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Affective and Cognitive Empathy Deficits Distinguish Primary and Secondary Variants of Callous-Unemotional Youth

A Dissertation

Submitted to the Graduate Faculty of the
University of New Orleans
In partial fulfillment of the
Requirements for the degree of

Doctor of Philosophy
in
Applied Developmental Psychology

By

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For Sam, my brother and protector.
The world moves too slow in your absence.

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Abstract

The current study examined whether a sample of detained male adolescents (*n* = 107; Mean age = 15.50; SD = 1.30) could be disaggregated into two distinct groups, consistent with past research on primary and secondary variants of callous-unemotional (CU) traits in adolescents. This study also sought to determine a possible explanation for the CU traits among youth in the secondary variant by examining whether they differ from primary variants on measures of cognitive and affective empathy. Using Latent Profile Analyses, two groups of adolescents high on CU traits were identified, a large group (*n* = 30) high on CU traits but low on anxiety (primary) and a smaller group high on both CU traits and anxiety (*n* = 10; secondary). Using self-report and computerized measures of affective (e.g., emotional reactivity) and cognitive empathy (e.g., affective facial recognition and theory of mind (ToM)), results revealed that the secondary variant demonstrated the lowest levels of cognitive empathy. In contrast, the primary variant demonstrated the lowest levels of self-report affective empathy, but these levels were not significantly different from the secondary variant. Multiple regression analyses testing the association among measures of empathy, CU traits, and anxiety produced a mostly consistent pattern of results. One exception was the finding of an interaction between CU traits and anxiety in the prediction of fear recognition accuracy that indicated that CU traits were positively associated with accuracy in recognizing fearful facial expressions when anxiety was low. The current study builds upon previous work examining primary and secondary variants of CU traits by suggesting that both primary and secondary variants may exhibit similar deficits in affective empathy, but that secondary variants may also exhibit deficits in cognitive empathy and perspective-taking that are not present in primary variants.

Key Words: Callous-Unemotional Traits, Affective Empathy, Cognitive Empathy, Adolescence, Theory of Mind

Introduction

Psychopathy is a serious personality disorder in adults that is characterized by a constellation of interpersonal (i.e., glibness), affective (i.e., lack of empathy), and behavioral (i.e., antisocial) features (Cleckley, 1976). The affective features of psychopathy, also referred to as callous-unemotional (CU) traits (e.g., lack of empathy/remorse, shallow affect, callousness), constitute a core component of psychopathy (Cleckley, 1976; Hart & Hare, 1996) and are frequently studied among youth populations as a downward extension of psychopathy (Frick, 2009). In support of this extension, evidence suggests that CU traits in childhood and adolescence are predictive of psychopathy in adulthood, even after controlling for conduct disorder and other childhood risk factors (Burke, Loeber, & Lahey, 2007; Lynam, Caspi, Moffitt, Loeber, & Stouthamer-Loeber, 2007).

Youth with CU traits are believed to demarcate a unique subgroup of antisocial youth whose behavior tends to be more severe and violent in nature. For example, recent qualitative (Frick & Dickens, 2006; Frick & White, 2008; Pardini & Fite, 2010) and quantitative (Edens, Campbell, & Weir, 2007; Leistico, Salekin, Decoster, & Rogers, 2008) reviews indicate that psychopathic or CU traits predict a more severe, stable, and aggressive pattern of behavior in antisocial youth. In addition, antisocial youths with CU traits show a large number of genetic, neurocognitive, emotional, personality, and social differences compared to antisocial youths without these traits (see Frick, Ray, Thornton, & Kahn, 2014; Frick & Viding, 2009; Frick & White, 2008, for reviews).

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 those youth with serious conduct problems who also show elevated rates of CU traits. A child or adolescent has to meet full criteria for CD and exhibit two of the following four traits over at least a 12-month period: lack of remorse or guilt, callous-lack of empathy, unconcern about performance at school or work, and shallow or deficient affect. 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 of research is whether there are distinct developmental pathways that can lead to CU traits.

Psychopathy as a Heterogeneous Construct

While psychopathy has historically been viewed as a homogenous construct, a recent review of seminal theories and empirical work provides compelling evidence that there may be distinct variants of psychopathy with potentially different etiologies (Skeem, Poythress, Edens, Lilienfeld, & Cale, 2003). In an early and influential theoretical model, Karpman (1941, 1948a) proposed a theory of two psychopathy subtypes. Specifically, Karpman (1941, 1948a) theorized that primary psychopathy is characterized by an innate or heritable affective deficit, while secondary psychopathy is characterized by an affective deficit produced by adaptation to environmental factors such as parental rejection, abuse, or trauma. He emphasized that the divergent etiology of these variants was crucial for understanding the underlying motivation of psychopathic behavior and thus could be important for treatment (Karpman, 1941, 1948a). At the same time, Karpman (1941) also noted that individuals falling into these two categories would be indistinguishable by their callous, irresponsible, and antisocial behavior, but could be differentiated by the presence of anxiety and their type of aggression. Karpman argued that those within the secondary variant would show elevated rates of anxiety and engage in more reactive aggressive behavior, while those falling into the primary variant would not show signs of anxiety and demonstrate planned or more proactive means of carrying out aggression (Karpman, 1948b).

A substantial amount of research supports many of the core features of Karpman's model. Specifically, research on adults confirms that individuals high on psychopathic traits can be meaningfully split into two distinct groups based on their levels of trait anxiety. Groups with low levels of anxiety (i.e., primary psychopathy) frequently show deficits in laboratory tasks measuring passive avoidance (Arnett, Smith, & Newman, 1997; Newman & Schmitt, 1988) and responses to emotional stimuli (Hiatt, Lorenz, Newman, 2002; Newman, Schmitt, & Voss, 1997; Sutton, Vitale, & Newman, 2002). Research also indicates that groups with high levels of anxiety (i.e., secondary psychopathy) show higher levels of past child abuse and trauma in incarcerated adult samples (Blagov et al., 2011; Poythress et al., 2010).

Importantly, past research in adult populations has demonstrated that these two variants of psychopathy may not differ in their level of CU traits (Blagov et al., 2011; Hicks, Markon, Patrick, Krueger, & Newman, 2004; Poythress et al., 2010; but see Vassileva, Kosson, Abramowitz, & Conrad, 2005). However, they may differ on other dimensions of psychopathy, such as impulsivity and aggressive behavior. For example, Skeem and colleagues (2003) suggested that the secondary variant may demonstrate more difficulties in emotion regulation and thus would be more likely to show higher levels of hostility, aggression and impulsivity. This assertion has largely been supported in adult samples when measuring aggression (Falkenbach, Poythress, & Creevy, 2008; Hicks et al., 2004; Vidal, Skeem, & Camp, 2010; but see Poythress et al., 2010) and impulsivity (Blagov et al, 2011; Poythress et al., 2010; Vassileva et al., 2005; but see Skeem, Johansson, Andershed, Kerr, & Eno Louden, 2007).

Extension to CU Variants in Youth

Although the research on variants of psychopathy prior to adulthood has been limited, there have been promising findings in samples of clinic-referred and incarcerated adolescents. As in adult samples, research in adolescent populations suggest that individuals high on psychopathy or CU traits can be meaningfully split into two distinct groups based on their levels of trait anxiety. Those individuals in the group defined as primary psychopathy display low levels of anxiety, while those in the group defined as secondary psychopathy demonstrate high levels of anxiety (Kahn et al., 2013; Kimonis, Frick, Cauffman, Goldweber, & Skeem, 2012; Lee, Salekin, & Iselin, 2010; Sharf, Kimonis, & Howard, 2014). Consistent with adult samples, research among adolescents also suggests that the variant high on anxiety (i.e., secondary psychopathy) shows higher levels of past child abuse and trauma (Kahn et al., 2013; Kimonis, Skeem, Cauffman, & Dmitrieva, 2011; Sharf et al., 2014; Tatar, Cauffman, Kimonis, & Skeem, 2012; Vaughn, Edens, Howard, & Smith, 2009). Also consistent with adult samples, the two variants do not differ on their level of CU traits, but the group high on anxiety is more impulsive (Kahn et al., 2013; Kimonis et al., 2012). This high anxiety variant also shows more problems with depression, anger, and aggression (Kahn et al., 2013; Kimonis, et al., 2012; Kimonis et al., 2011; Lee et al., 2010; Vaughn, et al., 2009). Also consistent with the research on adults (Hiatt et al., 2002; Newman, et al., 1997; Sutton et al., 2002), the low anxiety variant (i.e., primary psychopathy) shows deficits in their processing of emotional stimuli that are not apparent in the secondary variant (Kimonis et al., 2012). For instance, Kimonis and colleagues (2012) found that when using an Emotional Pictures Dot-Probe Task, the secondary variant did not show deficits in the processing of emotional stimuli depicting distress in others, while the primary variant did show these deficits.

Taken together, the results of these studies suggest that causal models proposed to explain the development of CU traits need to consider these two variants with very different characteristics. Further, these differing characteristics are consistent with theories suggesting that CU traits in the primary variant are a result of an emotional deficit related to low behavioral inhibition that can interfere with the development of empathy, guilt, and other aspects of conscience (Kimonis et al., 2012). In contrast, individuals in the secondary variant appear to have problems in emotional and behavioral regulation that could result from abuse and other trauma early in development (Kimonis et al., 2012). These empirical findings and theoretical interpretations raise an important question. If the secondary variant does not show deficits in the processing of emotional stimuli depicting distress in others, why do they still show elevated levels of CU traits? One line of research may provide some data to help address this question. This area of research focuses on the distinct components involved in empathic processing.

Empathy as a Multidimensional Process

The construct of empathy is important for understanding youth with high levels of CU traits not only because lack of empathy, in part, defines the construct of CU traits, but also because empathy is believed to play a key role in social cognition and prosocial behavior (Decety, 2010). For instance, empathy is thought to be important in the inhibition of aggression and promotion of prosocial behavior (Eisenberg & Eggum, 2009). To this end, shared negative arousal between individuals often results in distress, and serves as a signal that activates empathic concern and thus promotes prosocial behavior. When this shared arousal is absent, there is no motivation to act in order to decrease any discomfort promoted by the negative arousal (Decety & Michalska, 2010).

Due to its complexity, empathy has been defined in a variety of a ways. From a developmental standpoint, empathy is typically defined as an affective response or arousal that is derived from understanding another's emotional state or feelings in a particular situation (Eisenberg, Shea, Carlo, & Knight, 1991). These and other common definitions of empathy emphasize the affective components; however, it is widely accepted that empathy includes both affective and cognitive components that differ in their developmental trajectories (Baron-Cohen & Wheelwright, 2004; Davis, 1980; Decety & Jackson, 2004; Eisenberg & Eggum, 2009; Hodges & Klein, 2001). In general, affective features are typically defined as arousal to or resonation and congruence with another's emotional state (Blair, 2005; Hoffman, 1987; Singer & Lamm, 2009). In contrast, cognitive empathy is often considered synonymous with perspective-taking abilities, such as being able to imagine or take the perspective of another in order to understand what they may be feeling (Davis, 1980; Davis, 1983; Decety, 2010). While cognitive and affective components are both involved in the process of empathy, their developmental trajectories differ in course and complexity.

Affective Empathy. 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 showing comfort to others in distress (Warneken & Tomasello, 2009). Furthermore, affective responsiveness, or emotional contagion, is present among infants, as they become distressed and cry when exposed to other crying newborns (Dondi, Simion, & Caltran, 1999). Importantly, this developmental sequence shows that the ability to perceive and respond appropriately to other's affective expression occurs early in development, prior to the development of a sense of self, which is necessary for the process of cognitive empathy (Hastings, Zahn-Waxler, & McShane, 2006).

