Emotion Recognition, Emotion Regulation, and Callous-Unemotional Traits in Incarcerated Male Youth

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ABSTRACT

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Youth with Callous-Unemotional (CU) traits represent an important subgroup of antisocial youth whose behavioral, affective, and cognitive functioning appear sharply different from other youth with conduct problems. However, few, if any studies have examined the interaction of cognitive control and emotion recognition among youth with CU traits, an important aspect of anti-social behavior. The current study examined the performance of adolescent males with Callous-Unemotional (CU) traits using an *Emotional Go/Nogo* task (EGNG), a measure of emotion recognition, cognitive control, and emotional regulation, with a specific focus on the recognition and regulation of responses to negative facial expressions.

Participants included 268 male, sentenced or detained youth (ages 16-18 years), from a large correctional facility in New York City. On the EGNG, youth were presented with a series of facial expressions (angry, happy, sad, fearful, and neutral) and were asked to respond to a particular facial expression (“Go” trials) while inhibiting their response to a neutral expression (“Nogo” trials), or vice versa. CU traits were measured via the *Inventory of Callous-Unemotional Traits* (ICU), a 24-item self-report instrument assessing levels of Callousness, Uncaring, and Unemotional traits.

With regard to the main research question, emotion recognition, results indicated that this sample of antisocial youth with CU traits did not demonstrate deficits in recognizing fear or any other emotion faces in the EGNG task. However, youth with higher CU traits appeared more

susceptible to emotional interference from negative emotional faces (Fear, Angry, Sad), evidencing difficulties in both behavioral inhibition and emotional reactivity within these conditions. In addition, analyses revealed unpredicted associations among EGNG performance, reading level, and race/ethnicity, suggesting a role of cultural, contextual, and individual level factors influencing emotional regulatory ability in these youth.

Compared to studies that have examined the ability to label fearful affect, these findings suggest that discriminating fear from neutral faces may not be as deficient in youth with CU traits as previously reported. This is consistent with research that has found that CU traits may improve adolescents' ability to label the expression of fear and may facilitate antisocial behavior. Importantly, this study highlights the utility of examining CU traits in antisocial youth, and has important theoretical and clinical implications. Future research should continue to examine the regulation of responses to fear and other negative emotions in youth with CU traits, as well as relationships among these variables and behavioral characteristics (e.g., propensity to violence).

Table of Contents

List of Tables

List of Figures

Acknowledgments

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Dedication

To all the youth at Rikers Island Correctional Facility:

Your strength, honor, and courage will forever remain an inspiration.

malum quidem nullum esse sine aliquo bono.

Chapter I

Introduction

Juvenile antisocial and delinquent behaviors represent a major issue in the United States, with parties responsible for treating these youth extending beyond the justice system to encompass public health, mental health, and educational sectors. However, youth offenders are not a homogeneous group, making treatment aimed at the general population of offenders difficult (Frick & Viding, 2009; Moffitt, 1993). In efforts to effectively delineate subgroups of antisocial youth to aid with treatment and prevention, most classification systems have focused on the behavioral or personality dimensions of antisocial behavior and group youth according to the variety of symptoms they exhibit, risk factors, age of onset, and the trajectory of behavior (Cottle, Lee, & Heilbrun, 2001; Dodge & Pettit, 2003; Moffitt, 1993; Raine, 2002). However, classifying individuals solely on behavioral traits, personality outcomes, or risk factors has proven to be problematic, as it not only ignores possible differential pathways concerning the unique development of each of these outcomes, but also the implications for treatment that these pathways hold.

In the past decade, research aimed at better understanding the development of severe antisocial behavior in youth has led many psychologists to begin extending adult concepts of this behavior to children, namely, the concept of psychopathy (Frick & Ellis, 1999). Of note, a particular aspect has emerged in the literature that may more clearly differentiate behavior patterns of antisocial youth from an early age: the presence of Callous and Unemotional (CU) traits (Frick & White, 2008; Lynam, 1996; Viding, Blair, Moffitt, & Plomin, 2005). Briefly, CU traits are defined as a “lack of guilt, lack of empathy, and a callous use of others for one’s own gain” (Frick & White, p. 359). To date, there is a growing literature that indicates that youth with

CU traits represent an important subgroup of antisocial youth whose behavioral, cognitive, and affective functioning appear sharply different from other youth with conduct problems (Frick & Dickens, 2006; Salekin, 2008). These youth show a more severe, stable, and aggressive pattern of antisocial behavior, and similar to their adult counterparts, youth with CU traits tend to respond less well to typical intervention. However, to date, there has been limited research examining treatment for these youth (Frick, 2004; Salekin, 2010).

Given this, research aimed at understanding the pathways that can lead to the development of CU traits has clear implications for intervention (Frick, 2006; Blair, 2005; Woodworth & Waschbusch, 2007; White & Frick, 2010). In particular, studies examining the specific neurocognitive impairments seen in youth with CU traits and the possible reasons for these impairments have the potential to influence more focused prevention and intervention efforts aimed at reducing adolescent offending behavior, as well as lend insight into the assessment and interpretation of emotional development and its role in delinquency (Viding, McCrory, Blakemore, & Frederickson, in press). Along these lines, a body of evidence is emerging that suggests that youth with CU traits differ from youth without CU traits in the ability to recognize and process emotions, particularly fear and sadness (Marsh & Blair, 2008; Frick, 2009). In addition, there is evidence to indicate that individuals with psychopathy and CU traits present with difficulties on tasks requiring cognitive control, such as inhibition of a behavioral response (Blair, 2005; Budhani & Blair, 2005; Roussy & Toupin, 2000). However, the majority of the extant studies have used community samples of youth with a large age range (e.g., 10-18 years) and varying levels of antisocial behavior. Further, few, if any studies have examined the influence of cognitive control on antisocial behavior, or the interaction between emotional regulation and cognitive control.

This paper aims to first describe the general population of antisocial youth in the United States and need for research into effective interventions for these youth, as they are often underserved within both the justice system and community. It will then provide an outline of the various methods that researchers have used to subtype antisocial youth, as well as risk factors related to various aspects of their behavior from both the juvenile justice and psychological literature. The paper will then briefly outline and define the development of the concept of psychopathy, its extension to CU traits, and their importance in delineating within antisocial youth a more serious subgroup. Following this, this paper will outline the Integrated Emotion Systems Model (IES; Blair, 2006), a cognitive neuroscience theoretical model proposed to explain the emergence of psychopathy and CU traits, and the current empirical literature in support of this model from studies using children and adolescents from both community and juvenile offending samples. The IES posits that CU traits are likely due to abnormalities within the amygdala and prefrontal cortex, and that dysfunction in these areas leads to deficits in emotion processing, emotional learning, the processing of punishment, and socialization (Blair, 2006). Specifically, these sections will focus on youths' abilities to recognize emotions, process emotional stimuli, use punishment information to guide behavior, and inhibit behavioral responding. Lastly, this paper will discuss a study that examined the role of CU traits in emotion recognition and inhibition in a sample of incarcerated male adolescents from Rikers Island Correctional Facility in New York. Directions for future research and implications for prevention and intervention will be discussed.

Juvenile Antisocial and Offending Behavior

In 2007, there were approximately 1.7 million juvenile delinquency cases heard in the United States juvenile courts (individuals age 18 or younger), with 73% of these cases involving male youth (Office of Juvenile Justice and Delinquency Prevention; OJJDP, 2010). In 2008, approximately 2.11 million juveniles were arrested in the US (OJJDP, 2009), with these individuals accounting for 16% of all violent crime arrests and 26% of all property crime arrests (OJJDP, 2010). These youth offenders are at a substantially higher risk than the general population for a number of psychological and medical problems, including mental illness, substance use disorders, HIV/AIDS risk behaviors, sexually transmitted infections, and other major health problems (Fazel, Doll, & Langstrom, 2008; Forrest, Tambor, Riley, Ensminger, & Starfield, 2000; Teplin, Abram, McClelland, Dulcan, & Mericle, 2002; Teplin, Elkington, McClelland, Abram, Mericle, & Washburn, 2005).

In the general population of youth, prevalence estimates of psychiatric disorders are generally about 20% (Carter, Wagmiller, Gray, McCarthy, Horwitz, & Briggs-Gowan, 2010). However, it is estimated that between 68% and 88% of male juvenile detainees meet criteria for one or more psychiatric disorders, with many of them displaying symptoms of externalizing disorders (Karnik, Soller, Redlich, Silverman, Kraemer, & Happanen et al., 2009; Teplin et al., 2002; Washburn, Teplin, Voss, Simon, Abram, & McClelland, 2008). In a recent meta-analysis of the prevalence of mental disorders in adolescents held in juvenile detention and correctional facilities in the United States, Fazel et al. (2008) found that in males, 3.3% had a psychotic disorder, 10.6% were diagnosed with major depression, 11.7% with Attention-Deficit/Hyperactivity Disorder (ADHD), and 52.8% with any lifetime Conduct Disorder. These mental disorders, particularly externalizing disorders, greatly elevate youths' risk for recidivism (return to incarceration), stressing the need for early and effective intervention and prevention (Cottle et al., 2001; McReynolds, Schwalbe, & Wasserman, 2010). Additionally, these youth offenders are at a much greater risk for early death than their non-delinquent peers, with reported rates of death prior to the age of 25 ranging from four times greater than the general population (Teplin, McClelland, Abram, & Mileusnic, 2005) to 500% greater (Ramchand, Morral, & Becker, 2009), most often by gunshot wounds.

