referred samples (Jolliffe and Farrington 2006). However, in support of their distinctiveness, Jolliffe and Farrington (2006) found that scores on the cognitive empathy scale demonstrated significant associations with a measure of extraversion (positive) and neuroticism (negative), while scores on the affective empathy scale were unrelated to extraversion and positively associated with neuroticism. Other research using the BES has found that scores on affective empathy are positively related to dimensions of impulsivity and anxiety, while scores on cognitive empathy are not significantly related to these constructs (Jolliffe and Farrington 2011; Pechorro et al. 2015). In past research, the BES demonstrated good internal consistency ($\alpha = 0.76$ and $\alpha = 0.80$) in adolescent populations for the cognitive and affective scales, respectively (Sebastian et al. 2012). The internal consistency in the current sample was $\alpha = 0.78$ and $\alpha = 0.60$ for the affective empathy and cognitive empathy subscales, respectively.

Emotional Pictures Dot-Probe Task (Kimonis et al. 2006; Kimonis et al. 2008a) The emotional pictures dot-probe task is a spatially oriented attention task designed to measure attentional bias towards emotional cues and serves as an index of emotional reactivity (Schippell et al. 2003). Thus, this task was used as a laboratory measure of affective empathy (i.e., emotional reactivity to others' distress). The task is computer administered and, for the most part, uses slides taken from the International Affective Picture System (IAPS). The slides used for the task were selected to represent distress in others (e.g., crying child), positive emotional content (e.g., puppies), and neutral emotional content (e.g., a fork). In order to have enough slides for the three categories of neutral, distress, and positive, additional neutral ($n = 42$) and distress ($n = 19$) slides matching the IAPS slide content were added. For example, additional slides of crying children were added to the existing IAPS slides of crying children. Scores from this task using this expanded picture list have been correlated with CU traits (which includes components of empathy) in past samples of children (Kimonis et al. 2006) and adolescents (Kimonis et al. 2008a).

The task contains a practice trial of 16 picture pairs, which is followed by four experiment blocks with each block containing 24 picture pairs. Every picture pair presentation contains three components that appear sequentially. First, a 500 millisecond fixation cross appears in the center of the screen. Next, a 250-millisecond presentation of two picture stimuli that are centered appear directly above and below the fixation cross. Finally, an asterisk (i.e., dot-probe) appears at either the location of the top or bottom picture previously presented. The participant is asked to select a key on the keyboard corresponding to the location of the dot-probe as quickly as possible. The picture pairs include three combinations of emotional content: neutral-neutral, distress-neutral, and positive-neutral and the combinations are counterbalanced across all trials.

The time between the onset of the dot-probe and when the participant presses a key is recorded in milliseconds and is used to calculate an attentional facilitation index for each different category of emotional valence (MacLeod and Mathews 1988). For example, the facilitation index for distress = ½ [(neutral only/probe top – distress up/probe top) + (neutral only/probe bottom – distress down/probe bottom)]. The facilitation index controls for location effects (a participant's tendency to attend to either the top or bottom of a screen) by adding latency for responses to top and bottom picture locations and taking an average. The dot-probe task assumes the participant's response will be faster, if their attention is oriented towards spatial location of the probe. Thus, higher scores indicate greater attentional orienting to the emotional stimuli than to the neutral stimuli. For the purposes of the current study, only the facilitation index to distress pictures was used as the measure of affective empathy. Consistent with previous studies utilizing this paradigm (e.g., Kimonis et al. 2012), responses were recorded as incorrect and excluded if a response took longer than 5000 ms and those participants whose facilitation scores differed from the mean by more than three standard deviations were eliminated from analyses ($n = 8$). In the current study, the internal consistency of response times across the distress pictures was $\alpha = 0.90$.

NimStim Affective Facial Recognition Task (Tottenham et al. 2009) Affect recognition was measured using facial stimuli taken from the NimStim set of facial expressions (Tottenham et al. 2009). This set of facial stimuli contains color photographs of adults, both male and female varying in ethnic composition, and depicts frontal images of emotional expressions. The design of the current task followed the procedures used by the University of New South Wales Facial Emotion Task (FACES; Dadds et al. 2004). Specifically, facial expressions of happiness, sadness, anger, disgust, fear, or neutral expressions were displayed by six adult faces (total of 36 stimuli) varying in ethnic composition and gender. Facial stimuli were presented in a random order for two seconds each. After each individual facial stimulus, a screen appeared instructing the participant to select which emotion was portrayed from a list of all six emotions. Participants were given a practice run of six trials (one of each emotion) prior to beginning the experiment.