Considering that CU traits are defined in part by a lack of concern about another's feelings, it is not surprising that many studies have consistently found support for affective empathy deficits in youth with high levels of CU traits (Chabrol, Van Leeuwen, Rodgers, & Gibbs, 2011; Dadds et al., 2009; Dadds, Cauchi, Wimalaweera, Hawes, Brennan, 2012; Jones, Happe, Gilbert, Burnett, & Viding, 2010; Pardini & Byrd, 2012; Pardini, Lochman, & Frick, 2003). For example, in a sample of 4^{th} and 5^{th} grade urban school children, Pardini and Byrd (2012) found that CU traits were negatively associated with both measures of empathic sadness and empathic concern. Similarly, in a sample of children and adolescents age 9 to 16, Jones and colleagues (2010) found youth with higher levels of CU traits were less likely to report 'feeling bad' about an aggressive act they committed and were also less likely to care about the victim's feelings compared to children without CU traits. A more recent electroencephalography (EEG) study found that when exposed to images of others in distress, youth with high levels of CU traits are less likely to become aroused compared to youth with low levels of CU traits (Cheng, Hung, & Decety, 2012). Thus, there is consistent support for affective empathy deficits among CU youth.

Cognitive Empathy. Unlike affective empathy, cognitive empathy can begin to be measured by the age of 4, 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, Cross, & Watson, 2001). Although children have knowledge about mental states and can attribute them to others by the age of 2 (Bretherton, McNew, & Beeghley-Smith, 1981), they have not yet acquired the ability to understand representational states in order to infer what others might think or believe until approximately 4 years of age (Perner, 1991). Identification of facial affect is one way in which mental states are attributed to others. Past research has found that facial affect recognition is present by the pre-school years (Reichenbach & Masters, 1983) but that the level of accuracy improves into the adolescent years (Kolb, Wilson, & Taylor, 1992; Tonks, Williams, Frampton, Yates, & Slater, 2007).

When examining cognitive empathy deficits among children with elevated CU traits, results are mixed. Among the extant research, some studies have shown that youth with high levels of CU traits show deficits in cognitive empathy when measured by affective facial recognition (Dadds et al., 2009) or self-reports of perspective-taking (Chabrol et al., 2011; Pardini et al., 2003). However, other studies employing emotion recognition (Schwenck et al., 2012; Dadds et al., 2012) or cognitive perspective-taking tasks (Anastassiou-Hadjicharalambous & Warden, 2008; Cheng et al., 2012; Jones et al., 2010) found youth high on CU traits did not exhibit deficits in cognitive empathy. Importantly, the study by Dadds and colleagues (2009) suggests age differences in the association between empathy and CU traits. Specifically, this study found that parent reported CU traits were associated with both emotional and cognitive empathy deficits in boys under the age of nine, but they were unrelated to cognitive empathy deficits after this age (Dadds et al., 2009). These findings suggest that youth with CU traits may be more likely to exhibit deficits in cognitive empathy earlier on (along with affective empathy deficits) but learn perspective-taking later in development.

Theory of Mind. The cognitive component of empathy is closely related to the construct of theory of mind (ToM). Specifically, ToM is defined as the ability to attribute self and other's mental states, including intentions, beliefs, and knowledge (Premack & Woodruff, 1978). In fact, several authors have proposed that cognitive empathy is the same as ToM (Blair, 2005; Decety, 2010). The process of attribution involved in ToM is necessary for predicting and appropriately responding to another's behavior, thus forming a crucial component of social skills during development (Baron-Cohen, Leslie, & Frith, 1985).

Research suggests that the acquisition of ToM follows a predictable developmental pattern (Stone, Baron-Cohen, & Knight, 1998). Specifically, ToM begins to manifest around 18 months of age in the form of joint attention (i.e., using direct gaze or gestures to share a common interest) and protodeclarative pointing (i.e., pointing to share enjoyment with others; Baron-Cohen, 1989; 1995). At 3 to 4 years of age, children are able to understand false belief, or that other people may possess beliefs that are incorrect and different from their own, which is typically referred to as first-order false belief (Gopnik & Astington, 1988; Wimmer & Perner, 1983). Around 6 to 7 years of age, children begin to understand that other individuals possess beliefs about what a third person thinks (second-order false belief; Perner & Wimmer, 1985). More subtle and advanced ToM abilities begin to solidify at ages 9 to 11 when children recognize and understand faux pas, which requires attribution of two mental states. A faux pas occurs when someone doesn't realize they should not say something to someone because the person hearing it would feel hurt or insulted (Baron-Cohen, O'Riordan, Stone, Jones, & Plaisted, 1999).

More recent and advanced conceptualizations of ToM suggest that ToM abilities are composed of both affective and cognitive components that may rely on different capabilities and recruit different brain regions (Shamay-Tsoory, Tomer, Berger, Goldsher, & Aharon-Peretz, 2005). For instance, Shamay-Tsoory and colleagues (2005) outline a model differentiating cognitive ToM, which is defined as the ability to make inferences about others' beliefs or intentions, from affective ToM, which is defined as the ability to make inferences about others' emotions (Shamay-Tsoory et al., 2005). Within the broader framework of empathic processing, Shamay-Tsoory and colleagues (2010) have proposed that affective ToM requires integration of both cognitive ToM and emotional contagion (Shamay-Tsoory, Harari, Aharon-Peretz, & Levkovitz, 2010). Emerging research provides support for the conceptualization of ToM as a multi-component process. Specifically, findings from brain imaging research suggest distinct brain regions become activated when participants are asked to complete tasks aimed at assessing cognitive vs. affective ToM abilities (Kalbe et al., 2010; Sebastian et al., 2012a). Given that ToM is closely related to the construct of cognitive empathy and given that ToM is composed of distinct affective and cognitive components, it is important to understand how youth with CU traits may perform on tasks measuring ToM.

However, the literature examining the association between performance on ToM tasks and CU traits is limited. When measuring ToM as a unitary construct, studies in adult populations report that individuals with high levels of psychopathic traits do not show impairment in ToM (Blair et al., 1996; Richell et al., 2003; Widom, 1978). However, more recent research in adolescents has shown that CU traits specifically, are negatively associated with performance on ToM tasks (Sharp & Vanwoerden, 2014), even after controlling for levels of impulsivity and narcissism (Stellwagen & Kerig, 2013). Findings from the few studies that have examined cognitive and affective components of ToM independently are mixed (Sebastian et al., 2012b; Shamay-Tsoory et al., 2010). For example, among incarcerated adults, Shamay-Tsoory and colleagues (2010) found those with high levels of psychopathic traits showed deficits in affective ToM but not cognitive ToM abilities. Specifically, after controlling for intelligence level, offenders with high levels of psychopathic traits had significantly lower accuracy scores on tasks of affective ToM, but not cognitive ToM, in comparison to a healthy control group from the community. These accuracy scores in the affective condition, but not cognitive condition, were also significantly and negatively correlated ($r = -.49$) with scores from a self-report measure of psychopathy (Shamay-Tsoory et al., 2010). However, in a study of community youth, no differences were found in behavioral performance on cognitive and affective ToM scenarios between typically developing youth and a conduct problems group with significantly higher levels of CU traits (Sebastian et al., 2012b).

Taken together, the available research suggests that youth with high levels of CU traits consistently demonstrate deficits in affective empathy, but the results for cognitive empathy or ToM are mixed with some studies providing support for deficits in youth with CU traits and others failing to find support for these deficits. There could be a number of explanations for these findings, including the explanation provided above that the cognitive deficits are not consistent across age. However, these inconsistent results may also be due to the possibility that there are differences in the empathy deficits across the different variants of CU traits. Specifically, it is possible that the primary variant experiences deficits in affective empathy, due to a failure to become aroused to the cues of distress in others, whereas the secondary variant shows cognitive empathy deficits due to a failure to develop cognitive perspective skills as a result of their problems in emotional regulation. These difficulties in emotion regulation, as well as a failure to develop cognitive perspective skills, could be the result of experiencing maltreatment during childhood, which has shown a higher prevalence rate in secondary variants (e.g., Kahn et al., 2013; Kimonis et al., 2011).

Statement of Problem

To summarize, current research suggests that youth high on CU traits can be meaningfully split into two distinct groups based on their level of trait anxiety (e.g., Kahn et al., 2013). Specifically, a primary variant does not show elevated levels of trait anxiety but does show deficits in the processing of emotional stimuli, especially in response to distress in others, that are not apparent in the secondary variant. In contrast a secondary variant displays higher levels of anxiety and demonstrates greater histories of childhood abuse and trauma than the primary variant. Furthermore, the secondary variant demonstrates more difficulties in emotion regulation including higher levels of impulsivity, as well as problems with depression, anger, and aggression. However, the secondary variant does not show a deficit in the processing of emotional stimuli that is displayed by the primary variant.

The differences between these variants have resulted in several theories proposing distinct etiological pathways for these two groups high on CU traits. Specifically, the primary variant has been proposed to be the result of an emotional deficit related to low behavioral inhibition that can interfere with the development of empathy, guilt, and other important aspects of conscience (Kimonis et al., 2012). In contrast, the secondary variant has been proposed to be the result of deficits in emotional and behavioral regulation that result from abuse and other trauma early in development (Kimonis et al., 2012). What is not clear from these etiological theories is why, if the second group shows emotional arousal to the distress in others, they still show elevated levels of CU traits.

The current study tests one possible explanation for lack of empathy in youths high on CU traits and high on anxiety (i.e., secondary variant). Specifically, I test the possibility that the secondary variant will still show empathy deficits, leading to their CU traits, but that the type of empathy deficit will differ from the empathy deficit shown by the primary variant. Research examining cognitive and affective empathy deficits in CU youth separately finds consistent support for deficits in affective empathy among youth with elevated levels of CU traits; however, research on deficits in cognitive empathy among youth high on CU traits is less consistent. These inconsistent results may be due to the possibility that the primary variant is more likely to experience deficits in affective empathy due to a failure to become aroused to the cues of distress in others. The secondary variant, on the other hand, shows more deficits in cognitive empathy due to a failure to develop cognitive perspective skills as a result of their problems in emotional regulation and hypervigilance to threat cues because of their history of abuse. Thus, they may dedicate less cognitive resources to non-threat related emotions, such as distress in others.

Hypotheses

This explanation for the development of CU traits within these two groups leads to several predictions that have not been investigated to date and that were the focus of the current study. The current study used latent profile analyses (LPA) in a sample of detained male adolescents to test whether distinct groups emerge that differ on CU traits and level of anxiety. Detained adolescents were studied in order to use a sample that likely displays high rates of CU traits. Based on past research it was hypothesized that at least three groups of youth will be identified: a group high on CU traits and high on anxiety (secondary variant), a group high on CU traits and low on anxiety (primary variant), and a group low on CU traits and anxiety.

Several predicted differences between these three groups were tested. The first hypothesis was that the primary and secondary variant would differ on both self-report of affective and cognitive empathy as well as performance on computerized tasks designed to measure aspects of affective and cognitive empathy. Specifically, it was hypothesized that the primary variant would score lower on self-reports of affective empathy as well as demonstrate greater deficits on a computerized task assessing aspects of affective empathy (facilitation/attention to emotion pictures) compared to the secondary variant and a low CU group. In contrast, it was hypothesized that the secondary variant would score lower on self-reports of cognitive empathy, a computerized task of cognitive empathy (emotion recognition of facial stimuli), as well as a measure assessing affective and cognitive Theory of Mind (ToM) compared to the primary variant and low CU group.