Unfortunately, youth remain under-treated within both the juvenile justice system (Confessore, 2010; Moore, 2009; Feldmann, 2008; MacReady, 2009) as well as within the community (Teplin, Abram, McClelland, Washburn, & Pikus, 2005). Moreover, New York State is one of only two states in the nation that automatically tries youth ages 16 and above within the adult criminal system and holds them in adult facilities (N.Y. Fam. Ct. Act § 301.2, McKinney 1983 & Supp. 1996; N.Y. Penal Law § 30.00, McKinney 1987; N.Y. Crim. Proc. § 180.75, McKinney, 1993). In addition, many policy makers and politicians have called for lowering the age at which juveniles can be transferred to adult court and considered for adult penalties (Cauffman & Steinberg, 2000). There is an ongoing debate within both psychological and legal fields as to the age at which a juvenile should legally be considered an "adult," and in states where youth remain in the juvenile system until they are 18, whether or not the circumstances and criminal charges warrant a transfer from juvenile to adult court (Steinberg, Cauffman, Woolard, Graham, & Banich, 2009; Steinberg & Scott, 2003). Transfers depend on a host of variables, including, but not limited to: the state in which the youth resides, the criminal charge, and multiple psychological constructs (e.g., maturity, risk, amenability to treatment, psychopathy; Brannen, Salekin, Zapf, Salekin, Kubak, & DeCoster, 2006; Vitacco, Salekin, & Rogers, 2010).

However, there is emerging evidence to suggest that juveniles tried in adult criminal court and housed in adult facilities are at the highest risk for variety of mental health problems (Murrie, Henderson, Vincent, Rockett, & Mundt, 2009; Washburn et al., 2008). Despite this, there is a lack of appropriate care to meet the unique developmental needs of adolescents housed within adult facilities, underscoring the need for treatment of these youth (Washburn et al., 2008). Given these reports, youth offenders, whether they are housed in juvenile facilities, adult facilities, or remain in the community, present as populations in need of continued treatment, outreach, intervention, and research.

Diagnostic Constructs in Juvenile Delinquency

Youth involved in the justice system are often diagnosed with Oppositional Defiant Disorder (ODD) or Conduct Disorder (CD) at some point in their lives, with ODD often a precursor to the development of CD (Kimonis & Frick, 2010). As specified by the Diagnostic and Statistical Manual of Mental Disorders—Fourth Edition, Text Revision (DSM-IV-TR), to meet a diagnosis of CD, individuals must display a "repetitive and persistent pattern of behavior in which the basic rights of others or major age-appropriate societal norms or rules are violated" (p. 98), as evidenced by the occurrence of at least three of fifteen possible antisocial behaviors in the past 12 months (e.g., bullying, physical cruelty, fire setting, robbery), with at least one present in the past 6 months (American Psychiatric Association, 2000). If these behaviors continue into adulthood, individuals are at increased risk for the development of Antisocial Personality Disorder (APD; Kim-Cohen, Caspi, Moffitt, Harrington, Milne, & Poulton, 2003).

In the United States, lifetime prevalence rates of ODD and CD for community samples vary between 2-16% depending on the population and definition used, with estimates much higher in clinical settings (Boylan, Viallancourt, Boyle, & Szatmari, 2007; Carter et al., 2010;

Loeber, Burke, Lahey, Winters, & Zera, 2000). Further, despite similar prevalence rates in preschool years, boys become much more likely meet criteria for these diagnoses than girls as they enter adolescence and adulthood, with a ratio of 4:1 before adolescence, and 2:1 in adolescence (Loeber et al., 2000). Youth with ODD and CD are also at a substantially higher rate for comorbidity with other mental disorders, such as Attention Deficit/Hyperactivity Disorder (ADHD), depression, and anxiety (Loeber et al., 2000), though many of the internalizing problems in youth with conduct problems can be attributed to interpersonal difficulties and other stressors (e.g., school failure; Capaldi, 1992; Frick, Lilienfeld, Ellis, Loney, & Silverthorn, 1992).

Review: Theories of Antisocial Behavior

Criminology and juvenile justice literature. Researchers in the fields of criminology and juvenile justice have examined multiple micro- and macro-level factors that may predict the severity of antisocial behavior and risk for recidivism (return to incarceration), including individual, family, school, peer, and environmental factors. Many of the theories concerning the development of antisocial behavior have centered on both risk and protective factors, using the most salient characteristics to help develop effective interventions at multiple levels (Heilbrun, Goldstein, & Redding, 2005). Researchers further delineate factors into static (e.g., age at first offense, number of prior arrests, gender, race) and dynamic (e.g., access to weapons, substance abuse, peer affiliations) influences on antisocial behavior (Andrews & Bonta, 1998), and similar to psychological theories, have made efforts to determine which factor predict recidivism rates more than the others or which may be more amenable to intervention.

In one of the largest longitudinal studies of urban male youth, the Pittsburgh Youth Study, researchers cited multiple factors influencing externalizing disorders and antisocial behavioral outcomes, including lack of guilt feelings, psychopathic traits, impulsivity, low school achievement, poor parent-child communication, parental substance use, parental stress/anxiety, and living in a bad neighborhood (Loeber, Farrington, Stouthamer-Loeber, Moffitt, & Caspi, 2001). These risks were not equal among neighborhoods, however, as the average number of risk factors decreased as the SES of the neighborhood increased; interestingly, promotive effects, or factors that decreased the likelihood of antisocial behavior, increased as a function of neighborhood SES (Stouthamber-Loeber, Loeber, Wei, Farrington, & Wikstrom, 2002). In both youth and adults, other protective factors include positive social supports, strong attachments to prosocial adults, positive attitudes towards intervention, and strong commitments to school (DeMatteo, Heilbrun, & Marczyk, 2005; Lodewijks, de Ruiter, & Doreleijers, 2010).

Concerning risk for recidivism, Cottle et al. (2001) conducted a meta-analysis of 23 published studies using juveniles (mean age 14.7 years), and found younger age at first offense, younger age at first contact with the law, and a history of nonsevere pathology (e.g., stress, anxiety) best predicted risk for reoffending. These authors also cited a number of static (e.g., male gender, low socio-economic status, longer incarcerations) and dynamic (e.g., family instability, delinquent peer association, poor use of leisure time) factors as strong predictors, though noted that dynamic factors presented as the area most open to intervention efforts. In a recent, large study of males (aged 13-19 years) receiving mandatory treatment in the Dutch juvenile justice system, researchers examined seventy possible risk factors for recidivism two years after the initial assessment and combined them into a nine-factor model: antisocial behavior during treatment, sexual problems (specific to sex offenders), family problems, Axis-1 psychopathology, offense characteristics, conscience and empathy, intellectual and social capacities, social network, and substance abuse (Mulder, Brand, Bullens, & Van Marle, 2010). In this study, youth who reoffended had significantly higher scores on offense history and conscience/empathy than those who did not, whereas youth who did not reoffend had higher scores on sexual problems and Axis-1 psychopathology scores before treatment. With regard to violent and serious recidivism, antisocial behavior during treatment and family problems indicated increased risk.

Psychological literature. Within the psychological literature, early methods of predicting antisocial behavior and recidivism attempted to cluster groups of youth together based on patterns of behavior, such as the type of aggression exhibited, prevalence of co-occurring disorders, other behavioral symptoms, or the youths' degree of socialization; however, no method was able to gain widespread acceptance in the field, making it difficult to integrate findings across studies (Frick & Ellis, 1999). However, in taking a different approach, a number of comprehensive reviews have documented the multiple and diverse issues that put youth at risk for developing antisocial behaviors and CD (Dodge & Pettit, 2003; Frick, 1998; Frick, 2006; Loeber & Farrington, 2000; Raine, 2002). From these, both dispositional (innate) and contextual (environmental) variables have emerged as risk factors. Dispositional factors include genetic, social (e.g., hostile attribution bias), temperamental (e.g., emotional dysregulation) and personality irregularities (e.g., impulsivity, preference for novel stimuli, low fearfulness). In addition, studies have shown biological (e.g., neurochemical, autonomic reactivity) and cognitive (e.g., neurocognitive, low verbal intelligence) abnormalities, such as a dampened reactivity to emotionally distressing stimuli and difficulties on tasks of behavioral inhibition and cognitive control. Contextual factors include: problems with prenatal care (e.g., exposure to toxins, pregnancy and birth complications), parenting (e.g., parental psychopathology, inadequate discipline, neglect, abuse), peer groups (e.g., deviance, rejection), and living environment (e.g., exposure to violence).

Given the large number of risk factors, many researchers have created models to explain how these risk factors interact over time, and which, if any, predict antisocial behavior more than the others (Dodge & Pettit, 2003). Combinatory models (e.g., cumulative risk, additive, interactive) contend that the numbers of risk factors are more important than the type, that those with more risk factors have a higher probability of developing antisocial behavior, and that different factors can interact to produce similar outcomes (e.g., Loeber et al., 2001; Stouthamer-Loeber et al., 2002). Biosocial models argue that it is the interaction between biological predispositions (e.g., genetics, hormones, and neurotransmitters) and social factors (e.g., birth complications, toxins, home environment) that most influence antisocial behavior (e.g., Moffitt, 1993; Raine, 2002). Extending these, transactional models (e.g., biopsychosocial) maintain that while biological predispositions and social contexts influence antisocial behavior, these factors are mediated by life experiences, such as relationships with parents, peers, and social institutions (Cicchetti, Toth, & Maughan, 2000; Dodge & Pettit, 2003).

In sum, theories concerning risk factors, both from the psychological and juvenile justice literature, have been unable to fully explain the development of antisocial behavior. While they are able to predict who may develop certain behaviors, they are often unable to describe the process through which this occurs, an important step for early and effective intervention. Further, the majority of these theories have relied on outward behavioral manifestations and personality characteristics as classification tools, ignoring many underlying processes or causal pathways that may contribute to its emergence in youth (Blair, 2005; Frick, 2006). Similarly, these theories have difficulty explaining why individuals displaying the same antisocial behaviors can present with a variety of different risk factors, or why those who experience similar risk factors can have very different behavioral or personality outcomes (Frick & White, 2008).

Developmental theories of antisocial behavior. To overcome these difficulties, recent research has begun to use a developmental psychopathology perspective to help delineate the various causal pathways that lead the emergence of antisocial behavior. This approach recognizes that there are likely to be multiple distinct pathways that can lead to any antisocial outcome (e.g., aggression), each with its own set of risk factors and associated personality and behavioral traits (Cicchetti & Rogosch, 1996; Frick & Viding, 2009). Further, this approach allows for the integration of research from a variety of areas concerning both normal and abnormal developmental processes (e.g., biological and social risk factors) and the use of multiple levels of analysis to explore the causal pathways and differential development behind subtypes of antisocial youth. Through looking at the most basic underpinnings of types of antisocial behavior and identifying factors that may differentiate these more severe youth from other antisocial youth, treatment modalities and content can be better modified and individualized to meet the needs of various subtypes (Blair, Peschardt, Budhani, Mitchell, & Pine, 2006; Salekin & Frick, 2005).