Validation of the entire set of facial stimuli was conducted with adult undergraduate and community samples (Tottenham et al. 2009). Validity was measured by examining the concordance between participants' labels or responses and the facial expression intended to be presented. The overall concordance was high (mean kappa = 0.79; Tottenham et al. 2009). Reliability was tested by having participants label the same facial expressions (presented randomly each time) on two separate trials. The proportion of agreement across the two trials for participants was adequate (mean reliability score of 0.84, $SD = 0.08$; Tottenham et al. 2009). In the current sample, accuracy for correctly identifying one facial stimulus depicting sadness was particularly low (9 %) and was removed from the sad accuracy total as well as the facial accuracy total score. In addition, accuracy scores for the total and six individual facial expressions were eliminated from analyses if the score differed from the mean by more than three standard deviations. This resulted in the following number of participant scores being excluded from the current analysis: happy ($n = 4$), angry ($n = 2$), fearful ($n = 1$), disgust ($n = 3$), sad ($n = 5$), neutral ($n = 3$), and total accuracy ($n = 5$).

Affective and Cognitive Theory of Mind Task (Hynes et al. 2006) This task measures the participant's ability to make inferences about another's mental state. Participants are provided with written scenarios or stories that are designed to assess both cognitive and affective ToM. Additional written scenarios formed a 'physical' condition that serve as a control. Each condition contains 14 scenarios and each scenario is followed by a three option multiple-choice question. All scenarios are presented visually on the computer for the participant to read at their own pace; scenarios do not differ in word length (Hynes et al. 2006).

The scenarios consist of everyday situations. In the cognitive condition, participants are asked to make a cognitive attribution to a character (e.g., "Why did the burglar give himself up?") and in the affective conditions, participants were asked to make an emotional attribution to a character (e.g., "How does Ruth feel?"). The physical scenarios ask the participant about physical details in the story (e.g., "Why did the alarm sound?"). The cognitive and physical scenarios in this task were originally taken from the Strange Stories Task (Happé 1994) which has shown to measure ToM ability and is sensitive in detecting ToM deficits among individuals who may pass more simple measures of ToM. The affective scenarios were developed and validated by Hynes et al. (2006). To minimize the amount of carry-over effects, scenarios were grouped into two runs containing seven questions from each condition type (21 scenarios per run), and presented in the following order for each run: physical control scenarios (7), cognitive scenarios (7), and emotional scenarios (7). In this sample, accuracy decreased from the first to second block and a mixed MANCOVA (controlling for age and IQ) using the error rate from the two runs as a within group independent variable revealed a trend for a deterioration in performance from the first block to the second block of this task, multivariate $F(3, 91) = 2.60$, $p = 0.058$, possibly indicating effects of fatigue or boredom. Therefore, only data from the first run were included in analyses. Participants whose scores differed from the mean by more than three standard deviations were eliminated (cognitive ToM, $n = 1$; emotional ToM, $n = 2$).

Procedures

Institutional Review Board approval for the study procedures was obtained prior to the onset of data collection. Parent contact information for all youth currently residing at the detention facilities was provided to the researchers. In order to obtain parental consent, a telephone informed consent procedure was conducted with audiotape serving as the record of consent and hard copies of all consent forms were mailed to parents. Youth assent took place in person either individually or within small groups at the detention facility. Of those youth whose parents were contacted, 86 % gave consent for their child to participate in the study. Of youth approached after parental consent, 94 % assented to participate in the current study. Data collection took place in two sessions and participants received snacks in appreciation for participating after each portion of the study. Youth were reminded that the information they provided would remain confidential, except when specified by the consent process (i.e., evidence of abuse, and intention to harm others or self) and were told that their participation would have no effect on their legal status.