Methods

Participants

One hundred twelve male participants, age 12 to 20, were recruited from three secure detention facilities in the Southeastern United States: Rivarde Detention Center in Harvey, LA, the Youth Study Center in New Orleans, LA, and the Terrebonne Juvenile Detention Center in Houma, LA. Youth in all three 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%). The current sample size provided adequate power to detect a moderate effect size ($f^2 = .15$) at the $p < .05$ level using a three group MANCOVA in g-power (Faul, Erdfelder, Lang, & Buchner, 2007). A moderate effect size was expected based on previous studies that have produced effect sizes in this range when examining group differences in youth with different variants of CU traits on measures of internalizing symptoms (Kahn et al., 2013) or negative emotionality (Kimonis et al., 2012).

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 scale of the Antisocial Process Screening Device (APSD; Frick & Hare, 2001), the ICU was developed to provide more items assessing CU traits to overcome low internal consistency of the items on the APSD (see, e.g., Loney, Frick, Clements, Ellis, & Kerlin, 2003). The ICU has three subscales (Callousness, Unemotional, and Uncaring) and a total score. The current study utilized the total ICU score by summing all 24 items. Items are rated on a four-point scale ranging from 0 ("not at all true") to 3 ("definitely true"). The reliability and validity of the self-report version of the ICU has been supported in incarcerated (Kimonis et al., 2008) and community (Essau, Sasagawa, & Frick, 2006; Roose, Bijttebier, Decoene, Claes, & Frick, 2010) samples of adolescents. Specifically, past research has found that higher total scores, as well as the callousness and uncaring subscale scores of the ICU, are uniquely associated with increased aggression and delinquency (Kimonis, Frick, Munoz, & Aucoin, 2008; Kimonis et al., 2008), even after controlling for other personality factors, such as extraversion and conscientiousness that are thought to be related to antisocial behavior (Essau et al., 2006). In addition, past research in community samples of children and adolescents has found higher total scores on the ICU are significantly and negatively correlated with measures of both affective (Jones et al., 2010; Munoz, Qualter, & Padgett, 2011; Roose et al., 2010) and cognitive empathy (Munoz et al., 2011; Roose et al., 2010). Further, the hypothesized variants in the current study have been found in a previous study of incarcerated adolescents using the ICU as a measure of

CU traits (Kimonis et al., 2008). The internal consistency in the current sample for the ICU total score was α = .72.

The Revised Child Anxiety and Depression Scales (RCADS; Chorpita, Yim, Moffitt, Umemoto, & Francis, 2000). The RCADS is an adaptation of the Spence Anxiety Scales (Spence, 1997) and consists of 47-items assessing symptoms of each anxiety disorder (except PTSD and Specific Phobias) and depression based on DSM-IV criteria (American Psychiatric Association, 2000). Items were rated on a 4-point scale (i.e., "Never," "Sometimes," "Often," or "Always") corresponding to how frequently the symptom was experienced. The current study used a total anxiety score that was obtained by summing all the relevant items assessing anxiety symptoms (37 items). This total anxiety score has demonstrated good internal consistency (α = .95) in previous studies of children and adolescents (Daughters et al., 2009). The RCADS has also demonstrated evidence of good cross-informant, convergent, and predictive validity among both community and clinic-referred samples. For example, in a large sample of clinic-referred youth, ages 7 to 17, the RCADS demonstrated good convergent validity with other measures of anxiety (*r*'s = .59 - .72; Chorpita, Moffitt, & Gray, 2005). Further, in a community sample of parents and youth age 11 to 15, the RCADS demonstrated good cross-informant validity ($r = .50$) and total RCADS anxiety scores reported by youth were significantly associated with measures of behavioral inhibition (Muris, Meesters, & Spinder, 2003). The internal consistency in the current sample for the total RCADS anxiety score was α = .95.

Basic Empathy Scale (BES; Jolliffe & Farrington, 2006). The BES is a 20-item self-report inventory measuring cognitive (e.g., the ability to understand the emotions of another individual) and affective (e.g., the ability to experience the emotions of another individual) empathy. 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 & Farrington, 2006). The cognitive scale is composed of nine items (i.e., 'when someone is feeling down I can usually understand how they feel') while the affective scale 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 five-point Likert scale ranging from 1 ('strongly disagree') to 5 ('strongly agree'). There is a moderate correlation ($r = .41$) between the cognitive and affective scales (Jolliffe & 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. In past research, the BES demonstrated good internal consistency ($\alpha = .76$ and $\alpha = .80$) in adolescent populations for the cognitive and affective scale respectively (Sebastian et al., 2012b). The internal consistency in the current sample was $\alpha = .78$ and $\alpha = .60$ for the affective and cognitive scales, respectively.

Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999). The WASI is a brief test of intellectual ability derived from the Wechsler Intelligence Scale for Children (WISC-III; Wechsler, 1991) and Wechsler Adult Intelligence Scale (WAIS-III; Wechsler, 1997) and was normed for individuals aged 6 to 89. The current study utilized the two-subtest short form, which includes the Vocabulary and Matrix Reasoning subtests to obtain a Full Scale IQ estimate (FSIQ). The Vocabulary subtest consists of 42 items in which individuals give oral definitions of four images and 37 words that are presented both orally and visually. The Matrix Reasoning subtest consists of 35 incomplete grid patterns; individuals choose the correct response from five possible choices. The Full Scale IQ for the two-subtest form is highly correlated with the Full Scale IQ on both the WISC-III (*r* = .81) and WAIS-III (*r* = .87; Wechsler, 1999). In the current sample, four youth declined to complete the IQ testing but were still included in the analyses.

Emotional Pictures Dot-Probe Task (Kimonis, Frick, Fazekas, & Loney, 2006; *Kimonis, Frick, Marsee, & Aucoin, 2008)*. 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, Vasey, Cravens-Brown, & Bretveld, 2003). 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.

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. The second component consists of a 250-millisecond presentation of two picture stimuli that are centered and appear directly above and below the fixation cross. Finally, the last component is an asterisk (i.e., dot probe) that appears at either the location of the top or bottom picture previously presented. The participant was asked to select a key on the keyboard corresponding to the correct location of the dot-probe (i.e., top or bottom) as quickly as possible. The dot followed picture pairs, which included three combinations of emotional content: neutral-neutral, distress-neutral, and positive-neutral. The location and type of picture stimuli were counterbalanced across all trials so that equal numbers of emotional and neutral stimuli appeared in both the top and bottom locations.

The time between the onset of the dot-probe and when the participant presses a key is recorded in milliseconds. An attentional facilitation index can be calculated for each different category of emotional valence (MacLeod & 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)]. Specifically, the participant's average response time to probes replacing distress stimuli is subtracted from their average response time to probes replacing neutral stimuli. 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 allocated towards and corresponds with the spatial location of the probe. Thus, higher scores indicate greater attentional orienting to the emotional stimuli. For the purposes of the current study, only the facilitation index to distress pictures was used.

Consistent with previous studies utilizing this paradigm (e.g., Kimonis et al., 2012), if the participant did not respond to a dot probe stimuli within 5000 ms, that response was recorded as incorrect and those responses were not included in calculating the facilitation index to distress for the current study. Also consistent with previous studies (e.g., Kimonis et al., 2012), participants whose facilitation scores differed from the mean by more than three standard deviations were eliminated from the current analyses. In the current study, facilitation scores for n = 8 youth were not included due to a combination of these exclusion factors.

Past research among incarcerated adolescents has shown that low levels of facilitation to distress in CU youth are associated with higher levels of proactive and reactive aggression as well as violent delinquency (Kimonis et al., 2008). More importantly, when examining variants of psychopathy in adolescent offenders, this dot probe task differentiated primary variants from secondary variants, with the primary variant showing lower levels of facilitation to distress (Kimonis et al. 2012). Further, in samples of incarcerated adolescents, the facilitation index to distress has demonstrated adequate internal consistency (α =.80 - .81; Kimonis et al., 2008; Kimonis et al., 2012). In the current study, the internal consistency of response times across the distress pictures was α = .90.

NimStim Affective Facial Recognition Task (Tottenham et al. 2009). In the current study, affect recognition was measured using facial stimuli taken from the NimStim set of facial expressions (Tottenham et al. 2009). This set of facial stimuli contain color photographs of adults, both male and female varying in ethnic composition, and depict frontal images of emotional expressions. Each expression also has separate open and closed mouth versions. The design of the current task was modeled after the University of New South Wales Facial Emotion Task (FACES; Dadds, Hawes, & Merz, 2004). Specifically, facial expressions of happiness, sadness, anger, disgust, fear, or neutral expressions are displayed by six adult faces (for a total of 36 different stimuli). The adult actors in the NimStim set of facial expressions chosen for this task varied in ethnic composition (3 Caucasian, 1 African American, 1 Hispanic, and 1 Asian) as well as gender (3 female and 3 male). In addition, for each facial expression, we varied open and closed mouth expressions, so that each facial expression was presented three times as 'open mouthed' and three times as 'closed mouthed' within the task. This was done in order to control for potential perceptual differences between facial stimuli (e.g., tooth visual) since this type of difference in facial feature may bias responses (Kestenbaum & Nelson, 1990). Facial stimuli were presented in a random order for 2 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 participant's labels or responses and the facial expression intended to be presented. The overall concordance was high (mean kappa = .79; Tottenham, et al., 2009). Reliability scores were measured 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 .84, *SD* = .08; Tottenham et al., 2009). Past research in samples of clinic-referred (Leist & Dadds, 2009) and community (Dadds et al., 2006) children and adolescents has shown that affect recognition (using the FACES task) differs between control groups and youth with high levels of CU traits. Specifically, youth with high levels of CU traits had poorer recognition of fearful faces compared to those without CU traits (Dadds et al., 2006; Leist & Dadds, 2009).

In the current sample, differences in accuracy between open and closed mouth expressions were tested using a series of mixed multivariate analysis of covariance (MANCOVA) with open and closed mouth accuracy as a within groups independent variable (controlling for age and IQ). Results revealed no differences in accuracy rates for open and closed mouthed expressions for both individual facial expression accuracy and total facial accuracy (range p = .50 to .93). Thus, total accuracy for each of the six expressions and a total facial accuracy score were calculated using both open and closed mouthed expressions. In the current sample, accuracy rates ranged from 52% - 84% for fearful expressions; 73% to 80% for disgust expressions; 30% to 87% for angry expressions; 71% to 90% for neutral expressions; and 87% to 94% for happy expressions. The accuracy rate was 9% to 94% for sad expressions. Thus, 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, leaving the range of sadness accuracy at 52% to 94%. 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 expressions (n = 4), angry expression (n = 2), fearful expressions (n = 1), disgust expressions (n = 3), sad expressions (n = 5), neutral expressions (n = 3), and total accuracy (n = 5). One youth did not complete this task in the current study.

Affective and Cognitive Theory of Mind Task (Hynes, Baird, & Grafton, 2006). This task measured the participant's ability to make inferences about another's mental state. Participants were provided with written scenarios or stories that are designed to assess both cognitive and affective ToM. Additional written scenarios formed a 'physical' condition that served as a control. Each condition contained 14 scenarios and each scenario was followed by a multiple choice question. All of the scenarios were presented visually on the computer for the participant to read at their own pace; scenarios did not differ in word length (Hynes et al., 2006). Participants were then presented with a question about the scenario, which remained on the screen for 7 seconds to allow them to time to consider an answer. The question remained on the screen while three answer options were presented for the participant to choose from.