In accordance with this developmental psychopathology approach, a common method of subtyping youth with antisocial behavior and CD has been to distinguish between those whose behavior emerges in childhood versus those whose behavior emerges during adolescence (e.g., American Psychiatric Association, 2000; Moffitt, 1993, 2003). In her seminal paper, Moffitt (1993) termed youth with childhood onset “life-course-persistent” (LCP), while those with adolescent onset are “adolescent-limited” (AL), indicating at least two clear pathways to, and concerning antisocial behavior, each with distinct etiologies, risk factors, and trajectories. In accordance with this, children with a childhood onset to their behavior generally begin showing problems prior to age 10 (American Psychiatric Association), during preschool or early elementary school years; their behavior generally increases in severity as they age, and they are more likely to show antisocial behavior into adulthood (Moffitt, Caspi, Harrington, & Milne, 2002; Woodward, Fergusson, & Horwood, 2002). In contrast, individuals whose behavior begins in adolescence begin exhibiting behavior problems in accordance with the onset of puberty, during which time peer relationships become particularly important (Moffitt; Fergusson, Lynsky, & Horwood, 1996).

A number of studies have found evidence to support this distinction, citing differences in the pattern of development and associated risk factors between childhood and adolescent onset antisocial behavior. For example, youth whose antisocial behavior begins in childhood tend have families with histories of externalizing disorders, to have more prenatal risk factors (e.g., maternal anxiety during pregnancy), come from more disadvantaged backgrounds, have more unstable homes, have more interparental conflict (e.g., cruelty to mother), and have parents who use harsher parenting strategies and are less emotionally responsive than childhood with adolescent-onset (Aguilar, Sroufe, Egeland, & Carlson, 2000; Barker & Maughan, 2009; Dandreaux & Frick, 2009; Odgers, Milne, Caspi, Crump, Poulton, & Moffitt, 2007; Woodward et al., 2002). Further, childhood-onset youth tend to show deficits in a variety of cognitive (e.g., verbal) and neuropsychological variables (e.g., executive functioning, memory, spatial) as they age (Aguilar et al., 2000; Ferguson et al., 1996; Moffitt & Capsi, 2001; Piquero, 2001; Raine, Moffitt, Caspi, Loeber, Stouthamer-Loeber, & Lynam, 2005; Raine, Yaralian, Reynolds, Venables, & Mednick, 2002). They also tend to be characterized by more temperamental and personality risk factors, such as avoidant attachment (Aguilar et al., 2000), difficulties in emotion regulation (Frick & Morris, 2004; Moffitt et al., 1996), impulsivity (McCabe, Hough, Wood, & Yeh, 2001; Silverthorn, Frick, & Reynolds, 2001), and attention problems (Woodward et al., 2002). In contrast to the childhood-onset group, the adolescent-onset group tends to primarily exhibit higher levels of rebelliousness, association with delinquent peers, and to be more rejecting of conventional traditions and values (Dandreaux & Frick, 2009; Moffitt et al., 2002).

In further support of the child/adolescent distinction, a number of longitudinal studies have supported differential trajectories between these two groups. For example, Moffitt et al. (2002) followed a cohort of 539 New Zealand males from ages 3 through 26 years (the Dunedin longitudinal study) and found that in comparison to those with antisocial behavior beginning adolescence (AL), those displaying a childhood-onset (LCP; about 10% of the sample) displayed the most serious offenses (e.g., assault, robbery), had more symptoms of APD, showed more violence against women, had more psychopathic personalities, and were reported to have more serious psychiatric and behavior problems. Further, these men were more likely to have a criminal conviction, accounting for three times their share of the cohort's total drug-related offenses and five times their share of violent offenses (53%). In contrast, those on the AL path (about 26% of the sample) had better life outcomes, as they were more likely than the LCP group to benefit from a good job (80% had high school qualifications), had higher status jobs, and were able to benefit from positive relationships with women. However, while less severe than the LCP men, AL men also had difficulties in adulthood involving criminal convictions and psychiatric symptoms, indicating that their symptoms may not be solely confined to adolescence.

Similarly, in their longitudinal study of 411 South London males first surveyed at age eight and followed to age 48 (from the Cambridge Study in Delinquent Development), Piquero, Farrington, Nagin, & Moffitt (2010) found that out of five groups (non-offenders, low-adolescence peak offenders, very low rate chronic offenders, high-adolescence peak offenders, and high-rate chronic offenders) the two groups highest on life failure at age 48 were those that exhibited the highest offending rate through age 40: the low-rate and high-rate chronic offenders. Notably, both groups exhibited a childhood onset to their antisocial behavior. However, the high-rate chronic offenders reported significantly more life failure than the low-rate offenders, suggesting that there may be different trajectories of antisocial behavior beginning in childhood. Notably, difficulties between AL and LCP men are not confined to psychiatric and social issues; LCP men have also been shown to exhibit greater health difficulties than AL men, such as increased injuries, sexually transmitted infections, systemic inflammation, periodontal disease, smoking, and chronic respiratory illness (Odgers, Caspi, Broadbent, Dickson, Hancox, & Harrington et al., 2007; Piquero, Daigle, Gibson, Piquero, & Tibbetts, 2007).

Consistent with a developmental psychopathology approach, the differential patterns of development, risk factors, and trajectories between LCP and AL youth have led to theoretical models that propose distinctive causal mechanisms and pathways that lead to each outcome. Moffitt and colleagues (Moffitt, 1993; Moffitt, Caspi, Dickson, Silva, & Stanton, 1996) have posited that LCP behavior develops early in life, arising through an interaction among inherited or acquired neuropsychological vulnerabilities (e.g., cognitive deficits, difficult temperament, hyperactivity/impulsivity) and difficult social environments (e.g., family dysfunction, inadequate parenting strategies, poor educational settings). In contrast, AL behavior was proposed to develop primarily as an exacerbation of typical adolescent rebelliousness, citing associations with delinquent peer groups and a failure to meet the demands of adolescence as primary influences. Further, these adolescents seem to be using antisocial means as attempts to obtain a sense of maturity and adult status (Dandreaux & Frick, 2009).

However, despite the significant data in support of the childhood/adolescent distinction, there has also been support for additional delineations within this model (e.g., Piquero et al., 2010). Researchers in this area have begun to explore whether an extended model may be a better fit, one that further subtypes youth with childhood-onset antisocial behavior based on the trajectory and stability of their behavior, specific vulnerabilities that may make them more difficult to socialize, and the developmental processes that are disrupted by the interaction between vulnerability and social environment (e.g., Frick, 2004; Frick & Ellis, 1999; Jones, Laurens, Herba, Barker, & Viding, 2009; Viding et al., 2005). Consistent with a developmental psychopathology approach to the emergence of antisocial behavior, early identification of the multiple distinct pathways that can lead to various outcomes in adulthood has clear implications for multiple areas of early and directed intervention.

Given this need, researchers have begun to connect childhood-onset antisocial behavior to the construct of psychopathy in adulthood (e.g., Frick & Ellis, 1999; Lynam, 1996). Individuals with psychopathy exhibit a cluster of antisocial traits that are among the most severe, violent, persistently disruptive, and resistant to treatment (Blair, Mitchell, & Blair, 2005). In older juvenile samples (ages 15/16-20/21), psychopathic features have been associated with more frequent and varied violent acts, less situation-specific crimes, and a greater incidence of instrumentally aggressive acts (Flight & Forth, 2007; Kruh, Frick, & Clements, 2005). These traits have also been predictive of both general and violent recidivism from mid-adolescence to young adulthood, even after accounting for other risk factors related to offending (Edens, Campbell, & Weir, 2007; Salekin, 2008), and the presence of psychopathic traits has been shown to predict future criminal and aggressive violent behavior in severely antisocial adolescents (Vitacco, Neumann, & Caldwell, 2010). Importantly, while the presence of these traits in youth may not necessarily lead to the development of the full-blown disorder of psychopathy in adulthood, they may be able to provide additional insight into the development of more severe antisocial behavior, even if it does not reach the level of psychopathy. As such, a promising area of focus has been to subgroup youth with childhood-onset antisocial behavior by the presence or absence of Callous-Unemotional (CU) traits, a downward extension of the one of the factors currently included in the definition of psychopathy in adults (Christian, Frick, Hill, Tyler, & Frazer, 1997; Frick & Ellis, 1999; Frick & Morris, 2004; Frick, 2004, 2010; Lynam, 1996). Prior to a discussion on CU traits, a brief overview of the construct of psychopathy is provided.

Psychopathy and Antisocial Behavior

The foundations of the current definitions of psychopathy can be traced back to the work of Hervey Cleckley, who first discussed multiple potential criteria for the disorder through a variety of case studies in his seminal work, *The Mask of Sanity*. These include: superficial charm, lack of anxiety, lack of guilt, undependability, dishonesty, egocentricity, failure to form lasting intimate relationships, failure to learn from punishment, poverty of emotions, lack of insight into the impact of one's behavior on others, and failure to plan ahead (1941). In an effort to quantify and extend the breadth of these features, Robert Hare brought the concept of psychopathy to mainstream psychological literature through the development of the Psychopathy Checklist (PCL; Hare, 1980) and the Psychopathy Checklist-Revised (PCL-R; Hare, 1991, 2003) for use with adult populations. Since then, literature concerning the development of psychopathy in adults has flourished, and there is a large body of literature documenting the features, functional impairments, and outcomes of adults with psychopathy (see Blair et al., 2005; Kiehl, 2006, for review). Similarly, multiple theories concerning the development of psychopathy in adults have been proposed. These theories describe this disorder as arising out of dysfunction in one of two areas: cognitive systems (i.e., Response Set Modulation, Fear Dysfunction, Violence Inhibition Mechanism) or neural systems (i.e., Frontal Lobe Hypothesis, Somatic Marker Hypothesis). Cognitive systems theories focus on how information is processed (e.g., abnormalities in what the brain does), whereas neural systems theories focus on where in the brain this information is processed (e.g., abnormalities in where the brain is activated). However, many of the theories proposed by both cognitive and neural models have been unable to explain the full gamut of symptoms seen in individuals with pyschopathy. Further, these theories are based largely on adult research, and there has been few data in support of these theories in children and adolescents (Blair, 2010a). There is a move to use a more comprehensive approach to understanding the emergence of psychopathy and areas of the brain that may be involved, in many ways combining aspect of both cognitive and neural models (e.g., limbic system; Blair, 2005; Kiehl, 2006). Table 1 provides a list and short description of the prominent theories of psychopathy.