Data Analytic Plan

In order to reduce the influence of outliers in the independent variables (i.e., CU traits and anxiety), a

winsorization scheme was used to modify any outlying data points (defined as 2 SD above and below the mean) by changing their values to the next most extreme, non-outlying value in the distribution. This procedure maintains a values' position in the distribution but ensures that any mean differences observed are not driven by a few scores in the tail of the distribution (Tabachnick and Fidell 2013). All hypotheses were tested using CU traits and anxiety as winsorized continuous variables in hierarchical regressions and testing for interaction effects between CU traits and anxiety on all measures of affective (BES self-report affective empathy and Emotional Pictures Dot-Probe Task) and cognitive (BES self-report cognitive empathy, NimStim Affective Facial Recognition Task, Affective and Cognitive ToM tasks) empathy. Also, IQ was included in all analyses to ensure that associations with facial recognition accuracy and ToM were independent of general intelligence. IQ, measured by the Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler 1999), and sample mean-centered variables for CU traits and anxiety were entered in the first step of the multiple regression analyses and the multiplicative interaction term composed from centered predictor variables was entered in a second step. The amount of incremental variance accounted for by the addition of the interaction term was tested for significance. Any significant interaction was explored using computational tools recommended by Preacher et al. (2006) in order to test the significance of the simple slopes showing the associations of the dependent variables and CU traits at both high (1 SD above the mean) and low (1 SD below the mean) values of the moderator (i.e., anxiety; Preacher et al. 2006).

Results

Preliminary Analyses

Descriptive statistics and zero-order correlations among study variables are provided in Table 1. First, as evident from the table, CU traits and anxiety were not significantly correlated with age or ethnicity. Further, the self-report of affective empathy and laboratory measure of emotional facilitation to distress (emotional pictures dot-probe task) were not significantly correlated with each other ($r = 0.10$; $p = 0.35$), suggesting that they were not measuring a similar construct. However, the self-report of cognitive empathy was significantly correlated with affect recognition accuracy ($r = 0.36$, $p < 0.001$) but not with performance on the ToM task ($r = 0.17$ and 0.18, $p = 0.08$ for affective ToM and cognitive ToM, respectively). The only significant zero-order correlations with CU traits were with self-report of affective ($r = -0.34$, $p < 0.001$) and cognitive ($r = -0.29$, $p = .002$) empathy. IQ was significantly associated with both self-report and laboratory measures of cognitive empathy and ToM, but was unrelated to CU traits, anxiety, or measures of affective empathy. Mean scores on the ICU and BES in the current sample were similar to mean scores reported in other samples of detained youth (Feilhauer et al. 2012; Kimonis et al. 2008b; Pechorro et al. 2015). Mean scores on the RCADS were somewhat higher (27.04 vs. 22.09) than those obtained in clinical samples of adolescents in a similar age range (Chorpita et al. 2005).

Tests of Main Study Hypotheses

The results of hierarchical regression analyses predicting the affective empathy variables are reported in the top portion of Table 2. For self-report affective empathy, there were main effects of both CU traits, $b^* = -0.30$, $p = 0.002$, $b = -0.27$, 95 % CI [−0.430, −0.110] and anxiety, $b^* = 0.28$, $p = 0.003$, $b = 0.12$, 95 % CI [0.042, 0.190], explaining approximately 8 and 9 % of the variance respectively. However, there were no significant main effects for the facilitation towards distress pictures from the emotional pictures dot-probe task. Also, for both the self-report and laboratory measure of affective empathy, there were no significant interactions between CU traits and anxiety.

In the bottom half of Table 2, the results of the hierarchical regressions testing the interactions between CU traits and anxiety on cognitive empathy measures are provided. For self-report cognitive empathy, there was a significant main effect of CU traits, $b^* = -0.25$, $p = 0.006$, $b = -0.14$, 95 % CI [−0.240, −0.042] that was modified by a significant interaction between CU traits and anxiety, $b^* = -0.29$, $p = 0.002$, $b = -0.01$, 95 % CI [−0.014, −0.003], that explained an additional 8 % of the variance. As reported in Fig. 1, CU traits and self-reported cognitive empathy were uncorrelated at lower levels of anxiety, $b^* = 0.01$, $p = 0.91$, $b = 0.01$, 95 % CI [−0.130, 0.140] but were negatively correlated at higher levels of anxiety, $b^* = -0.52$, $p < 0.001$, $b = -0.29$, 95 % CI [−0.413, −0.160]. Another interaction emerged for predicting cognitive ToM, $b^* = -0.20$, $p = 0.03$, $b = -0.00$, 95 % CI [−0.003, −0.000], explaining an additional 4 % of the variance. As indicated in Fig. 2, CU traits and cognitive ToM were non-significantly correlated at higher levels of anxiety, $b^* = -0.16$, $p = 0.10$, $b = -0.02$, 95 % CI [−0.060, 0.013] but were significantly positively correlated at lower levels of anxiety, $b^* = 0.25$, $p = 0.05$, $b = 0.03$, 95 % CI [0.000, 0.070].