The scenarios consisted of everyday situations. In the cognitive condition, participants were 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 asked the participant about physical details in the story (e.g., ‘why does Paul pay in installments?’). The cognitive and physical scenarios in this task were originally taken from the Strange Stories Task (Happe, 1994). The affective scenarios were developed and used with the existing cognitive and physical scenarios by Hynes and colleagues (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 past research, performance on the Strange Stories Task has differentiated adults with an Autism diagnosis from healthy control adults and children as well as a group of adults who were intellectually impaired (Happe, 1994). Specifically, adults with Autism made more errors than the other two groups (Happe, 1994). Performance on the Strange Stories Task has also differentiated children and adolescents with an Asperger diagnosis from a control group of children and adolescents with no diagnosis, in that those with an Asperger diagnosis scored significantly lower than the control group (Kaland et al., 2005). In the current study, accuracy for individual scenarios in the first run ranged from 31% to 95% (cognitive) and 76 to 91% (emotional). In the second block, accuracy on individual scenarios ranged from 60 to 83% for the cognitive scenarios and 22 to 83% for emotional scenarios. 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 = .058).

Therefore, only data from the first run were included in the current study. Participants whose scores differed from the mean by more than three standard deviations were eliminated from the current analyses (cognitive ToM, $n = 1$; emotional ToM, $n = 2$). An additional three youth did not complete this task in the current study.

Record Review Forms. Background information was extracted from the institutional files of each participant. The Record Review form consisted of items measuring basic demographic information, criminal history data, psychoeducational testing results, and mental health variables. Age, ethnicity, and days in the detention facility were coded from the institutional files for purposes of the current study. For the current sample, the average number of days spent in the detention facility was 13.94 ($SD = 10.70$). Due to the low base rate of the other racial/ethnic groups (e.g., Hispanic, Other), participants were dichotomized into two groups: Non African American = 0 and African American = 1.

Procedures

Institutional Review Board approval for the study procedures was obtained prior to the onset of data collection. In order to obtain parental consent, a telephone informed consent procedure was conducted with the parents of participants. Audiotape served as the record of consent for the researchers. Hard copies of all consent forms were also mailed to parents. Youth assent took place in person either individually or within small groups at the detention facility. After obtaining parental consent and youth assent, the data collection took place in two sessions. For the first session, paper and pencil questionnaires (i.e., ICU and RCADS) were administered to the participants during either a small group session (approximately 4 participants per group) or individually, depending upon the regulations of the facility. During the second session, participants met individually with the researcher and completed an intelligence assessment (i.e., WASI) as well as the four primary study tasks on the computer (i.e., Emotional Pictures Dot-Probe Task, Basic Empathy Scale, NimStim Affective Facial Recognition Task, and the Affective and Cognitive ToM Task). Both sessions took take place in a private room at the detention facility and together both sessions typically lasted three hours. Participants received snacks as a thank you for participating after each portion of the study. Youth were reminded that the information they provide would remain confidential except when specified by the consent process (i.e., evidence of abuse, and intention to harm others or self). Youth were also told that their participation in the research would have no effect on their length of stay at the detention facility nor would it have an effect on their court proceedings.

Data Analytic Plan

In order to reduce the influence of outliers in the independent variables, a winsorization scheme was used to modify any outlying data points (defined as 2 SD above and below the mean) for both ICU total score and the RCADS Anxiety total score by changing their values to the next most extreme, non-outlying value in the distribution. This procedure maintains a values' position in the distribution and ensures any mean differences observed are not driven by scores in the tail of the distribution (Tabachnick & Fidell, 2013). This resulted in the change of four data points for the ICU total score and five data points for the RCADS Anxiety total score.

Next, using Mplus (Muthen & Muthen, 2008), Latent profile analysis (LPA; Lazarfeld & Henry, 1968) was conducted to test whether distinct groups emerge that differ on their level of CU traits and anxiety. LPA is a person-centered, model-based cluster procedure, which is a type of latent variable mixture modeling used with continuous variables. LPA is considered superior to traditional clustering analysis because it allows for a more flexible model specification and provides several goodness-of-fit indices to aid in selecting the optimal number of groups (Pastor, Barron, Miller, & Davis, 2007; Vermunt & Magidson, 2002). In the current study, LPA analysis using full information maximum likelihood (FIML; Schafer & Graham, 2002) was performed to classify the participants on two variables: CU traits and anxiety symptoms. A series of models with increasing numbers of groups or classes was run and the best fitting model was chosen based on a combination of the following methods: comparing tests of statistical significance, goodness of fit indices, and interpretability of the profiles (see Flaherty & Kiff, 2012). Selection of the best fitting model was also based on sizes of groups within models. Specifically, solutions that contained groups with less than 5% of the cases were examined with caution.

To compare the models on a test of statistical significance, the Lo-Mendell-Rubin (LMR; Lo, Mendell, Rubin, 2001) likelihood ratio test was examined. The LMR is a method that tests the fit of a model with K groups against one with K-1 groups (Muthen, 2003). The LMR determines whether the fit of a specific model (K) is better than one that is more parsimonious (K-1). Specifically, when estimating the fit of a model with K groups, the LMR tests the null hypothesis that the data are better fit by a model of K-1 groups. A low p-value on the LMR index indicates better model fit for at least K groups and supports the rejection of the K-1 model (Muthen, 2003). Model fit was also compared by examining goodness of fit using information criterion indexes. Specifically, the Baysian Information Criterion (BIC; Schwartz, 1978; Raftery, 1986) as well as the sample size adjusted BIC (SSA-BIC; Yang, 2006) were examined. Next, the Akaike's Information Criteria (AIC; Akaike, 1973, 1974) was also examined. For all three of these information criteria indices, a decrease in value is indicative of a better fitting model. That is, a model with a lower BIC, AIC, or SSA-BIC value is indicative of a better fit than a model with higher values on these indices. Finally, the entropy value was examined, which is a measure of classification uncertainty. In Mplus the entropy value is rescaled and reported as the ‘relative entropy’. The relative entropy value ranges from zero to one with values near one indicating high certainty in classification and values closer to zero indicating low certainty in classification.

A series of ANOVAs or chi-square tests were conducted to determine if the groups obtained from the LPA analysis differed on important demographic variables (i.e., age, ethnicity, IQ, and days spent in detention facility). Although the groups did not differ on any of these variables, IQ was still used as a covariate in all analyses because of the goal of determining group differences on the measures of cognitive empathy after controlling for general intelligence. Assuming that the corresponding measures of empathy (cognitive or affective) were correlated with one another, a series of MANCOVAs, controlling for IQ, were planned to test whether the primary and secondary variant differed on measures of affective and cognitive empathy. However, because the measures of affective empathy (BES self-report of affective empathy and Emotional Pictures Dot-Probe Task) were uncorrelated with each other ($r = .10$, $p = .35$), group differences were tested for these measures in individual ANCOVAs. In contrast, because the measures of cognitive empathy were significantly intercorrelated, a MANCOVA was conducted to test whether groups differed on tasks measuring cognitive empathy (BES self-report cognitive empathy, NimStim Affective Facial Recognition Task, Affective and Cognitive ToM tasks) after controlling for IQ. Significant MANCOVAs was followed by individual ANOVAs to determine which individual variables differed across groups and pairwise comparisons were used to determine differences between groups on the individual variables.

Finally, due to the very small group of youth showing the secondary variant identified in the LPA analyses, all hypotheses were also tested using CU traits and anxiety as continuous variables (again using the winsorized versions described above) in hierarchical regressions and testing for interaction effects between CU traits and anxiety on all measures of affective and cognitive empathy. Specifically, IQ was entered into the first step, sample mean-centered variables for CU traits and Anxiety were entered in the second step, and the multiplicative interaction term composed from centered variables for CU traits and Anxiety was entered in the third step. The amount of incremental variance accounted for at each successive step was tested for significance and any significant interaction was explored using the procedure recommended by Holmbeck (2002). In this procedure, the regression equation from the full sample is used to calculate predicted values of the dependent variable at both high (one SD above the mean) and low (one SD below the mean) levels of the predictors (CU traits and Anxiety). Further, the significance of the simple slopes testing the significance of the association of one predictor with the dependent variable at the different levels of the other predictor were also conducted.

Results

Descriptive Statistics

Descriptive statistics for all main study variables are presented in Table 1. In addition, results of correlation analyses between all main study variables are presented in Table 2. Total ICU score was significantly negatively correlated with both self-report measures of cognitive ($r = -.29$, $p < .01$) and affective ($r = -.34$, $p < .001$) empathy as well as significantly positively correlated with number of days spent in detention ($r = .22$, $p < .05$). RCADS Anxiety total was significantly positively associated with self-reported affective empathy ($r = .34$, $p < .001$) and significantly negatively associated with affective ToM ($r = -.22$, $p < .05$). IQ was significantly associated with all measures of cognitive empathy (*r's* ranging from .20 to .36).

Latent Profile Analysis

Profile Selection. Using Mplus (Muthen & Muthen, 2008), latent profile analysis (LPA;

Table 1. Descriptive Statistics of Main Study Variables

Measure	Mean / %	SD / N	Range
Age	15.50	1.30	8
Ethnicity (% African American)	79%	85	-
WASI IQ	82.19	8.33	38
Total Days Institutionalized	13.94	10.65	54
ICU Total	28.50	7.72	33
RCADS Anxiety Total	27.04	16.70	63
Dot Probe – Facilitation Index	-9.63	39.36	232.33
BES – Affective Empathy	30.10	6.94	37
BES – Cognitive Empathy	32.11	4.58	26
NimStim Affective Facial Recognition Task	28.52	4.58	23
Affective ToM	6.18	1.08	4
Cognitive ToM	5.42	1.06	4

Note. 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.

Lazarfeld & Henry, 1968) was conducted in order to classify participants on the following two variables: the total score from the ICU (Frick, 2004) and the total Anxiety score from the RCADS (Chorpita, et al., 2000). The results of the LPA analysis were not consistent with our hypothesis for a three class model, but instead a five class model appeared to fit the data best based on a combination of methods. Specifically, when looking at the methods for comparing the groups (see Table 3), the LMR test was only significant for the two class model, indicating the two class model was a better fit than a one class model for this sample. The AIC, BIC, and the SSA-BIC all showed modest increases as the class size went from two to three and then from three to four classes. Consistent with the increase in these indices the entropy value decreased from 0.81 to .70 as class size changed from two to three classes, and then to .71 as the class size changed from three to four classes. However, when comparing the four class model to the five class model, there was a decrease, albeit modest, in the AIC value and the SSA-BIC indicative of a better fitting model. In addition, the entropy value increased to 0.79 in the five class model. Finally, when comparing the five class model to a six class model, there was a modest increase in AIC and BIC values, and a small decrease (2.24) in the SSA-BIC value. The entropy value increased to .84 in the six class model indicating a better model fit; however, the size of class 4 in this model was very small (*n* = 4) and constituted less than 5% of the sample. Thus, this model was eliminated from further comparison. Across all models, the posterior probabilities for class membership were relatively high ranging from .80 to .95 (See Table 4). Ultimately, the five class model was selected over the two class model because the resulting classes allowed for interpretations that were consistent with the theoretical viewpoint set forth in our hypotheses. The five class model also produced similar values in SSA-BIC and entropy levels compared to the two class model... As an additional step, the first (*n* = 12) and fourth class (*n* = 41) within this five class model was merged into one class. This was due to the fact that both of these groups presented with low scores on both CU traits and anxiety that made them largely indistinguishable for the purposes of group comparisons in the current study.