Table 1

Theories for the Development of Psychopathy

	Name	*Description*	*Citation*
Cognitive	Response Set Modulation Hypothesis (RSM)	An attention-based model that posits that individuals with psychopathy present with a deficit in the automatic processing of stimuli, and particularly with the use of this processing to guide their behavior. Further, the RSM hypothesis argues that individuals with psychopathy have a deficit in their ability to shift their attention and pay attention to peripheral cues.	Patterson & Newman, 1993; Newman, Schmitt, & Voss, 1997
	Fear Dysfunction Hypothesis (FD)	Posits that individuals with psychopathy evidence impairment in the neurological systems modulating fear (e.g., septal hippocampal system, amygdala), and are less punished by being frightened by aversive stimuli.	Patrick, 1994; Mealy 1995; Gray, 1987.
	Violence Inhibition Mechanism Model (VIM)	Argues that dysfunction in the system that is activated by distress cues (e.g., sad/fearful facial expressions) hinders the developmental of moral socialization.	Blair, 1995
Neural	Frontal Lobe Dysfunction Hypothesis (FLD)	Implicates dysfunction in the frontal lobe in the development of antisocial behavior, particularly is it relates to reactive aggression and deficits in executive functioning (e.g., planning).	Gorenstein, 1982; Moffitt, 1993; Raine, 2002
	Somatic Marker Hypothesis (SM)	Identifies the ventromedial prefrontal cortex as the primary area of dysfunction. Deficits in this area hinder the forming of "somatic markers," or bodily feedback made through somato-sensory structures, which are supposed to influence decision-making through the labeling of an action or option as good or bad.	Bechara, Damasio, & Damasio, 2000

Recently, a literature has emerged that has attempted to extend the concept of psychopathy to adolescents. Multiple variations and additions of adult measures have been created for children and adolescents, including the Antisocial Process Screening Device (APSD; Frick & Hare, 2001), the Psychopathy Checklist- Youth Version (PCL-YV; Forth, Kosson, & Hare, 2003), the Youth Psychopathic Traits Inventory (YPI; Andershed, Kerr, Stattin, & Levander, 2002), and the Psychopathy Content Scale (Murrie & Cornell, 2000) on the Millon Adolescent Clinical Inventory (Millon, 1993); the majority of these scales are parent or teacher reports, though self-report versions have also been created. These scales are now primarily used in forensic settings, providing an advantage over typical diagnoses (e.g., CD, APD) by giving information about an individual's personality and behavioral functioning simultaneously. In legal proceedings and court hearings, there has been an increased in the presentation of psychopathic traits as evidence (Viljoen, MacDougall, Gagnon, & Douglas, 2010). Though not an official DSM-IV-TR diagnosis (Moffitt, Arseneault, Jafree, Kim-Cohen, Koenen, Odgers, et al., 2008), aspects of psychopathy appear as associated features in both the diagnosis of CD and APD (American Psychiatric Association, 2000; p. 95 and p. 703, respectively). Further, there is a movement among researchers to begin incorporating psychopathic traits into the DSM-V, with increasing support to add CU traits as a specifier for CD (McMahon, Witkiewitz, Kotler, & The Conduct Problems Prevention Research Group, 2010; Pardini & Fite, 2010; Pardini, Frick, & Moffitt, 2010).

Despite the abundance of research in this area, there remains ongoing debate as to how many facets or clusters best describe the construct, particularly with regard to the inclusion or exclusion of actual antisocial behavior (Amato, Cornell, & Fan, 2008; Cooke & Michie, 2001). However, three, but sometimes four components have consistently emerged through factor analysis as being predominant aspects of psychopathy in both adults and children: deficient affective experience (e.g., CU traits), an impulsive and irresponsible behavioral style (e.g., acts without thinking, lack of realistic goals), a narcissistic and deceitful interpersonal style (e.g., brags, teases, has a sense of grandiosity), and occasionally an antisocial lifestyle (e.g., poor anger control, criminal involvement), though there is debate as to whether this warrants inclusion into the description of psychopathy (Frick & White, 2008; Salekin, Brannen, Zalot, Leistico, & Neumann, 2006). In addition, recent work by Patrick and colleagues has attempted to further deconstruct the construct of psychopathy into aspects that more closely resemble aspects of personality development, citing disinhibition, boldness, and meanness as the three predominant factors (Patrick, Fowles, & Frueger, 2009).

Callous-Unemotional Traits

Regardless of how it is defined, however, a deficient affective experience has been argued to be the hallmark and most critical aspect in the development of psychopathy (Blair et al., 2006). Individuals with impairments in this sector show diminished empathy, shallow affect, callousness, and a lack of guilt or remorse. The concept of CU traits in children represents a downward extension of this affective component. Individuals with CU traits show a lack of guilt and empathy, poverty in emotional expression, and a callous use of others for their own benefit (Kimonis & Frick, 2010; Kimonis, Frick, Skeem, Marsee, Cruise, & Munoz et al., 2008). Importantly, there is a growing body of evidence in support of these traits designating a particular subgroup of antisocial youth who may go on to develop a more severe, persistent, and aggressive pattern of behavior. While other aspects of psychopathy (e.g., narcissism, impulsivity) are significantly correlated with overall levels of conduct problems (in some cases, more correlated; Corrado, Vincent, Hart, & Cohen, 2004; Frick, Bodin, & Barry, 2000), the presence of CU traits appears to delineate within antisocial youth a group at risk for a more stable path of delinquency and early onset to their behavior (Frick & White, 2008). As such, they represent a subgroup of youth that likely has a unique developmental pathway to antisocial behavior.

CU traits and antisocial behavior. Youth with CU traits show a more severe and stable pattern of antisocial behavior than other youth. In support of this, youth high on CU traits have been shown to have a greater number and variety of conduct problems and a stronger history of police contact in both clinical and mental health settings than other antisocial youth (Christian et al., 1997; Frick, Cornell, Barry, Bodin, & Dane, 2003). Youth with CU traits also tend to exhibit both reactive (responding to a real or perceived threat immediately) and proactive aggression (premeditated aggression, involving planning), whereas most antisocial youth primarily exhibit reactive aggression (Caputo et al., 1999). In psychiatric hospital settings, the presence of CU traits has been associated with longer lengths of stay in samples of children ages 7-11 and 12-17 years (Stellwagen & Kerig, 2010). In school settings, higher levels of CU traits have been uniquely associated with more direct bullying, even when controlling for the association between conduct problems and direct bullying (Viding, Simmonds, Petrides, Frederick, 2009). Further, juvenile sex offenders have been shown to have higher rates of CU traits than other offenders (Caputo, Frick, & Brodsky, 1999), and youth with higher levels of CU traits have been shown to have a greater number of sexual offense victims, used more violence with their victims, and engaged in more sexual offense planning (Lawing, Frick, & Cruise, 2010).

CU traits in childhood and adolescence have also been linked to greater incidence of antisocial behavior later in life. In one study that directly assessed the predictive validity of CU traits, children (age 11) with high levels of CU traits evidenced more severe and more instrumental aggression, and on one-year follow up, had higher rates of self-reported delinquency when compared to children with conduct problems but without CU traits (Frick et al., 2003). When this same cohort of children was assessed at yearly intervals for four more years (until age 15), at each year, youth with higher CU traits exhibited the highest rates of conduct problems, self-reported delinquency, and police contacts, above youth with conduct problems, without CU traits (Frick, Stickle, Dandreaux, Farrell, & Kimonis, 2005). Similarly, in a sample from Great Britain of individuals aged 5-16 years, parent-reported CU traits (e.g., breaks promises, shows little guilt/emotion) were significantly associated with greater levels of psychiatric issues, conduct problems, and emotional difficulties three years later, when controlling for other confounding variables (Moran, Rowe, Flach, Briskman, Ford, Maughan, et al., 2009). Importantly, in a younger sample of Australian children (ages 4-9 years), parent-rated CU traits were predictive of antisocial behavior 12-months later, even when initial levels of antisocial behavior were controlled for (Dadds, Fraser, Frost, & Hawes, 2005). While they showed overlap with other aspects of psychopathy in children (e.g., hyperactivity, peer problems), CU traits provided small but significant increments in the predictive validity of antisocial behavior within this age group.

In studies looking at the predictive validity of CU traits over longer periods of time, these traits have also been shown to correlate with later antisocial behavior. In a community sample of males beginning at age 14, the males with the highest levels of interpersonal callousness, as well as those who did not show a substantial change in their level of callousness from ages 14 to 18, showed the highest levels of APD traits at age 26 (Pardini & Loeber, 2008). Similarly, Burke, Loeber, & Lahey (2007) assessed the predictive ability of CU traits measured annually from recruitment (ages 7 to 12) to age 19 in a clinic referred sample, finding that initial levels of CU traits predicted psychopathy scores in late adolescence, even after controlling for other risk factors to antisocial behavior (e.g., intelligence, socio-economic status).