Table 1 Descriptive statistics and zero-order correlations of main study variables

	1	2	3	4	5	6	7	8	9	10	11	Mean / %	SD / N
1. Age												15.50	1.30
2. Ethnicity	0.03											79 %	85
3. WASI IQ	−0.10	−0.28**										82.19	8.33
4. Total Days Institution	0.05	0.15	−0.12									13.94	10.65
5. ICU Total	−0.05	0.07	−0.03	0.22*								28.50	7.72
6. RCADS Anxiety Total	0.10	0.01	−0.08	−0.19†	−0.17†							27.04	16.70
7. BES Affective Empathy	0.05	−0.20*	−0.11	−0.10	−0.34***	0.34***						30.10	6.94
8. Dot-Probe Facilitation	0.15	0.03	−0.07	−0.09	−0.09	−0.16	0.10					−9.63	39.36
9. BES Cognitive Empathy	0.17†	−0.05	0.23*	−0.13	−0.29**	0.16	−0.01	−0.10				32.11	4.24
10. NimStim Facial Task	0.14	−0.16	0.28**	0.09	0.00	−0.10	−0.17	−0.27**	0.36***			28.52	4.58
11. Affective ToM Block	0.06	−0.12	0.20*	0.16	0.13	−0.22*	−0.31**	−0.09	0.17†	0.34***		6.18	1.08
12. Cognitive ToM Block	−0.01	−0.17	0.36***	0.14	0.06	−0.10	−0.15	0.05	0.18†	0.32***	0.39***	5.42	1.06

Ethnicity African American =1 and other =0, *WASI IQ* Wechsler Abbreviated Scale of Intelligence – Intelligence quotient, *ICU* Inventory of Callous Unemotional Traits, *RCADS* Revised Child Anxiety and Depression Scale, *BES* Basic Empathy Scale, *ToM* Theory of Mind

*** = $p \leq 0.001$, ** = $p \leq 0.01$, * = $p \leq 0.05$, † = $p \leq 0.08$

Post-Hoc Analyses

Contrary to predictions, there were no significant main effects for CU traits or interactions with anxiety in predicting accuracy in the affective facial recognition task. However, this composite score collapses across different types of emotional faces and it is possible that the deficit in facial recognition associated with CU traits is specific to certain emotions (Blair et al. 2001; Fairchild et al. 2009; Kimonis et al. 2006). Thus, exploratory analyses were conducted predicting accuracy for identifying the six facial emotions separately. Due to the large number of analyses and the post-hoc nature of these tests, these results need to be interpreted cautiously.

These analyses revealed a significant interaction between CU traits and anxiety for predicting fear recognition accuracy, $b^* = -0.20$, $p = 0.04$, $b = -0.00$, 95 % CI [−0.004, −0.000], explaining an additional 4 % of the variance. When this interaction was explored, CU traits and fear recognition accuracy were not significantly associated at higher levels of anxiety, $b^* = -0.05$, $p = 0.71$, $b = -0.01$, 95 % CI [−0.060, 0.041] but they were positively correlated at lower levels of anxiety, $b^* = 0.32$, $p = 0.02$, $b = 0.06$, 95 % CI [0.010, 0.120]. There was also a significant main effect of CU traits, $b^* = -0.20$, $p = 0.04$, $b = -0.04$, 95 % CI [−0.072, −0.001] and a trend for significance for an interaction between CU traits and anxiety, $b^* = -0.18$, $p = .07$, $b = -0.002$, 95 % CI [−0.004, 0.000] on disgust recognition accuracy with the interaction explaining an additional 3 % of the variance. When the form of this interaction was explored, the results indicated that CU traits and disgust recognition were not significantly correlated at low levels of anxiety, $b^* = -0.04$, $p = 0.79$, $b = -0.01$, 95 % CI [−0.060, 0.042] but they were negatively correlated at high levels of anxiety, $b^* = -0.37$ $p = 0.01$, $b = -0.07$, 95 % CI [−0.114, −0.020].