Thus, the final model consisted of 4 groups (see Table 5). The first group (*n* = 53) was labeled "Low CU / Low Anx" because it showed significantly lower scores on CU traits (*M* = 24.50, *SD* = 5.43) than the second group (*M* = 36.33, *SD* = 3.60) and the fourth group (*M* = 36.10, *SD* = 3.70) but did not differ from the third group (*M* = 21.43, *SD* = 4.89). This group also had significantly lower scores on Anxiety (*M* = 23.54, *SD* = 8.93) than both the third (*M* = 53.64, *SD* = 6.61) and fourth (*M* = 50.80, *SD* = 9.16) groups but had significantly higher scores than the second group (*M* = 12.90, *SD* = 8.04). The second group (*n* = 30) labeled "primary", scored significantly higher on CU traits (*M* = 36.33, *SD* = 3.60) than the Low CU / Low Anx and the third group but did not differ from the fourth group. The primary variant also had significantly lower anxiety scores (*M* = 12.90, *SD* = 8.04) than all other three groups. The third group, labeled "Low CU / High Anx" (*n* = 14), scored significantly lower on CU traits (*M* = 21.43, *SD* = 4.89)

Table 2. Zero-order Correlations of Main Study Variables

	1	2	3	4	5	6	7	8	9	10	11
1. Age											
2. Ethnicity (African American)	.05										
3. WASI IQ	-.10	-.28**									
4. Total Days Institutionalized	.05	.15	-.12								
5. ICU Total	-.05	.07	-.03	.22*							
6. RCADS Anxiety Total	.10	.01	-.08	-.19†	-.17†						
7. Dot Probe Facilitation Index	.15	.01	-.07	-.09	-.09	-.16					
8. BES Affective Empathy	.05	-.20*	-.11	-.10	-.34***	.34***	.10				
9. BES Cognitive Empathy	.17†	-.05	.23*	-.13	-.29**	.16	-.10	-.01			
10. NimStim Facial Task	.14	-.16	.28**	.09	.00	-.10	-.27**	-.17	.36***		
11. Affective ToM	.06	-.12	.20*	.16	.13	-.22*	-.09	-.31**	.17	.34**	
12. Cognitive ToM	-.01	-.17	.36***	.14	.06	-.10	.05	-.15	.18	.32**	.39***

Note. *** = $p \leq .001$, ** = $p \leq .01$, * = $p \leq .05$, † = $p \leq .08$. 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.

Table 3. Fit Statistics for Latent Profile Models

	Statistic				
Model	**AIC**	**BIC**	**SSA-BIC**	**LMR**	**Entropy**
2 Class	560.75	579.46	557.34	19.46***	0.81
3 Class	563.30	590.03	558.43	3.23	0.71
4 Class	566.32	601.07	559.99	2.78	0.70
5 Class	***564.53***	***607.29***	***556.74***	***7.27***	***0.79***
6 Class	*563.75*	*614.53*	*554.50*	*6.32*	*0.84*

Note. *** = $p < .001$. AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; SAA-BIC = Sample size Adjusted BIC; LMR = Lo-Mendell-Rubin likelihood ratio test.

Table 4. Posterior Probabilities for Latent Profiles

	Class 1	*Class 2*	*Class 3*	*Class 4*	*Class 5*	*Class 6*
Model						
2 Class						
Class 1 (n = 24)	**.94**	.06				
Class 2 (n = 83)	.05	**.95**				
3 Class						
Class 1 (n = 55)	**.86**	.00	.14			
Class 2 (n = 22)	.00	**.93**	.07			
Class 3 (n = 30)	.13	.04	**.83**			
4 Class						
Class 1 (n = 10)	**.85**	.03	.04	.09		
Class 2 (n = 49)	.03	**.83**	.12	.02		
Class 3 (n = 33)	.02	.14	**.85**	.00		
Class 4 (n = 15)	.01	.06	.00	**.85**		
5 Class						
Class 1 (n = 12)	**.80**	.00	.00	.15	.05	
Class 2 (n = 30)	.00	**.88**	.01	.11	.00	
Class 3 (n = 10)	.00	.03	**.87**	.07	.04	
Class 4 (n = 41)	.03	.06	.01	**.87**	.02	
Class 5 (n = 14)	.00	.00	.02	.04	**.93**	
6 Class						
Class 1 (n = 41)	**.89**	.03	.03	.00	.03	.01
Class 2 (n = 30)	.09	**.89**	.00	.00	.00	.02
Class 3 (n = 13)	.04	.00	**.87**	.04	.00	.04
Class 4 (n = 4)	.00	.00	.02	**.93**	.06	.00
Class 5 (n = 11)	.07	.00	.00	.01	**.92**	.00
Class 6 (n = 8)	.00	.05	.00	.00	.00	**.95**

Table 5. Profile Variable Means and Standard Deviations

	Low CU / Low Anx *(n = 53)*	**Primary** *(n = 30)*	**Low CU / High Anx** *(n = 14)*	**Secondary** *(n = 10)*	**Test Statistic**	**Effect Size**
CU Traits						
ICU Total	24.50 (5.43)[a]	36.33 (3.60)[b]	21.43(4.89)[a]	36.10 (3.70)[b]	F (3, 103) = 58.14***	$\eta_p^2 = .63$
Anxiety						
RCADS Anxiety Total	23.54 (8.93)[a]	12.90 (8.04)[b]	53.64 (6.61)[c]	50.80 (9.16)[c]	F (3, 103) = 103.80***	$\eta_p^2 = .75$

Note. *** = $p \leq .001$. Means with different superscripts differ significantly in pairwise comparisons. CU = callous-unemotional; Anx = Anxiety; ICU = Inventory of Callous Unemotional Traits; RCADS = Revised Child Anxiety and Depression Scale.

than the primary and fourth group but did not differ from the Low CU / Low Anx group. In addition, the Low CU / High Anx group scored significantly higher on anxiety (M = 53.64, SD = 6.61) than the Low CU / Low Anx group and the primary variant. Finally, a small fourth group (n = 10), labeled "secondary" scored significantly higher on CU traits than the Low CU / Low Anx and Low CU / High Anx group, but did not differ from the primary variant. Further, the secondary variant scored significantly higher on anxiety than both the primary and Low CU / Low Anx group.

Next, the four groups were compared on the potential confounding variables of age, IQ, and days in detention using a series of ANOVAs. No significant differences between groups were found on age (F (3, 103) = 1.36, p = .26, η_p^2 = .04), IQ (F (3, 99) = 1.32, p = .27, η_p^2 = .04), or days in detention (F (3, 99) = 2.57, p = .06, η_p^2 = .07). A chi square analysis comparing the four groups on ethnicity was also non-significant (χ^2 (3) = 1.24, p = .74), φ = .11.

Comparison of Groups on Measures of Affective and Cognitive Empathy

As noted previously, given that the two measures of affective empathy were not significantly correlated with one another (r = .10, p = .35), two separate ANCOVAs

Table 6. Profile Differences in Affective Empathy Measures

	Low CU / Low Anx	Primary	Low CU / High Anx	Secondary	Test Statistic	Effect Size
	(n = 48)	*(n = 26)*	*(n = 13)*	*(n = 8)*		
Dot Probe Facilitation Index	-9.69 (39.88)	-4.49 (32.82)	-5.53 (38.89)	-40.55 (53.47)	F (3, 90) = 1.82	η_p^2 = .06
	(n = 52)	*(n = 27)*	*(n = 14)*	*(n = 10)*		
BES Affective Empathy	30.60 (5.98)[a]	27.25 (6.48)[b]	34.24 (8.32)[a]	31.75 (6.17)[ab]	F (3, 98) = 3.89**	η_p^2 = .11

Note. ** = $p \leq .01$. All analyses used the Wechsler Abbreviated Scale of Intelligence – Intelligence quotient (WASI IQ; Wechsler, 1999) as a covariate. Rates with different superscripts differ significantly in pairwise comparisons. CU = callous-unemotional; Anx = Anxiety; BES = Basic Empathy Scale.

(controlling for IQ) were conducted with the affective empathy measures as the dependent variables and using the four groups identified in the LPA (see Table 6). For the facilitation index to distress, the overall ANCOVA was not significant (F (3, 90) = 1.82, p = .15, η_p^2 = .06). However, consistent with hypotheses, the overall ANCOVA for the BES self-report affective empathy scale was significant (F (3, 98) = 3.89, p = .01, η_p^2 = .11). Post hoc pairwise comparisons revealed that the primary variant scored the lowest on affective empathy (M = 27.25, SD = 6.48) and differed significantly from both the Low CU / Low Anx (M = 30.61, SD = 5.98) and Low CU / High Anx group (M = 34.21, SD = 8.32). Contrary to hypotheses, the primary variant did not differ significantly from the secondary variant (M = 31.76, SD = 6.17) on self-report affective empathy, although there was a trend (p = .07) in this direction.

Next, a MANCOVA (controlling for IQ) was conducted comparing groups on measures of cognitive empathy (BES self-report cognitive empathy, NimStim Affective Facial Recognition Task, and Affective and Cognitive ToM tasks). As noted in Table 7, the overall MANCOVA was significant (multivariate F (12, 225) = 3.62, p < .001, η_p^2 = .14). Follow up

Table 7. Multivariate Analyses of Covariance for Measures of Cognitive Empathy

	Low CU / Low Anx		Primary		Low CU / High Anx		Secondary	
Variable	*(n = 49)*		*(n = 23)*		*(n = 13)*		*(n = 8)*	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Measures of Cognitive Empathy								
BES Cognitive Empathy	32.21[a]	3.47	31.24[ac]	3.36	37.24[b]	4.48	29.74[c]	5.18
NimStim Affective Facial Task	28.36	4.98	29.27	3.82	30.13	1.92	26.34	6.82
Affective ToM	6.15[a]	1.11	6.52[a]	0.85	5.90[ab]	1.26	5.36[b]	1.04
Cognitive ToM	5.19[a]	1.00	5.86[b]	1.01	5.66[b]	0.95	5.08[a]	1.36

Note. Effects are based on a multivariate analysis of covariance using Wilks' λ. All analyses used the Wechsler Abbreviated Scale of Intelligence – Intelligence quotient (WASI IQ; Wechsler, 1999) as a covariate. Means reported in the table are least-squared means adjusted for the covariates. Means with different subscripts differ at the $p < .05$ level in pairwise comparisons. Multivariate F (12, 225) = 3.62, $p < .001$, $\eta_p^2 = .14$; BES Cognitive Univariate F (3, 88) = 9.42, $p < .001$, $\eta_p^2 = .24$; NimStim Affective Facial Task Accuracy Univariate F (3, 88) = 1.36, $p = .26$, $\eta_p^2 = .04$; ToM Affective Univariate F (3, 88) = 2.63, $p = .05$, $\eta_p^2 = .08$; ToM Cognitive Univariate F (3, 88) = 3.10, $p < .05$, $\eta_p^2 = .10$.

ANCOVAs revealed a significant difference between groups on BES self-report cognitive empathy (univariate F (3, 88) = 9.42, $p < .001$, $\eta_p^2 = .24$), affective ToM (univariate F (3, 88) = 2.63, $p = .05$. $\eta_p^2 = .08$) and cognitive ToM (univariate F (3, 88) = 3.10, $p < .05$, $\eta_p^2 = .10$). The follow up ANCOVA for the NimStim affective facial recognition task was not significant (F (3, 88) = 1.36, $p = .26$, $\eta_p^2 = .04$).