Stability of CU traits. In addition to being valid predictors and correlates of antisocial behavior, both psychopathic and CU traits have been shown to remain relatively stable from childhood to adolescence and from adolescence to adulthood, an important finding if they are to be considered actual "traits" that remain steady across development (Andershed, 2010; Edens, Skeem, Cruise, & Cauffman, 2001). In a community sample of high-risk children (mean age 10.65 years at initial assessment), intraclass correlation estimates (used to approximate the reliability of measurements) of CU traits over four years using parent ratings were estimated to be ICC = 0.71, evidencing relatively high stability (Frick, Kimonis, Dandreaux, & Farrell, 2003). In a forensic sample of youth using a self-report instrument (ages 13-20 at initial interview), estimates of psychopathic traits over a 6-month time period evidenced high stability within this time frame (Lee, Klaver, Hart, Moretti, & Douglas, 2009). Further, in a study of inner-city males, estimates over an eight-year time period (from ages 8-16 years) were found to be moderate for parent ratings (r = 0.50), though lower for teacher ratings (r = .27); these authors also reported little measurement invariance (used to determine whether an instrument assesses the same construct across time) between items, supporting the idea that CU traits are a unidimensional construct (Obradovic, Pardini, Long, & Loeber, 2007).

In evaluating the stability of CU traits from late adolescence into adulthood, studies have found these traits to be moderately stable in community samples from ages 17 to 24 years (r = 0.60; Blonigen, Hicks, Krueger, Patrick, & Iacono, 2006) and from ages 16 or 18 to 22 or 24 years (ICC = 0.40; Loney, Taylor, Butler, & Iacono, 2007). However, in one study, the stability estimate of initial levels of CU traits at age 13 to psychopathy scores eleven years later (age 24) was reported to be $r = 0.30$; many youth showed a decline in their levels of CU traits as they aged, indicating that these traits may evidence a degree of malleability (Lynam, Caspi, Moffitt, Loeber, & Stouthamer-Loeber, 2007). In support of this idea with younger children, recent work by Fontaine, Rijsdijk, McCrory, and Viding (2010) indicated that that in a large twin study of youth aged 7-12 years ($n = 9,462$), while there was a small group of children (3.4%) who showed a pattern of stable, high levels of CU traits, a little over a quarter of the children (26.5%) showed unstable levels of teacher-rated CU traits over this four-year period (note: 70.2% of children showed stable, low levels of CU traits). As such, research aimed at examining the development of these traits should also focus on explaining why these traits appear stable in some youth, but not in others (Andershed, 2010).

The findings by Fontaine and colleagues demonstrate that while these traits are predictive of later outcomes and show stability into adulthood, this may only be true for those with stable, high levels of CU traits in childhood and adolescence, and may not be absolute predictors of severe pathology in adulthood. Rather, a more realistic approach may be to consider that youth continue to develop as they age and remain influenced by their environment. While these traits do appear to have some stability, areas for significant intervention are evident, and predictions about long-term outcomes for youth who exhibit these traits should be taken with care (Cauffman, Kimonis, Dmitrieva, & Monahan, 2009; Fontaine et al., 2010).

Differential development of CU traits. Youth with CU traits are marked by distinct differences in risk factors and patterns of social, cognitive, and emotional development when compared to youth with antisocial behavior, but without CU traits. In particular, a number of studies have examined the relative genetic contribution to CU traits. Recently, twin studies have been able to show the unique genetic influences of CU traits, and found that these traits are substantially heritable and predictive of later antisocial behavior (Larsson, Andershed, Lichtenstein, 2006; Taylor, Loney, Bobadilla, Iacono, & McGue, 2003; Viding & Larsson, 2010). Studies have also found support for distinct genetic factors differentially influencing the development of two main facets of psychopathy: affective deficiency and an impulsive behavioral style (Forman, Lichtenstein, Andershed, & Larsson, 2010).

Extending these findings, Viding et al. (2005) found that in a large community sample of 7-year olds twins, the heritability component for general conduct problems was high (.68), though this number differed significantly for youth low (.30) and high (.81) on teacher-reported levels of CU traits (e.g., "does not show feelings or emotions"). Additionally, antisocial behavior for youth without CU traits was moderately influenced by shared environmental effects, whereas antisocial behavior for youth with CU traits evidenced no influence of shared environmental effects. These findings were first replicated when the youth were 9-years old, as antisocial behavior was more heritable for youth with than without CU traits, with this difference more pronounced when controlling for levels of hyperactivity (Viding, Jones, Frick, Moffit, & Plomin, 2008). When these youth were 12-years old, four distinct trajectories concerning CU traits were identified, with these trajectories largely driven by genetic influences; the highest heritability rate was for boys with stable, high levels of CU traits (Fontaine, Rijsdijk, McCrory, & Viding, 2010). Importantly, however, these differing trajectories highlighted the malleability of CU traits, indicating that there is still substantial room for intervention.

In addition to genetic differences, individuals with antisocial behavior, but without CU traits, seem to have behavior marked primarily by difficulties in emotion regulation and impulsivity, rather than the deficits in emotional experiences seen in youth with CU traits (Frick & Morris, 2004). Those without CU traits tend to be less aggressive, and when they are aggressive, it tends to be reactive in nature, as they respond impulsively and with hostile emotions to real or perceived threat by others (Blair, 2010b; Frick et al., 2003; Pardini, Lochman, & Frick, 2003). Youth without CU traits have also exhibited deficits in verbal intelligence when compared to youth with CU traits (Loney, Frick, Ellis, & McCoy, 1998; Salekin, Neumann, Leistico, & Zalot, 2004), and higher intelligence has been shown to interact with levels of CU traits to produce greater violent delinquency (Munoz, Frick, Kimonis, & Aucoin, 2008).

Youth without CU traits but with conduct problems are more likely that youth with CU traits to have parents that showed dysfunctional parenting practices (e.g., Oxford, Cavell, & Hughes, 2003; Edens, Skopp, & Cahill, 2008). In one study of youth (aged 6-13 years), ineffective parenting was only associated with conduct problems in youth without CU traits; children with CU traits evidenced a large number of conduct problems regardless of the quality of parenting they received (Wooton, Frick, Shelton, & Silverthorn, 1997). Along these lines, in a longitudinal sample of twins, Viding, Fontaine, Oliver, & Plomin (2009) recently found that negative parental discipline at age 7 years was a risk factor for conduct problems at age 12, but not for the development of CU traits.

Unique characteristics of youth with CU traits. Youth with CU traits exhibit multiple biological, behavioral, cognitive, and emotional features that help distinguish them from other youth. Biologically, these youth show reduced electrodermal responses (measured via skin conductance) to distress cues and threatening stimuli, indicating that they are less physiologically reactive to distressing stimuli (Blair, 1999; Isen, Raine, Baker, Dawson, Bezdjian, & Lozano, 2010). Further, boys high on CU traits and conduct problems have also been shown to exhibit lower resting levels of cortisol than control participants or boys with only conduct problems (Loney, Butler, Lima, Counts, & Eckel, 2006; O'Leary, Loney, & Eckel, 2007). As cortisol is a stress reactivity hormone that indexes activity in the hypothalamic–pituitary (HPA) axis (Takai, Yamaguchi, Aragaki, Eto, Uchihashi, & Nishikawa, 2004), these findings indicate that these youth may be less reactive to stressful events. Lastly, in recent work by Dadds and colleagues, results indicated that male youth with conduct problems and high CU traits showed lower levels of eye contact to both mothers and fathers than youth with conduct problems and low levels of CU traits, in both free play and "emotion talk" settings (Dadds, Jambrak, Pasalich, Hawes, & Brennan, 2011).

Behaviorally, antisocial youth with CU traits exhibit deficits in the processing of punishment (Frick & White, 2008). These youth are often less sensitive to punishment cues than other antisocial youth and show a reward-dominant response style, indicating that they have difficulty changing their response style after receiving a reward, even when punished (Barry, Frick, DeShazo, McCoy, Ellis, & Loney, 2000; Fisher & Blair, 1998; O'Brian & Frick, 1996; Pardini et al., 2003). Cognitively, youth with CU traits tend to expect more positive outcomes from their aggressive behavior with peers than other antisocial youth (Pardini et al., 2003), and tend to endorse social goals associated with revenge and dominance following minor provocation from peers, rather than more positive goals, such as relationship building or respect (Pardini, 2011).

Youth with CU traits also tend to show more deficits in affective empathy and perspective taking than in cognitive perspective taking, indicating that while they may be able to verbalize another's point of view, they may have difficulty determining how this person may feel (Anastassiou-Hadjicharalambous & Warden, 2008). Along these lines, when comparing boys (aged 9-16 years) with psychopathic tendencies to boys with autism spectrum disorders (ASDs), Jones, Happe, Gilbert, Burnett, and Viding (2010) found that those with psychopathic traits showed specific deficits in domains associated with affective empathy, while those with ASDs showed unique deficits in cognitive perspective taking ability. Furthermore, Dadds, Hawes, Frost, Vassallo, Bunn, & Hunter, et al. (2009) found that in a community sample of children (aged 3-13 years), higher levels of parent-reported psychopathic traits were associated with deficits in affective empathy for males across all ages. Interestingly, however, analyses of cognitive empathy by age indicated that deficits in cognitive empathy were much less pronounced in the adolescent group than other age groups; the adolescent males appeared to "catch up" to their typically developing peers in this area, despite low levels of affective empathy. As such, while these males were able to interpret and describe another's point of view, they exhibited deficits in explaining how others' may feel. Lastly, Pardini (2011) found that in a sample of adjudicated male and female juveniles (aged 11-18 years), while youth with CU traits were as able as youth without CU traits to judge whether their aggressive behavior would cause harm to a victim, they "simply do not care when it does" (pp. 253).

In addition, there is evidence to indicate CU traits are associated with distinct personality correlates in youth when compared to measures of general antisocial behavior or conduct problems. Youth with CU traits show a preference for novel, exciting, thrill-seeking, and dangerous activities (Frick et al., 1999; Frick et al., 2003), a lack of fearfulness, and higher levels of sensation-seeking behaviors (Essau, Sasagawa, & Frick, 2006; Frick et al., 2003; Pardini, 2006). These youth have also exhibited lower levels of trait anxiety and neuroticism, even when controlling for level of conduct problems, indicating that they may be less distressed or worried about events in their lives (Andershed, Gustafson, Kerr, & Stattin, 2002; Frick et al., 1999; Pardini, Lochman, & Powell, 2007; Lynam et al., 2007).