Discussion

The current study investigated whether the association between CU traits and empathy differed, depending on the type of empathy and depending on the level of anxiety accompanying the CU traits. The predictions were based on past work suggesting that there may be distinct variants of psychopathy/CU traits that differ on their level of anxiety and that differ on the causal processes leading to these traits (Kimonis et al. 2012; Skeem et al. 2003). The finding most consistent with predictions was that CU traits were negatively associated with self-report measures of cognitive empathy (Fig. 1) and with reduced accuracy in recognizing disgust in faces at high levels of anxiety, although the latter finding emerged in post hoc analyses only. There were also negative associations at high levels of anxiety for the ability to take another's perspective on a ToM task (Fig. 2) but this association did not reach statistical significance.

These findings could explain why past studies that did not consider the role of anxiety have reported mixed results on the association between CU traits and cognitive empathy (e.g., Dadds et al. 2009, 2012; Jones et al. 2010; Pardini et al. 2003). Also, these results are consistent with past findings linking secondary variants of CU traits (i.e., persons with CU traits and high levels of anxiety) with abuse and trauma and would be consistent with one explanation for how this trauma may lead to a callous-lack of empathy in some children

Table 2 Hierarchical regression analyses with callous unemotional traits and anxiety as predictors of affective and cognitive empathy

Affective Empathy Measures

	BES Affective Empathy			*Dot-Probe Facilitation*		
	*b**	*b* [95 % CI]	R^2	*b**	*b* [95 % CI]	R^2
WASI IQ	−0.09	−0.08 [−0.230, 0.070]		−0.09	−0.39 [−1.280, 0.491]	
ICU	**−0.30**	**−0.27** [−0.430, −0.110]		−0.12	−0.56 [−1.511, 0.384]	
Anxiety	**0.28**	**0.12** [0.042, 0.190]		−0.18†	−0.41 [−0.852, 0.030]	
			0.21			0.04
ICU X Anxiety	−0.09	−0.00 [−0.013, 0.004]		−0.14	−0.04 [−0.091, 0.013]	
			0.22			0.06

Cognitive Empathy Measures

	BES Cognitive Empathy			*NimStim Facial Task*			*Affective ToM*			*Cognitive ToM*		
	*b**	*b* [95 % CI]	R^2	*b**	*b* [95 % CI]	R^2	*b**	*b* [95 % CI]	R^2	*b**	*b* [95 % CI]	R^2
WASI IQ	**0.22**	**0.12** [0.030, 0.210]		**0.26**	**0.14** [0.040, 0.250]		0.18†	0.02 [−0.001, 0.050]		**0.34**	**0.04** [0.020, 0.070]	
ICU	**−0.25**	**−0.14** [−0.240, −0.042]		−0.00	−0.00 [−0.113, 0.110]		0.10	0.01 [−0.012, 0.040]		0.06	0.01 [−0.020, 0.033]	
Anxiety	0.13	0.03 [−0.012, 0.080]		−0.08	−0.02 [−0.071, 0.031]		−0.18†	−0.01 [−0.024, 0.000]		−0.06	−0.00 [−0.020, 0.010]	
			0.15			**0.08**			**0.09**			**0.13**
ICU X Anxiety	**−0.29**	**−0.01** [−0.014, −0.003]		−0.13	−0.00 [−0.010, 0.002]		−0.12	−0.00 [−0.002, 0.000]		−0.20	−0.00 [−0.003, −0.000]	
			0.23			**0.10**			**0.10**			**0.17**

Coefficients in bold significant at $p \leq 0.05$, † $p \leq 0.07$. All predictors were centered using sample means prior to entering them into regression analyses. *b** = standardized beta, *b* = unstandardized beta, *CI* = confidence interval, *WASI IQ* Wechsler Abbreviated Scale of Intelligence – Intelligence quotient, *ICU* Inventory of Callous Unemotional Traits, *BES* Basic Empathy Scale, *ToM* Theory of Mind