For self-report cognitive empathy, post hoc pairwise comparisons revealed that, consistent with hypotheses, the secondary variant scored the lowest on cognitive empathy (M = 29.74, SD = 5.18); however, this was only significantly different from the Low CU/ Low Anx (M = 32.21, SD = 3.47) and the Low CU / High Anx (M = 37.24, SD = 4.48) groups. Contrary to hypotheses, the secondary variant did not score significantly lower than the primary variant (M = 31.24, SD = 3.36) on self-report cognitive empathy. For affective ToM, posthoc pairwise comparisons were consistent with hypotheses showing the secondary variant (M = 5.36, SD = 1.04) scored significantly lower than primary variant (M = 6.52, SD = 0.85). The secondary variant also scored significantly lower than the Low CU / Low Anx group (M = 6.15, SD = 1.11) but did not differ from the Low CU / High Anx group (M = 5.90, SD = 1.26). Finally, for cognitive ToM, post hoc pairwise comparisons were also consistent with hypotheses showing that the secondary variant (M = 5.08, SD = 1.36) scored significantly lower than the primary variant (M = 5.86, SD = 1.01) as well as the Low CU / Low High Anx group (M = 5.66, SD = 0.95), but did not differ from the Low CU / Low Anx group (M = 5.19, SD = 1.00).

To examine whether there were any significant differences between groups on accuracy for specific facial expressions on the NimStim affective facial recognition task, a MANCOVA (controlling for IQ) was conducted comparing groups on accuracy for all six facial expressions (happy, angry, fearful, disgust, neutral, and sad). As noted in Table 8, the overall MANCOVA

Table 8. Multivariate Analyses of Covariance for NimStim Affective Facial Task

	Low CU / Low Anx		**Primary**		**Low CU / High Anx**		**Secondary**	
Variable	*(n = 47)*		*(n = 24)*		*(n = 13)*		*(n = 7)*	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
NimStim Affective Facial Accuracy								
Happy Accuracy	5.74	0.44	5.88	0.34	5.92	0.00	6.01	0.28
Angry Accuracy	4.22	1.07	4.38	1.24	4.60	1.12	4.95	0.90
Fearful Accuracy	4.56	1.60	5.21	1.02	4.44	1.20	4.67	1.90
Disgust Accuracy	5.40[a]	1.06	4.84[a]	1.49	5.69[a]	0.48	4.04[b]	1.63
Neutral Accuracy	5.24	1.01	5.25	1.03	5.60	0.51	5.25	1.07
Sad Accuracy	4.00	0.91	3.96	0.81	3.93	0.64	4.13	1.21

Note. Effects are based on a multivariate analysis of covariance using Wilks' λ. All analyses used the Wechsler Abbreviated Scale of Intelligence – Intelligence quotient (WASI IQ; Wechsler, 1999) as a covariate. Means reported in the table reflect number of correct identifications and least-squared means adjusted for the covariates. Means with different subscripts differ at the $p < .05$ level in pairwise comparisons. The *n*'s in the table reflect the group sizes for the multivariate analysis and different group sizes for individual univariate tests are listed below. Multivariate F (18, 230) = 1.48, $p = .10$, $\eta_p^2 = .10$; Happy Accuracy Univariate F (3, 94) = 1.23, $p = .30$, $\eta_p^2 = .04$, (n = 99); Angry Accuracy Univariate F (3, 96) = 0.67, $p = .57$, $\eta_p^2 = .02$, (n = 101); Fearful Accuracy Univariate F (3, 97) = 1.59, $p = .20$, $\eta_p^2 = .05$, (n = 102); Disgust Accuracy Univariate F (3, 95) = 4.70, $p < .01$, $\eta_p^2 = .13$, (n = 100); Neutral Accuracy Univariate F (3, 95) = 1.48, $p = .23$, $\eta_p^2 = .05$, (n = 100); Sad Accuracy Univariate F (3, 93) = 0.83, $p = .97$, $\eta_p^2 = .003$, (n = 98).

was not significant (Multivariate F (18, 230) = 1.48, p = .10, η_p^2 = .10). Follow-up individual ANCOVAs were also conducted separately for accuracy on all six facial expressions given that not all of the facial accuracy scores for the six expressions were correlated with one another (*r's* ranging from .01 to .32). However, these analyses should be interpreted cautiously, given the lack of significant effects in the MANCOVA. Disgust recognition accuracy was the only emotional recognition measure that differed significantly between groups (F (3, 95) = 4.70, p = .01, η_p^2 = .13). Post hoc pairwise comparisons revealed that the secondary variant scored significantly lower (M = 4.04, SD = 1.63) on disgust recognition accuracy compared to all three groups [primary variant (M = 4.84, SD = 1.49); Low CU / Low Anx (M = 5.40, SD = 1.06); Low CU / High Anx (M = 5.69, SD = 0.48)].

Hierarchical Regression Analyses

With the exception of the analysis using the emotional pictures dot-probe task, the results of the group comparisons were generally in the expected direction, with the primary variant showing the lowest levels of affective empathy and the secondary variant showing lower levels of cognitive empathy. However, many of the pairwise comparisons did not reach statistical significance, possibly due to the relatively small number of youth who fell into this group (n = 10). Thus, a series of hierarchical regressions (controlling for IQ) were conducted testing the interaction between CU traits and Anxiety for predicting measures of affective and cognitive empathy.

The results of these analyses for the affective empathy variables are reported in Table 9. For the facilitation index to distress there was a trend for a main effect of Anxiety (β = -.20, p = .06), but no interaction, indicating lower levels of anxiety were associated with higher levels of facilitation to distress. For self-report affective empathy, there were main effects of both CU

Table 9. Hierarchical Regression Analyses with Callous Unemotional Traits and Anxiety as Predictors of Affective Empathy Measures

	Affective Empathy Measures					
	Dot Probe Facilitation			*BES Affective Empathy*		
	β	R^2	ΔR^2	β	R^2	ΔR^2
WASI IQ	-.07			-.10		
		.01			.01	
ICU	-.12			-.27**		
Anxiety	-.20†			.28**		
		.05	.04		.19	.18***
ICU X Anxiety	-.16			-.11		
		.07	.02		.20	.01

Note. *** = $p \leq .001$, ** = $p \leq .01$, † = $p = .06$. All predictors were centered using sample means prior to entering them into regression analyses. WASI IQ = Wechsler Abbreviated Scale of Intelligence – Intelligence quotient; ICU = Inventory of Callous Unemotional Traits; BES = Basic Empathy Scale.

traits (β = -.27, p < .01) and Anxiety (β = .28, p < .01) that accounted for 18% of the variance but no interaction. This pattern of findings indicate that higher levels of CU traits were associated with lower levels of self-report affective empathy but higher levels of Anxiety were associated with higher levels of self-reported affective empathy.

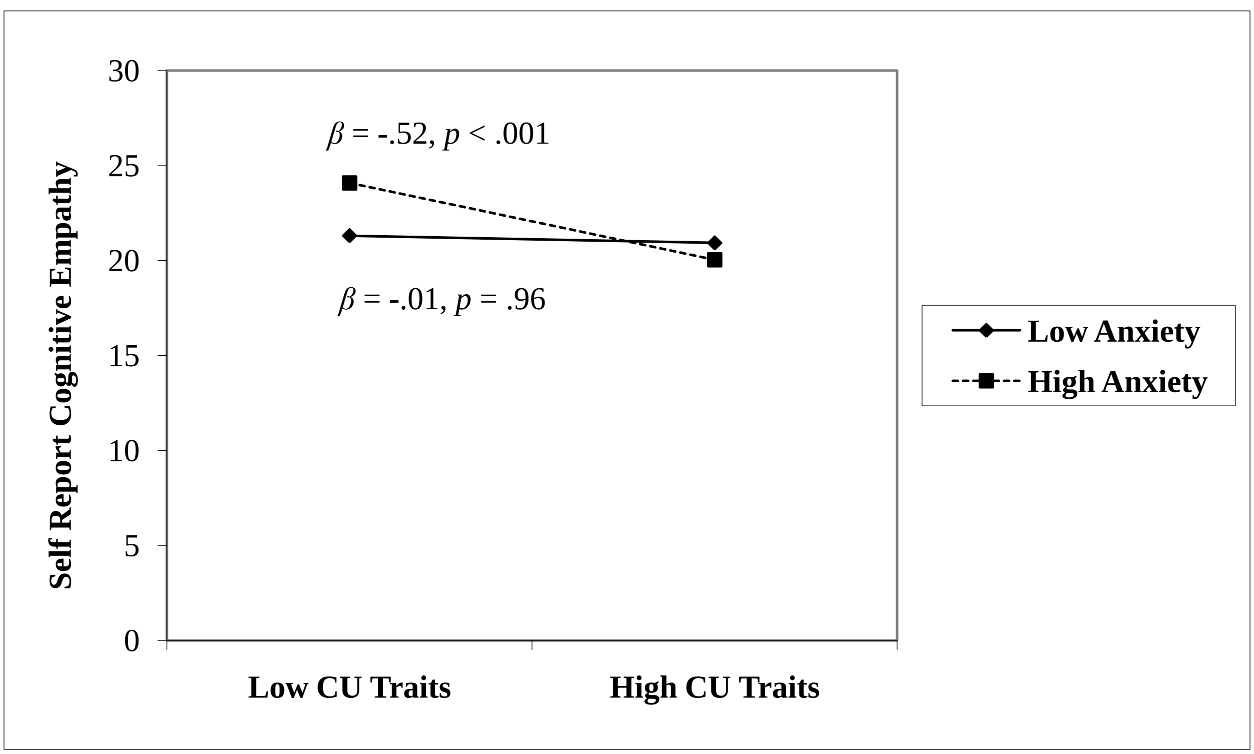
Table 10 summarizes the results of the hierarchical regressions testing the interaction between CU traits and anxiety on cognitive empathy measures. For self-report cognitive empathy there was a significant main effect of CU traits (β = -.27, p < .01) and a significant interaction between CU traits and Anxiety (β = -.28, p < .01). The form of this interaction was explored and reported in Figure 1. As reported in this figure, there was a non-significant association between CU traits and self-reported cognitive empathy at low levels of anxiety (β = -.01, p = .96). However, there was a significant negative association between CU traits

Table 10. Hierarchical Regression Analyses with Callous Unemotional Traits and Anxiety as Predictors of Cognitive Empathy Measures

	Cognitive Empathy Measures											
	BES Cognitive Empathy			*NimStim Facial Accuracy*			*Affective ToM*			*Cognitive ToM*		
	β	R^2	ΔR^2	β	R^2	ΔR^2	β	R^2	ΔR^2	β	R^2	ΔR^2
WASI IQ	.23**			.27**			.19†			.36***		
		.05			.08			.04			.13	
ICU	-.27**			-.002			.09			.03		
Anxiety	.13			-.10	.08	.01	-.20*			-.07		
		.16	.10**					.09	.05†		.14	.01
ICU X Anxiety	-.28**			-.14	.11	.02	-.12			-.20*		
		.24	.08**					.11	.01		.18	.04*

Note. ** = $p \leq .01$, * = $p \leq .05$, † = $p \leq .08$. All predictors were centered using sample means prior to entering them into regression analyses. WASI IQ = Wechsler Abbreviated Scale of Intelligence – Intelligence quotient; ICU = Inventory of Callous Unemotional Traits; BES = Basic Empathy Scale; ToM = Theory of Mind.