Youth with CU traits and conduct problems have also exhibited anomalies in the processing of emotional stimuli and facial expressions (Marsh & Blair, 2008). These deficiencies are likely the predominant issues at the heart of the construct of CU traits and a diminished affective experience (Blair et al., 2005). However, prior to reviewing this literature, a theoretical model will be presented that attempts to account for the primary influence on these deficiencies. This model attempts to close gaps and extend other theories that provide frameworks from which to view the emergence of severe antisocial behavior and psychopathy (i.e., varying developmental pathways of individuals with childhood onset), as these theories have not been able to provide a thorough explanation of either the mechanisms by which this disorder emerges or the full range of impairments seen in these individuals (Blair, 2005, 2006). Further, as previously mentioned, many of these theories focus on impairments in psychological constructs related to psychopathy (e.g., aggression, fear) and thus make the assumption that that these constructs represent unitary phenomena and that behaviors exhibited by individuals share a common etiology, which is often not the case (Blair et al., 2005).

Chapter II

The Integrated Emotion Systems Model

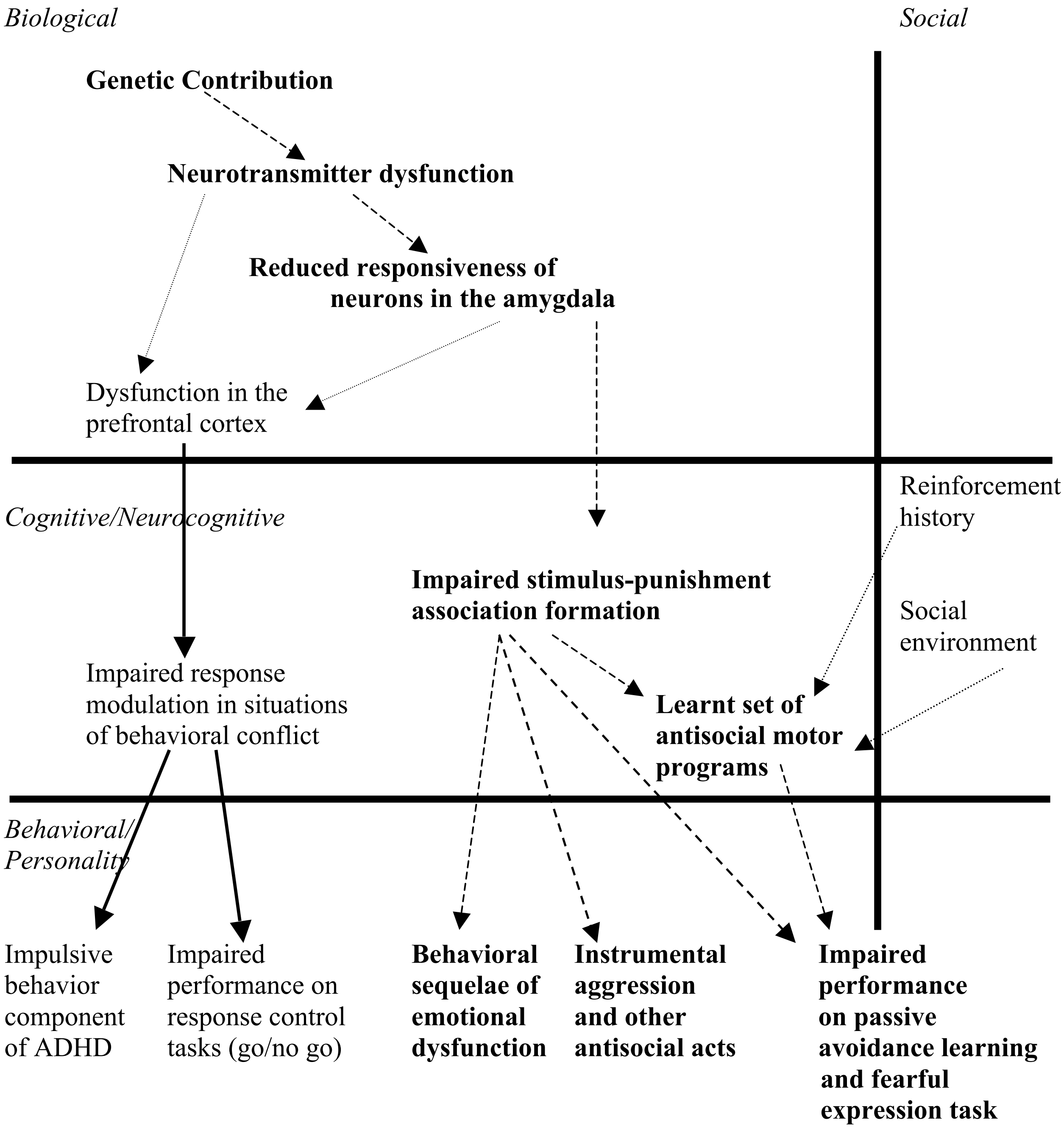
Given the shortcomings of previous models of the emergence of severe antisocial behavior and psychopathy (see Table 1), Blair developed the Integrated Emotional Systems model (IES; 2005). This model is similar to Moffitt's (1993) theory in that it attempts to subtype groups of individuals with antisocial behavior based on distinct etiologies, risk factors, and outcomes. However, Blair extends this by utilizing a cognitive neuroscience approach to view the development of various subtypes of antisocial behavior, and specifically, psychopathy.

Cognitive neuroscience aims to reveal the biological substrates underlying various forms of cognition and focuses specifically on the neural substrates of various brain processes (Gazzaniga, 2004). As such, when hypothesizing the etiology of psychopathy, a cognitive neuroscience approach focuses on identifying dysfunctional neural systems, the theorized ultimate cause behind these dysfunctions, and explaining how this is manifested in behavioral or cognitive outcomes (Blair, 2005). While the ultimate cause of a disorder, or "factors that are hypothesized to give rise to the basic pathology that… is at the heart of the disorder" (Blair et al., 2006, pp. 263), is argued to be genetic or social in nature, Blair posits that a comprehensive account of any disorder will involve a multi-disciplinary and multi-level approach to analysis (2005). This should involve not only specifying the overall behavioral profile and specific functional impairments, but also the neural systems implicated in these impairments, molecular level factors (e.g., hormones, neurotransmitters) that contribute to them, and the core genetic bases of these factors that influence the manifestations of the disorder. In this way, cognitive neuroscience allows for the integration of multiple areas of study, while at the same time, focusing on the root of the dysfunction that gives rise to the disorder itself.

At the most basic level, Blair and colleagues hypothesize that the ultimate cause of psychopathy is a genetic predisposition to amygdala dysfunction (Blair, 2006; Blair et al., 2006; Blair et al., 2005). As noted previously, estimates of the genetic contribution on CU traits are substantial (Viding et al., 2005; Viding, et al., 2007; Viding et al., 2009). This amygdala dysfunction gives rise to the neurocognitive and cognitive deficits seen in individuals with psychopathy (e.g., deficits in the recognition of certain facial expressions and emotions), which in turn give rise to the personality characteristics exhibited by these individuals (e.g., callous-unemotional traits and narcissism; Blair & Mitchell, 2009) as well as behavioral manifestations of the disorder (e.g., instrumental/proactive aggression, difficulties with emotion recognition, emotion regulation, socialization, morality, and emotional learning; Blair, 2007). In addition to amygdala dysfunction, Blair also hypothesizes abnormalities in various areas of the prefrontal cortex; though these are not hypothesized to be the primary area of dysfunction, the extant research does show some abnormalities in these areas in individuals with psychopathy (Blair, 2004). See Figure 1 for a visual representation of the IES Model.

Figure 1 illustrates Blair's (2005) model of the development of psychopathy and CU traits. The bolded words and dotted arrows denote the pathway involving amygdala dysfunction (i.e., genetic contribution → neurocognitive/cognitive deficits → personality/behavioral characteristics), and solid arrows denote the pathway involving prefrontal cortex dysfunction. The current study focuses on several components of the behavioral aspects of Blair's IES Model: impaired response control, emotional dysfunction, antisocial acts, and performance on a fearful expression task. However, it should also be noted that within this model, there is a social component (reinforcement history, social environment) that also likely affects the cognitive/neurocognitive aspects of the model, though this will not be examined in the current study. The following sections will provide overviews of the functional neuroanatomy of both the amygdala and prefrontal cortex, how dysfunction in these areas can lead to the development of psychopathy and psychopathic traits, and lastly, research to support each of these assertions.

Figure 1. The Integrated Emotions Systems Model (IES; Reprinted from *The psychopath: Emotion and the brain;* Blair et al., 2005, pp. 147)



The Amygdala, Emotional Learning, and Socialization

Anatomically, the amygdala represents a bundle of nuclei in the anterior mesial temporal lobe and is located in the center of multiple neurological circuitries; half of its body resides in the right temporal lobe, and the other half in the left (Adolphs, 1999; Swanson & Petrovich, 1999). It is predominantly responsible for processing emotional and social input, and has attachments extending to a number of brain areas whose functions can be modulated by emotion (e.g., frontal cortices, hippocampus, basal ganglia, hypothalamus; Adolphs, 1999). It is a central part of the limbic system, and through its connections to other neural structures, is heavily involved in the recognizing, regulation, and memory of emotions (particularly negative emotions), as well as in conditioning processes that require emotion (Davidson, Fox, & Kalin, 2007; DeLisi, Umphress, & Vaughn, 2009; LeDoux, 2000). As such, abnormalities in any area of the amygdala are likely to result in disruptions to more than one brain system.