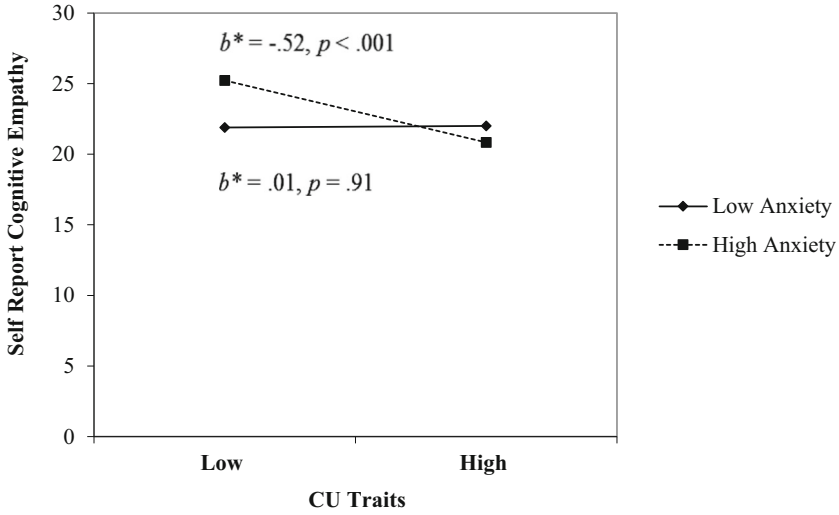

Fig. 1 Interaction between self-report cognitive empathy and callous-unemotional traits at high and low levels of anxiety using standardized estimates

(see Kimonis et al. 2012; Sharf et al. 2014). Specifically, abuse and trauma may lead to a bias in cognitive processing towards threatening or negative stimuli at the expense of being able to adequately detect other important aspects of the environment (Masten et al. 2008; Pollak 2008; Shackman et al. 2007; Shields and Cicchetti 1998), such as identifying non-threatening emotional facial expressions (Camras et al. 1983; Camras et al. 1990; During and McMahon 1991; Pears and Fisher 2005). Also, abuse and trauma can lead to problems in emotion regulation and chronically dysregulated emotional arousal can interfere with the development of perspective-taking skills (Pollak 2008; Shields and Cicchetti 1998). Importantly, further research needs to investigate key elements to this theoretical model, such as assessing abuse and trauma and directly testing if their influences on CU traits in those high on anxiety are mediated by deficits in cognitive empathy.

The significant interactions in predicting laboratory measures of cognitive empathy also indicated that CU traits were *positively* associated with perspective-taking on the ToM task and were *positively* associated with accuracy in recognizing fearful facial expressions at low levels of anxiety, although the latter finding needs to be interpreted cautiously due to the fact that it emerged in post-hoc analyses. Clearly, these findings support the hypothesis that CU traits may not always be related to deficits in emotional recognition and perspective-taking and, in fact, they may be related to *better* skills for those low on anxiety. This finding would be consistent with theories and past research suggesting that individuals with primary psychopathy have an enhanced ability to notice when others are vulnerable and this ability may facilitate their manipulative behavior or ability to use others for their own gain (Cleckley 1941; Salekin et al. 2010; Skeem et al. 2003). Nevertheless, because these associations at low levels of anxiety were not predicted, they need to be replicated in future studies.

Importantly, and inconsistent with our a priori hypotheses, there was no moderating influence of anxiety in the association between CU traits and affective empathy. This finding could explain why past research has relatively

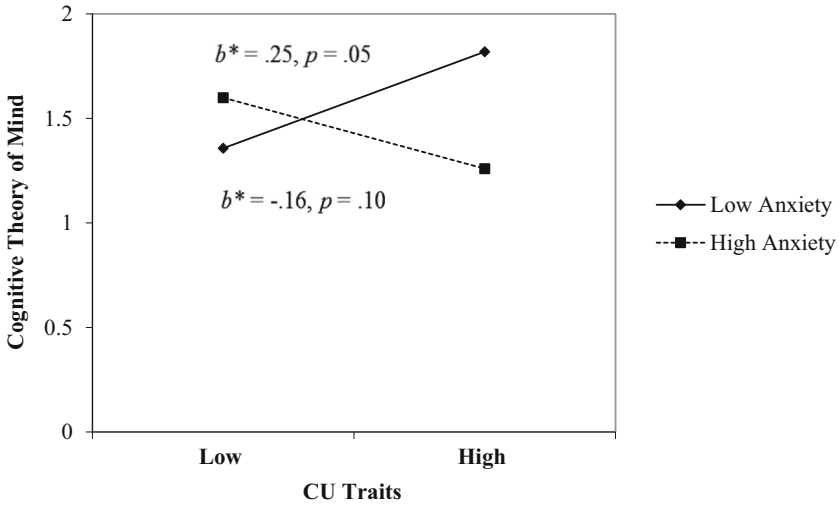

Fig. 2 Interaction between cognitive theory of mind and callous-unemotional traits at high and low levels of anxiety using standardized estimates