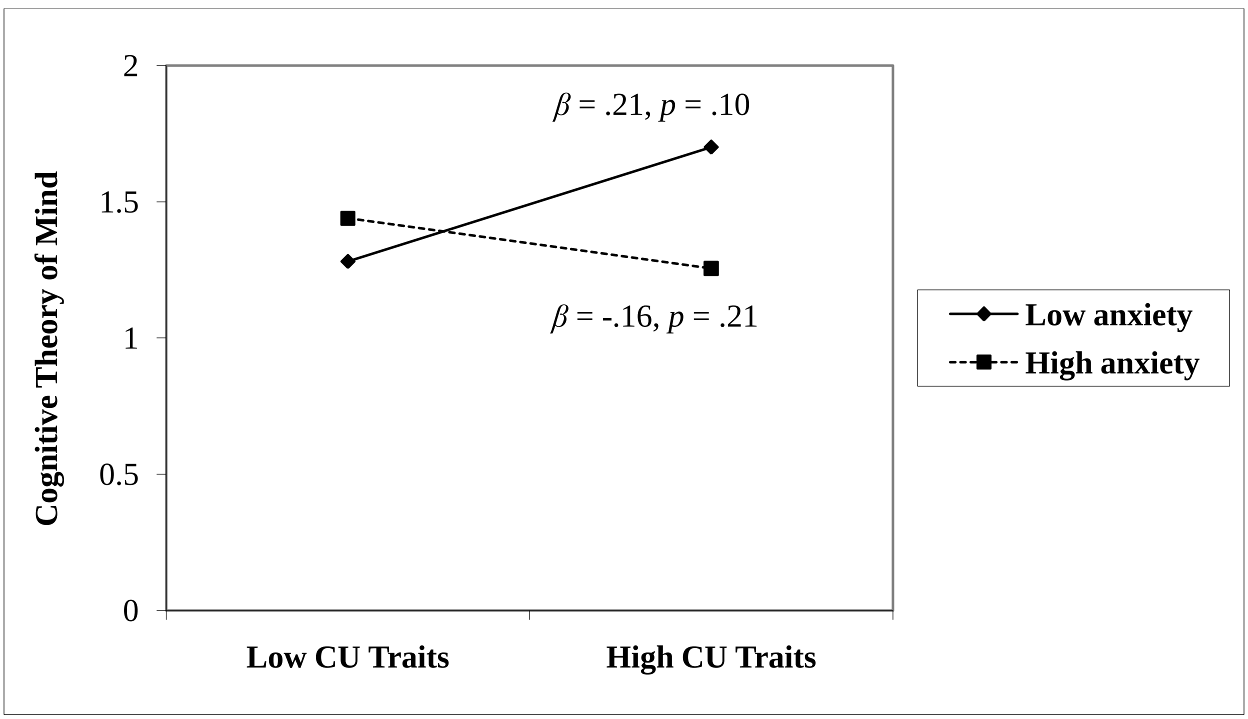
Figure 1. Interaction between self-report cognitive empathy and callous-unemotional traits at high and low levels of anxiety.



and self-reported cognitive empathy at high levels of anxiety (β = -.52, $p < .001$).

For affective ToM, there was a significant main effect of Anxiety (β = -.20, $p < .05$) but no significant interaction. However, for cognitive ToM there was a significant interaction between CU traits and anxiety (β = -.20, $p < .05$). This interaction was explored and the results are reported in Figure 2. There was a negative but non-significant association between CU traits and cognitive ToM at high levels of anxiety (β = -.16, p = .21) and there was a trend for a positive association between CU traits and cognitive ToM at low levels of anxiety (β = .21, p = .10).[1] There were no significant main effects or interactions for the regression analyses of the overall NimStim affective facial recognition task.

Figure 2. Interaction between cognitive theory of mind and callous-unemotional traits at high and low levels of anxiety.



[1] When this analysis was run using two SD above and below the mean, the result indicated there was a non-significant negative trend between CU traits and cognitive ToM at high levels of anxiety (β = -.34, p = .08). However, there was a significant positive association between CU traits and cognitive ToM at low levels of anxiety (β = .40, $p < .05$).

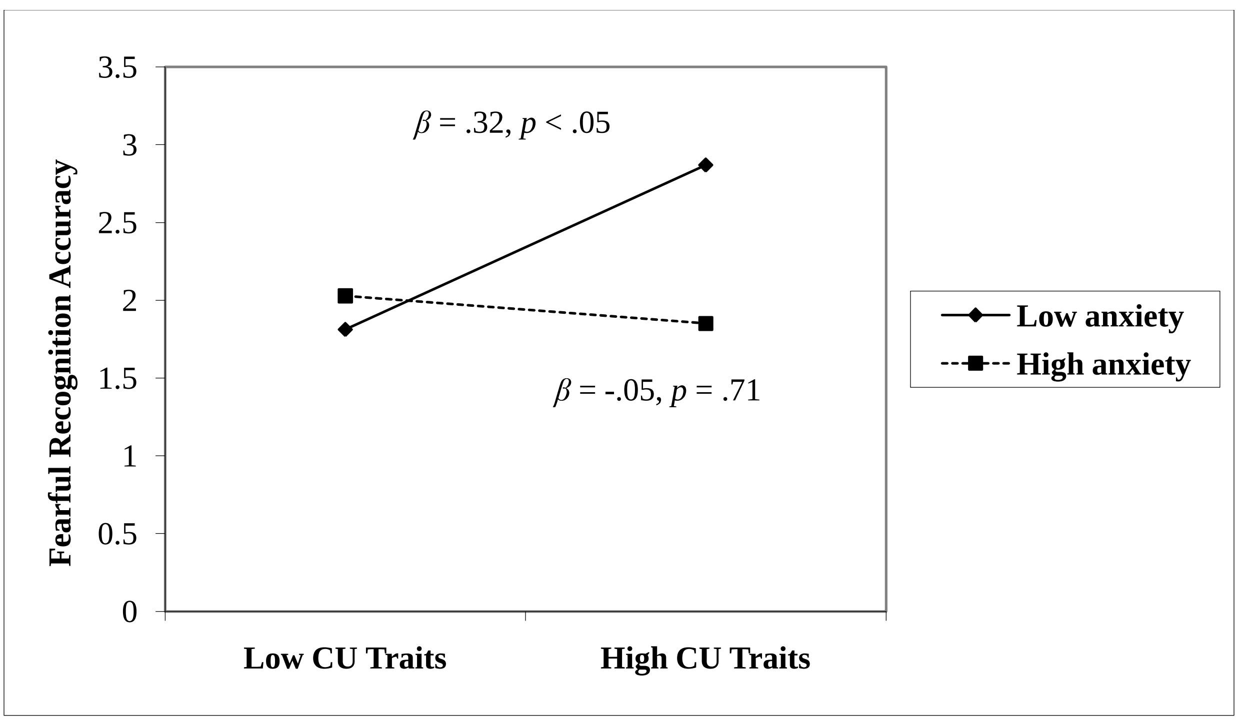
Table 11. Hierarchical Regression Analyses with Callous Unemotional Traits and Anxiety as Predictors of Facial Accuracy

	NimStim Affective Facial Task Accuracy																	
	Happy			***Angry***			***Fearful***			***Disgust***			***Neutral***			***Sad***		
	β	R^2	ΔR^2	β	R^2	ΔR^2	β	R^2	ΔR^2	β	R^2	ΔR^2	β	R^2	ΔR^2	β	R^2	ΔR^2
WASI IQ	.00			.22*			.15			.13			.22**			.01		
		.00			.05			.03			.02			.05			.00	
ICU	.05			.04			.13			-.20*			-.14			-.00		
Anxiety	.07			-.06			-.11			-.07			-.07			-.04		
		.01	.01		.05	.00		.06	.03		.07	.04		.07	.02		.00	.00
ICU X Anxiety	-.01			-.14			-.20*			-.18†			-.10			.06		
		.01	.00		.08	.02		.10	.04*		.10	.03†		.08	.01		.01	.00

Note. ** = $p \leq .01$, * = $p \leq .05$, † = $p = .07$. All predictors were centered using sample means prior to entering them into regression analyses. WASI IQ = Wechsler Abbreviated Scale of Intelligence – Intelligence quotient; ICU = Inventory of Callous Unemotional Traits

Finally, a series of hierarchical regressions were conducted testing the interaction between CU traits and Anxiety for predicting the accuracy of the six sets of facial expressions (Table 11). Results showed there was a significant interaction for CU traits and Anxiety on fear recognition accuracy ($\beta = -.20$, $p < .05$). The form of this interaction was explored and provided in Figure 3. There was a non-significant negative association between CU traits and fear recognition accuracy at high levels of anxiety ($\beta = -.05$, $p = .71$). However, there was a significant positive association between CU traits and fear recognition at low levels of anxiety ($\beta = .32$, $p < .05$). There was also a significant main effect of CU traits ($\beta = -.20$, $p < .05$) and a trend for significance for an interaction between CU traits and anxiety ($\beta = -.18$, $p = .07$) on disgust recognition accuracy. There were no significant main effects or interactions for the other four facial expressions.

Figure 3. Interaction between fearful recognition accuracy and callous-unemotional traits at high and low levels of anxiety



Discussion

The current study examined whether a sample of detained adolescents could be disaggregated into two distinct groups, consistent with past research on primary and secondary variants of psychopathy in adults (Skeem et al., 2003) and CU traits in adolescents (Kahn et al., 2013). The study also sought to determine a possible explanation for the lack of empathy among youth in the secondary variant by examining whether they differ from primary variants on measures of cognitive and affective empathy. Latent profile analysis identified four groups of youth that differed on levels of CU traits and anxiety. Two distinct groups of youths emerged that were high on CU traits and differed as predicted on anxiety reflecting a primary (low anxiety) and secondary (high anxiety) CU variant; two additional groups were identified that were both low on CU traits but differed on levels of anxiety (Low CU / High Anx vs. Low CU / Low Anx).

Consistent with predictions, the secondary variant demonstrated the lowest levels of cognitive empathy on both self-report and computerized tasks, but the group comparisons for the primary and secondary variant were only significant on measures of affective and cognitive ToM and disgust recognition accuracy. In contrast, the primary variant demonstrated the lowest levels of self-report affective empathy. However, these levels were not significantly different than those exhibited by the secondary variant, suggesting that both primary and secondary variants may demonstrate relatively similar deficits in affective empathy. While these results for affective empathy deficits across the primary and secondary variant are inconsistent with our hypotheses, they are aligned with past research that has consistently found evidence for affective empathy deficits across youth with high levels of CU traits (Chabrol et al., 2011; Dadds et al., 2009; Dadds et al., 2012; Jones et al., 2010; Pardini & Byrd, 2012; Pardini et al., 2003).

Analyses of CU traits and anxiety in continuous form produced a mostly consistent pattern of results. A significant interaction between CU traits and anxiety in predicting cognitive empathy measures suggested that those youth high on CU traits and high on anxiety demonstrate lower levels of self-reported cognitive empathy. In addition, an interaction predicting cognitive ToM demonstrated that those youth high on CU traits and low on anxiety tended to score higher on a measure of cognitive ToM. However, the slope for this interaction only became significant at two standard deviations. These results were consistent with the hypothesis that youth in the secondary variant would exhibit more deficits than those in the primary variant on tasks assessing cognitive empathy, suggesting overall that youth in the primary variant may demonstrate fewer difficulties in perspective-taking as it relates to the understanding or attribution of another's mental state.