Though small, the amygdala has been divided into as many as 12 parts (LeDoux, 2000), with ongoing controversy as to whether these parts represent a distinct system (the amygdala) or, rather, are simply extensions of other brain systems and should not be grouped together (LeDoux, 2007). Most often, however, the amygdala is referred to consisting of two main sections: the basolateral amygdala (BLA), including the lateral, basal, and accessory basal nuclei, and the central nucleus (CeN), including the cortical, medical, and central nuclei (LeDoux, 2007). Though highly connected, these parts and their accessory areas appear to serve slightly different functions (Blair, 2005; Blair et al., 2005; Everitt, Cardinal, Parkinson, & Robbins, 2003). Price (2003) describes three main systems that connect the functions of both parts of the amygdala to other parts of the brain. Briefly, the first system is mainly dependent on forebrain structures that that send sensory input to the amygdala, both to the BLA and CeN (e.g., structures involved in smell, taste, sight, motor functions). The second system consists of projections extending from mainly from the CeN to brainstem areas (hypothalamus, midbrain, lower brainstem), and is largely responsible for the control and modulation of visceral functions, such as heart rate, perspiration, digestion, and respiratory rate. The third system involves projections extending from the BLA to areas of the forebrain (e.g., orbital and medial prefrontal cortex, medial thalamus, ventromedial basal ganglia), and is believed to be involved in a variety of related functions, such as the forebrain modulation of visceral functions, mood, reward assessment, and goal-directed behaviors.

Flow of information both to and from these multiple systems is regulated, in part, through several neurotransmitters, such as norepinephrine, dopamine, serotonin, and acetylcholine, which influence the firing of various neuronal pathways within and surrounding the amygdala (LeDoux, 2007). The interaction between the BLA and dopamine has been shown to influence reward-seeking behaviors, and these pathways are important for appropriate behavioral responding (Ambroggi, Ishikawa, Fields, & Nicola, 2008). In particular, the neurotransmitter system involving norepineprhine (also known as noradrenaline), the noradrenergic system, may have implications for the development of pyschopathy (Blair, 2006). While it is unclear whether the amygdala dysfunction disrupts the noradrenergic system, or the system disrupts the amygdala, their connection is evident. This system has a long history in psychological literature implicating its involvement in anxiety and the fight-or-flight response (e.g., Gray, 1982), but has recently been shown to be involved in the processing of punishment signals (Rogers, Lancaster, Wakeley, & Bhagwagar, 2004), the extinction of previously learned experiences (Mueller, Porter, & Quirk, 2008), and in memory consolidation of aversive emotional experiences (McCaugh, 2004). As such, it is likely to affect learning experiences that involve emotion, punishment, and perceived aversive stimuli, such as certain types of instrumental learning that are dependent upon the processing and remembering of such emotional experiences. Here, an individual learns to either perform or withhold an action (after presentation of a stimulus) based on the presence of reward or punishment.

The IES Model highlights impairments in two types of instrumental (operant) learning in individuals with psychopathy: aversive conditioning and passive avoidance learning, both of which are thought to be vital in the development of appropriate socialization and emotional learning (Blair et al., 2005; Blair, 2005; Flor, Birbaumer, Hermann, Ziegler, & Patrick, 2002). These types of instrumental learning are dependent upon intact functioning of stimulus-reinforcement associations formed with direct input from the amygdala and the noradrenergic system. Aversive conditioning involves the pairing of a stimulus with an unpleasant reinforcement; passive avoidance learning involves withholding a response to avoid an unpleasant reinforcement (e.g., not responding to a stimulus that has produced punishment in the past; Blair et al.). As individuals with psychopathy have difficulty forming these stimulus-reinforcement associations, particularly stimulus-punishment associations, they are posited to have a dysfunction in the basic circuits of the amygdala (Blair, 2003, 2004, 2005, 2006; Blair et al., 2005).

At the heart of the IES Model, Blair argues that collectively, these deficits hinder the development of “moral socialization,” or socialization through emotional learning. During the typical socialization process, individuals learn to refrain from behavior that may cause harm to others; seeing the harm, hurt, or pain in others evokes an empathic response that is aversive, which then teaches individuals not to perform the behavior again. However, due to amygdala dysfunction, individuals with psychopathy may not learn to make these connections, as they are not only impaired in forming stimulus-punishment associations, but also in the more basic area of emotion processing, and as such, may not even be fully aware of fear or pain in others. When confronted with a stimulus that is aversive to most people (e.g., a crying child), they often appear less empathic because they are less “punished” by the negative reactions and emotions of others (Blair & Coles, 2000; Blair et al., 2005). It is for this reason (among others) that that these individuals are termed more “callous” and “unemotional” in the face of aversive stimuli.

In sum, Blair’s IES Model implicates dysfunction in the amygdala as being at the core of the development of psychopathy, possibly due to deficits in the noradrenergic system and connections to other brain areas that regulate the processing of punishment. These deficits hinder the process of moral socialization through emotional learning, and as such, individuals with psychopathy are impaired in their empathic responses to others. The following sections will outline literature in support of these assertions, first from neuroimaging studies, and then from studies using tasks that require individuals to process basic emotions.

Neuroimaging research in support of amygdala dysfunction. In support of the IES Model’s assertion of core amygdala dysfunction in individuals with psychopathy, some researchers have documented abnormal amygdala functioning using imaging techniques in children and adolescents with antisocial behavior, psychopathy, and most specifically, CU traits. This section will discuss research in support of this hypothesis, beginning with a review of imaging studies using adolescents with CD, adolescents with CD and psychopathic traits, and finally, adolescents with CU traits. It should be noted that a major limitation of many of the studies of children with CD is that they do not include more specific measures of the range of symptoms associated with this diagnosis (e.g., facets of psychopathy, aggression). CD does not represent a cluster of discrete and simple symptomatology, but rather, a wide variety of traits, some of which appear similar, but in fact have distinct neurological underpinnings (Blair, 2005). As such, in the majority of studies, it is difficult to disentangle which characteristics of CD may be associated with the observed results.

To date, four studies have documented abnormal amygdala activity in adolescents with CD. Sterzer, Stadler, Krebs, Kleinschmidt, and Poutska (2005) found that in a sample of 27 adolescents (aged 9-15 years), adolescent males with CD evidenced reduced activation the left amygdala when passively viewing emotional pictures (e.g., a dog growling) relative to healthy controls, even after controlling for anxiety and depression. In replicating these results in 2007, the same group of researchers, using the same task, indicated that in a sample of 22 adolescent males (mean age = 12 years), those diagnosed with CD displayed reduced left amygdala volume and bilateral anterior insular volume compared to age- and IQ-matched controls, indicating that adolescents with CD may not only have reduced activation in the amygdala, but also present with reduced amygdala volume (Sterzer, Stadler, Poutska, & Kleinschmidt). Contrary to both of these findings, however, Herpertz, Huebner, Marx, Vloet, Fink, & Stoecker, et al. (2008), also using a passive viewing task of emotionally salient images (e.g., a child crying) found that male youth (aged 12-17 years) with CD or combined CD/ADHD had *increased* left-sided amygdala activation when compared to age-matched healthy controls. Again, however, these studies are limited by their nonspecific descriptions of participants with CD.

Given the need for greater specificity of their samples, a group of researchers recently examined the differential brain activity of 75 male adolescents (aged 16-21 years) with either early-onset or adolescent-onset CD as compared to healthy controls, also measuring aspects of psychopathy and CU traits (Passamonti, Fairchild, Goddyer, Hurford, Hagan, & Rowe et al., 2010). In this study, participants were asked to view images of neutral, sad, and angry faces while undergoing functional Magnetic Resonance Imaging (fMRI) to document brain activation. In comparison to healthy controls, both groups of participants with CD displayed increased brain activation when viewing neutral vs. angry faces (i.e., in the amygdala, ventromedial prefrontal cortex, orbitofrontal cortex, and insula), though there was no difference between subtypes of CD. This indicates that the CD groups displayed hyperactivity when viewing neutral faces, consistent with some theories of aggression that hypothesize a tendency towards hostile or negative attributions of neutral stimuli (Dodge & Pettit, 2003). When viewing sad vs. neutral faces, however, participants with early-onset CD displayed reduced bilateral amygdala activation compared to those with adolescent onset CD, providing support for developmental differences between these two groups. Interestingly, there was no relationship between levels of psychopathic or CU traits in relation to brain activity. However, there was also no significant difference in levels of psychopathic or CU traits between the two CD groups, indicating that the instrument may not reliably distinguish between subtypes of antisocial individuals; the authors do indicate that other measures of pychopathy and CU traits may have revealed significant relationships. As such, results from this study make it unclear what the underlying mechanism is behind the differential pattern of activation between CD groups, and further, more specific research is needed in this area.

In addition to CD, some researchers have documented abnormal brain activation in individuals with CU traits. Using fMRI data, research has shown impairments in amygdala activity in adults with psychopathy and CU traits (Kiehl, Smith, Hare, Mendrek, Foster, & Brink, 2001). However, to date, only two studies have looked at the role of amygdala dysfunction in adolescents exhibiting CU traits. In the first, Marsh, Finger, Mitchell, Reid, Sims, & Kosson, et al. (2008) used fMRI data to examine the amygdala activity of 36 male and female children (aged 10-17 years): twelve with CU traits and either conduct disorder or oppositional defiant disorder, twelve with ADHD, and twelve comparison participants. The authors compared blood-oxygen-level-dependent (BOLD) responses among groups, which measured the amount of brain activity though quantifying levels of blood flow and oxygenation, as participants were shown a series of pictures from the Facial Affect Series (Ekman & Friesen, 1976) depicting 10 men and woman with neutral, fearful, and angry expressions. To ensure processing of the faces, participants labeled the gender of the individual. To determine levels of CU traits, the authors employed two widely used screening tools: the Antisocial Process Screening Device (APSD; Frick & Hare, 2001), a 20-item scale measuring CU traits and conduct and impulsivity problems completed by the participants' parents, and the Psychopathy Checklist-Youth Version (PCL-YV; Forth, Kosson, & Hare, 2003), a 20-item scale assessing a broad spectrum of interpersonal, affective, and behavior correlates of psychopathy through semi-structured interviews and collateral information. Participants in the CU traits group all had scores ≥ 20 on both the APSD and the PCL-YV. Results indicated that children with CU traits showed significantly less left amygdala activation when shown fearful facial expressions than both the comparison and the ADHD groups, while no differences among groups were found for angry or neutral expressions. Further, youth with CU traits evidenced reduced functional connectivity between the amygdala and the ventromedial prefrontal cortex compared to both the ADHD and comparison groups; youth with the highest levels of CU traits had the lowest levels of connectivity, indicating that their amygdala and prefrontal cortex communicated less during the course of viewing these pictures.