consistently documented a negative association between CU traits and emotional arousal to distress cues (Blair et al. 1999; Kimonis et al. 2006), whereas research on the association between CU traits and emotional recognition has produced more mixed results (Blair and Coles 2000; Blair et al. 2001; Loney et al. 2003; Sylvers et al. 2011; Woodworth and Waschbusch 2008). Specifically, the former seems to be related to CU traits across levels of anxiety (i.e., both variants), whereas the latter seems to be more specific to those with high levels of anxiety (i.e., the secondary variant). Deficits in affective empathy linked to the secondary variant would also be consistent with past literature on the effects of maltreatment in children. Specifically, while research has focused on identifying potential biases in cognitive processing that can impair identification of facial cues (e.g., Pollak and Kistler 2002), the underlying cause of this bias is likely due to heightened levels of negative emotionality and arousal that interfere with emotional regulation (Cummings et al. 1994). This poor emotion regulation is also associated with a decrease in empathy in both self-reports (Straker and Jacobson 1981) and in response to peer distress (Main and George 1985) in youth. Thus, consistent with our findings, research would suggest that those youth in the secondary variant could be similarly impaired on affective empathy as the primary variant.

One important caveat to our findings is the failure to find a significant association between CU traits and attentional orienting to distress cues on the dot-probe task. Past research suggests that this task may only tap emotional deficits in those high on CU traits and high on aggression (Kimonis et al. 2006; Kimonis et al. 2008a). As a result, the fact that we did not find a significant association may have been due to the failure to include a measure of aggression. Also, in contrast to prior research, self-reports of cognitive and affective empathy were not significantly correlated in the present sample. It may be that in a sample, such as a detained sample, that has a large number of individuals with relatively high levels of CU traits, the divergence between the two types of empathy is greater due to the presence of both primary and secondary variants.

All of these results need to be interpreted in light of several significant study limitations. First, as noted above, this study did not explicitly assess for histories of abuse and trauma and, as a result, our theoretical link between abuse and deficits in cognitive empathy could not be tested explicitly. Second, the current study examined only adolescents who were arrested and being held at a secure detention facility prior to adjudication. We felt that this was an important methodology to increase the range of CU traits studied in the sample but future research needs to determine how well these findings generalize to other types of samples and girls. The replication with girls is particularly important given the findings that CU traits and anxiety tend to be more highly correlated in girls (Salekin 2006). The replication in other age groups is important given that the association between CU traits and emotional recognition may differ across development. For instance, Dadds et al. (2009) found that CU traits are negatively associated with accuracy in emotional recognition prior to age nine but these deficits appear to diminish in later childhood and adolescence. Our results suggest that this improvement may be limited to those with low levels of anxiety, although this possibility should be tested explicitly in longitudinal studies. Third, because this was a correlational study, causal interpretations cannot be made. We have been careful to frame our results in terms of differential associations between CU traits and types of empathy without implying that one precedes or causes the other. However, we did present a theoretical model that specifies variants of CU traits differing in anxiety to support our predictions of a moderating influence of anxiety on the association of CU traits with the different types of empathy.

Within the context of these limitations, the results support past research suggesting that anxiety moderates the association of CU traits with other important constructs, supporting the presence of distinct variants of CU traits that are differentiated by the presence (i.e., secondary) or absence (i.e., primary) of anxiety (Skeem et al. 2003). Specifically, our findings suggest that CU traits are associated with affective empathy, irrespective of the level of anxiety. In contrast, CU traits are associated with problems in cognitive empathy in those high on anxiety. Future studies should directly test possible reasons for the differential associations between types of empathy and CU traits, such as our proposal that the deficit in affective empathy present in those with CU traits and low anxiety results from a temperament characterized by low emotional arousal to the distress in others, whereas the deficit in cognitive empathy in those high on anxiety results from the attributional biases and problems in emotional regulation that develop following abuse and trauma. Future research would also benefit from explicitly testing these causal linkages and testing possible reasons for why CU traits are associated with self-report of affective empathy in those with elevated anxiety. Finally, these hypothesized differences in etiology and empathy deficits between the two CU variants could be important for developing targeted and individualized treatment interventions for youth with these traits. For example, it is possible that interventions focusing on the effects of trauma may be important for children high on anxiety, whereas treatments that focus on motivating youth to modify their behavior, even in the absence of empathic concern for others,

may be more critical for youth with CU traits and low levels of anxiety (Frick 2012). In short, accounting for the heterogeneity among children and adolescents with CU traits could facilitate the implementation of treatments tailored to the individualized needs of these youths.

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Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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