Building upon previous work examining primary and secondary variants, the current study extends existing knowledge about the type of empathy deficits that may lead to the development of CU traits. Specifically, these results suggest both primary and secondary variants may exhibit similar deficits in affective empathy, but that secondary variants may also exhibit deficits in cognitive empathy and perspective-taking that are not present in primary variants. Although the link between CU traits with abuse and trauma was not tested directly in the current study, this link has been consistently documented in past research (see Kimonis et al., 2012; Sharf et al., 2014). The current results build on this past work by suggesting that this abuse and trauma experienced by the secondary group 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 (Pollak, 2008; Masten et al., 2008; Shackman, Shackman, & Pollak, 2007; Shields & Cicchetti, 1998). Thus, persons in the secondary group may dedicate less cognitive resources to non-threat related emotions, such as distress in others, leading to problems in their perspective-taking. Consistent with this possibility, compared to children without a history of maltreatment, maltreated children are less accurate at identifying emotional facial expressions (Camras, Grow, & Ribordy, 1983; Camras et al., 1990; During & McMahon, 1991; Pears & Fisher, 2005) and often show problems in emotion regulation that interfere with perspective-taking (Pollak, 2008; Shields & Cicchetti, 1998) and empathy (Straker & Jacobson, 1981; Main & George, 1985).

Findings for the current study may also help explain the mixed results in past research that have examined the association between CU traits and performance on measures of cognitive empathy or perspective-taking. 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 (Dadds et al., 2009) or self-reports of perspective-taking (Chabrol et al., 2011; Pardini et al., 2003). At the same time, studies using similar tasks of emotion recognition (Schwenck et al., 2012; Dadds et al., 2012) or cognitive perspective-taking (Anastassiou-Hadjicharalambous & Warden, 2008; Cheng et al., 2012; Jones et al., 2010) found youth high on CU traits did not show deficits in cognitive empathy. These studies did not account for the heterogeneity within this secondary subgroup of adolescents nor measure the comorbid influence of anxiety, which could account for the conflicting findings in the research.

The current study also found a significant interaction between CU traits and anxiety in the prediction of fear recognition accuracy. This interaction suggested that those youth who are high on CU traits, but low on anxiety, demonstrate higher accuracy for recognition of fearful facial expressions. A large body of research has found links between high levels of CU traits and abnormalities in emotional processing (see Frick et al., 2014 for a review). Evidence from this line of research has consistently shown that youth with CU traits exhibit reduced emotional reactivity or arousal to distress cues and emotional pictures/words (Blair et al., 1999; Kimonis et al., 2006; Loney et al., 2003; Sharp, Van Goozen, & Goodyer, 2006). However, the research examining the association between CU traits and affective facial recognition has produced more mixed results. For example, some studies have found an association between CU traits and deficits in fear recognition (Blair & Coles, 2000; Blair, Colledge, Murray, & Mitchell, 2001) whereas others have not (Loney et al., 2003; Woodworth & Waschbusch, 2008). Deficits in the recognition of other emotions have not been consistently found, although one study reported that CU traits were negatively associated with disgust recognition deficits (Sylvers, Brennan, & Lilienfeld, 2011).

Results from the current study add to previous research on emotional recognition and suggest that any deficits in facial recognition, particularly fear and disgust, may be specific to youth with CU traits who also have high levels of anxiety (i.e., secondary variant). In contrast, the current results revealed that CU traits were positively related to fear recognition accuracy with the primary group scoring the highest on fear recognition accuracy. These results indicate youth with high levels of CU traits and low levels of anxiety (i.e., primary variant) may actually be more accurate than other detained youth in recognizing fearful expressions. In other words, youth in the primary variant may be more adept at recognizing fear in others despite their reduced emotional reactivity when to viewing fear or distress in others (Blair et al., 2004; Cheng et al., 2012; Kimonis et al., 2006). This is consistent with early theoretical work proposing low fear or deficient emotional response to aversive stimuli as the underlying core deficit in psychopathy (Lykken, 1957). Further, the success in the recognition of fearful expressions is consistent with Cleckley's early work, which suggests that individuals with psychopathic traits may 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).

Limitations

Several limitations qualify these results. First, the sample size for the secondary variant (n = 10) was relatively small for group comparisons and this may have attenuated our ability to detect significant group differences in post hoc comparisons. In addition, recent research on primary and secondary variants in a community sample also found low base rates for a secondary variant (Humayun, Kahn, Frick, & Viding, 2014) and this variant also tends to make up smaller portions of the population in forensic samples as well (e.g., Kimonis et al., 2012). These lower rates of the secondary variant suggest that the development of CU traits within this variant may reflect a more atypical developmental pathway, at least within these types of settings. A second limitation in the current study is that we examined only adolescents who were arrested and being held at a secure detention facility prior to adjudication. The use of a detained population allowed for a sample of youth with higher levels of CU traits, but may limit the generalizability of the results to non-detained youth populations. Thus, future research should replicate these findings in clinic-referred and community samples as well as with children prior to adolescence in order to gain a broader understanding of the developmental sequence of empathy and the role it plays in the development of CU traits.

This latter recommendation is especially important given that the accuracy of cognitive empathy or perspective-taking skills appears to improve with age. For instance, the development of advanced perspective-taking skills only begins to solidify in ages 9 to 11 (Baron-Cohen et al., 1999). In addition, performance on measures of facial recognition specifically, indicate an increase in accuracy starting somewhere between the ages of 11 (Tonks et al., 1997) to 13 years old (Kolb et al.1992). These critical periods in the development of cognitive empathy or perspective-taking skills may be important to consider in future research in the selection of age ranges for the participants as well as their association in the development of CU traits. Indeed, Dadds and colleagues (2009) found that youth with CU traits may be more likely to exhibit deficits in cognitive empathy prior to age 9 but these deficits appear to diminish with age. While, these effects could be due to critical periods of development in these skills, it is also possible that youth with CU traits experience delays in the development of perspective-taking skills due to their deficits in affective empathy. This theory would be consistent with developmental models of empathy that suggest cognitive empathy arises and develops out of affective experiences or affective empathy (Singer, 2006; Hoffman, 1984). However, this would not explain why the secondary group would continue to have deficits or delays in the development of cognitive empathy or perspective-taking skills into adolescence. It may be that difficulties in emotion regulation within this group play a role in maintaining these perspective-taking deficits over time.

It may also be important to consider the role of gender in the development of CU traits, especially with regard to the role it plays in these distinct developmental pathways. Prior research in empathy development (e.g., Hoffman, 1977; Zahn-Waxler, Robinson, & Emde, 1992) as well as CU traits (e.g., Dadds et al., 2009) suggests that girls may differ from boys in their levels of empathy and CU traits. For instance, in studies of children and adolescents, girls tend to score higher on empathy on self-reports (de Wied et al., 2007; Mestre, Samper, Dolores, & Tur, 2009), parent reports (Auyeung et al., 2009) or a combination of parent report and laboratory task involving emotional videos (Strayer & Roberts, 2004). At the same time, levels of CU traits tend to be lower in girls (e.g., Essau et al., 2006; Sevecke, Kosson, & Krischer, 2009) and research on emotion recognition in girls with CU traits has been mixed with some research suggesting deficits in the recognition of sad facial expressions (Fairchild et al., 2010) and others showing enhanced fear recognition (Schwenck, Gensthaler, Romanos, Freitag, Schneider, & Taurines, 2014). In addition, Dadds and colleagues (2009) found that high levels of CU traits in girls were not associated with deficits in affective empathy, but primarily related to deficits in cognitive empathy. These differences in levels of CU traits and types of empathy deficits among girls with CU traits suggest gender may be an important factor when investigating developmental pathways of these traits. Further, other research has shown that the strength of genetic and environmental effects on CU traits may vary across gender (Fontaine, Rijsdijk, McCrory, & Viding, 2010) with shared environmental factors largely accounting for membership in a stable high CU trajectory for girls and heritability largely accounting for membership in this group for boys (Fontaine et al., 2010). Additionally, outcomes of children with CU traits have been shown to differ to some degree for boys and girls (Javdani, Sadeh, & Verona, 2011; Wymbs et al., 2012). For example, CU traits in adolescent girls were associated with lower risk for suicide attempts (Javdani et al., 2011) as well as lower risk for recurrent alcohol, marijuana, and substance use impairment compared to boys with similar levels of these traits (Wymbs et al., 2012). Taken together, these differences in trajectories and outcomes between boys and girls with CU traits suggest future research should continue to explore potential gender differences within primary and secondary pathways.

An additional limitation of the current study involves the computerized task of emotional reactivity (Emotional Pictures Dot-Probe Task) used to assess affective empathy. Although the findings were non-significant, the pattern of findings for the facilitation index to distress on this task were in contrast with previous research showing that the primary variant exhibits more deficits in facilitation to distress compared to the secondary variant (e.g., Kimonis et al., 2012).

In the current sample, the secondary variant had the slowest response times (indicative of worse facilitation) compared to the other groups. This divergence in findings may again be due, in part, to the small number of youth in the current sample who were identified in the secondary variant (n = 10). In addition, past research using the emotional pictures dot-probe task (e.g., Kimonis et al., 2012) has used a measure of abuse/trauma to distinguish secondary variants from primary variants. Since the current study did not assess for exposure to abuse or trauma, this may have played a role in our divergent findings for this task.

Conclusions

Within the context of these limitations, the results support past research suggesting that youths high on CU traits fall into two distinct variants (i.e., primary and secondary). The unique contribution of the current study are the findings that these variants may demonstrate different levels of cognitive empathy and associated perspective-taking abilities, but show similar deficits in affective empathy. Thus, the secondary variant demonstrates deficits across both cognitive and affective empathy, while the primary variant shows deficits largely related to affective empathy. These differences in cognitive empathy deficits are consistent with past research and theory (e.g., Kimonis et al., 2012; Skeem et al., 2003), suggesting that there may be distinct etiological pathways for each group. Specifically, the development of CU traits in the secondary variant may result from problems in emotional and behavioral regulation that could be the result of experiencing abuse and other trauma early in development (Kimonis et al., 2012). Emotional deficits in the primary variant, on the other hand, may be related to low levels of emotional reactivity that can interfere with the development of the affective components of conscience, such as affective empathy and guilt (Kimonis et al., 2012).

These presumed differences in etiologies and empathy deficits between the two CU variants are important for developing hypotheses about targeted interventions for youth with these traits. A growing body of research indicates that intensive treatment can successfully reduce severe conduct problems and aggression in youth with CU traits (Kolko & Pardini, 2010; Waschbusch, Carrey, Willoughby, King, & Andrade, 2007). It is possible that even greater gains can be made if treatments are tailored to the unique characteristics of the CU variants demonstrated in this and previous studies. For example, research suggests that cognitive-behavioral interventions may be effective treatment for internalizing problems (e.g., anxiety, depression, and anger) and related trauma histories that distinguish secondary variants (e.g., Kimonis et al., 2012; Kahn et al., 2013). As a result, these treatments may also be beneficial for those in the secondary group. In addition, considering the current study found evidence for deficits in cognitive empathy and perspective-taking skills in this group, this may be an important area to target for secondary variants within treatment or intervention paradigms. For the primary variant, prior research has shown that these youth respond positively to reward-only behavioral treatment (e.g., Hawes & Dadds, 2005). Results from the current study suggest that treatments or interventions may also benefit from taking into consideration the deficits in emotional reactivity among these youth while capitalizing on their potential strengths in perspective-taking. In summary, recent years have brought about several promising interventions for youths with CU traits. Accounting for the heterogeneity among youth with CU traits, including these differences in cognitive empathy and perspective-taking, could help to enhance these intervention efforts and allow treatment to be tailored more to the individual needs of the youth.

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