In attempts to replicate these findings, Jones, Laurens, Herba, Barker, and Viding (2009) evaluated the amygdala activity of 30 male adolescents (ages 10-12), again while viewing pictures of facial expressions: 17 participants with elevated levels of CU traits and thirteen age- and IQ-matched controls. However, here the authors examined the BOLD responses only to fearful and neutral faces. CU traits were measured via the APSD (Frick & Hare, 2001). Results indicated that while both groups exhibited enhanced responses to fearful versus neutral faces, showing the predicted heightened amygdala response to emotional stimuli, adolescents with CU traits exhibited lesser right amygdala activation to fearful faces than controls. The authors underscored the point that the presence of these impairments in children at these young ages lends evidence to the idea that psychopathy is a developmental disorder related to amygdala dysfunction.

Given the above studies, there is emerging neuroimaging research to show abnormal brain activity in adolescents with CD and CU traits. However, studies of individuals with CD are limited in that they rarely distinguish among the multiple symptoms and features associated with this diagnosis, making it difficult to draw conclusions about the mechanisms underlying the dysfunction. Research that has attempted to more specifically evaluate the relationship of CU traits and brain activity has indicated abnormal amygdala functioning in adolescents with CU traits. These individuals show reduced amygdala activation when viewing fearful faces, and in one study, reduced connectivity between the amygdala and prefrontal cortex, which lends support to Blair's IES Model. As such, adolescents with CU traits may be deficient in their processing of fearful facial expressions, as well as in their ability to use the detection of these faces to guide their everyday behavior. The following section will outline the behavioral studies in support of the IES Model, and will further explain the functional impairments of these individuals, likely due to the observed amygdala dysfunction discussed in this section.

Behavioral studies of emotion processing. In addition to these structural abnormalities, individuals with CU traits also exhibit difficulties in a variety of tasks that require activation of the amygdala, lending further support to the IES' assertion that this is a core area of dysfunction. In particular, studies have shown that these individuals show deficits in the processing of common emotions, particularly fear, sadness, and anger, and that this deficit spans across a number of areas (Marsh & Blair, 2008). However, similar to imaging research, some studies do not fully separate the facets of psychopathy (e.g., callous/unemotional traits vs. impulsive/conduct problems), making it difficult to determine if the dysfunction is due to pure CU traits or to some other aspect of psychopathy, again underscoring the importance of specifying adolescents with distinct behavioral traits. Further, the methods for measuring emotion processing vary widely among studies, with some tasks lacking in an accurate description of what they are intending to measure (e.g., facial expression naming, recognition of body poses, vocal tones). The following section will first review the extant literature concerning the deficits in facial expression recognition in youth with psychopathy, and then specifically with regard to CU traits, with a focus on tasks used to measure facial processing. It will then discuss studies that have involved measures of facial expression recognition and other areas of emotion recognition. Lastly, it will review the literature concerning deficits of youth with psychopathic traits with regard to other areas of emotion processing (e.g., sensitivity to distress, emotional memory), and then literature specific to youth with CU traits.

***Facial expression and emotion recognition*.** In one of the first studies to find support for emotional processing difficulties adolescents with psychopathy, Blair and Coles (2000) examined how well a community sample of boys and girls (aged 11-14 years; $n = 55$) enrolled in mainstream education in London could correctly identify various emotional facial expressions using the Expression Recognition Hexagon Task (Calder, Young, Rowland, & Perrett, 1996). In this task, participants were presented with adult faces from six common emotions (happiness, surprise, fear, sadness, disgust, anger) and asked to identify the emotion being portrayed from six possible options corresponding to each possible emotion. However, the expressions portrayed were blends of two different emotions put together (e.g., 90% happy, 10% surprised; 30% sad, 70% disgust), where participants had to indicate the predominant emotion being displayed. Levels of psychopathic traits were measured via an early version of the APSD, the Psychopathy Screening Device (PSD; Frick & Hare, 2000), which included a callous/unemotional factor and an impulsivity/conduct problems factor. Overall, the authors found that greater levels of psychopathy were associated with poorer recognition of angry, sad, and fearful expressions. Further, CU traits were specifically associated with a reduced ability to name fearful and sad expressions, while greater levels of impulsivity/conduct problems were associated only with a reduced ability to name fearful expressions.

Along similar lines, Blair, College, Murray, and Mitchell (2001) examined how quickly boys (aged 9-17 years; $n = 51$) recruited from schools for students with emotional and behavioral disturbances could identify adult facial expressions depicting the six major emotions as they morphed from relatively subtle to intense expressions (sadness, happiness, anger, disgust, fear, and surprise). In this task, called the Emotional Expression Multimorph Task, participants were instructed that they would see a neutral expression that would gradually morph into one of the six basic emotions. They were provided with a list of six emotions on an instruction sheets, and as soon as they knew which emotion was being displayed, they were to say it out loud. Psychopathic traits were again measured via the PSD (Frick & Hare, 2000). As hypothesized, results indicated that boys with psychopathic tendencies were less likely to correctly identify fearful faces, and were more likely to misidentify these faces as displaying one of the other five basic emotions than boys without psychopathic traits. Further, boys with psychopathic tendencies were less responsive to sad expressions, as they required a more intense level of expression to correctly name this emotion.

In later research that more specifically targeted the CU factor of psychopathy, Dadds, Perry, Hawes, Merz, Riddell, & Haines et al. (2006) evaluated the impact of antisocial behavior, CU traits, and eye gaze on fear recognition in a community sample of boys through two studies. CU traits were measured through the APSD (Frick & Hare, 2001), and antisocial behavior and emotional problems through the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997). Participants were shown a series of pictures from the University of New South Wales Facial Emotion Task (UNSW Facial Emotion Task; Dadds, Hawes, & Merz, 2004) in which six emotions (happiness, sadness, anger, disgust, fear, neutral) were displayed by four adult faces. In the first study (boys aged 8-15 years; n = 33), participants were asked to label the expression from a list of six emotions. In the second study (boys aged 9-17 years; n = 65), two more trials were administered: the first instructed participants to specifically look at the eyes, and the second, to look specifically at the mouth. Results indicated that in the first study, overall levels of antisocial behavior were associated with poorer recognition of neutral faces, as they were most often mistaken for anger. Further, also in the first study, boys with the highest levels of CU traits were significantly less adept at labeling fearful facial expressions than boys with low levels of CU traits, often identifying them as neutral or disgust. However, in the second study, their performance was no different from boys with low levels of CU traits when instructed to look at the eyes, indicating that deficient fear recognition may be due, in part, to visual neglect of the eye region in others' faces. This is consistent with research of individuals with amygdala damage (Adolphs, Gosselin, Buchanan, Tranel, Schyns, & Damasio, 2005).

Similarly, Leist and Dadds (2009) examined multiple variables related to facial expression recognition in a clinical sample of older boys and girls (aged 16-18 years; $n = 23$) who were receiving treatment for mental health and substance abuse issues from a residential treatment center. Participants were excluded if they had a recent history of serious violent or sexual offending, a serious risk of harm to self or others, or psychotic mental illness. In this study, the authors investigated CU traits (through the APSD; Frick & Hare, 2001), antisocial behavior and emotional problems (through the SDQ; Goodman, 1997), and four aspects of maltreatment (emotional maltreatment, neglect, physical abuse and sexual abuse; measured through the Maltreatment Classification System [MCS]; Barnett, Manly & Cicchetti, 1993). Emotion recognition was again measured via the UNSW Facial Emotion Task (Dadds, Hawes, & Merz, 2004). Overall, the authors found that higher levels of CU traits were uniquely associated with less accuracy when recognizing fear, regardless of antisocial behavior or history of maltreatment. Antisocial behavior was uniquely associated with impaired anger recognition, but better fear recognition. Further, emotional problems were uniquely associated with impaired recognition of neutral faces, but better recognition of anger and sadness. Lastly, maltreatment was uniquely predictive of enhanced recognition of fear and sadness. Taken together, these results provide support for the idea that children with CU traits represent a distinct subgroup of antisocial youth, as these traits were uniquely associated with an impaired ability to recognize fearful facial expressions.

However, not all researchers examining facial expression recognition have found deficits in the recognition of fear in adolescents with CU traits. Woodworth and Waschbusch (2007) examined the performance of individuals (aged 7-12 years; *n* = 73) enrolled in a summer day treatment program for children with disruptive behavior problems on tasks of facial affect recognition and emotional vignettes. CU traits were assessed using the APSD (Frick & Hare, 2001), and conduct problems through the Disruptive Behavior Disorder Rating Scale (DBDRS; Pelham, Gnagy, Greenslade, & Milich, 1992). In line with previous studies, children were first shown adult faces depicting six emotions (happiness, anger, disgust, fear, sadness, surprise) and were asked to identify the emotion. Following this, the participants were asked to listen to ten stories (two for each emotion: happiness, sadness, anger, fear, or guilt) and identify what emotion the main character was feeling. Overall, the authors found that children with higher levels of CU traits, regardless of whether they had conduct problems, were less accurate in identifying sad facial expressions. Further, the authors also found (though they were trend effects) that higher levels of CU traits actually *improved* participants' ability to identify the facial expression of fear, while youth with conduct problems, without CU traits, were less able to identify fear expressions. While findings are in contrast to most research in this area, they present an interesting perspective on children with CU traits. Perhaps in some cases, enhanced recognition of fear serves as reinforcement for antisocial behavior, and facilitates aggressive acts. However, this enhanced recognition does not necessarily mean that these individuals feel fear, empathize with fear, or use this information to guide their behaviors in the same ways that other individuals without CU traits do.

In addition to the literature on the recognition of facial expressions, other researchers have looked at additional areas of emotion processing in individuals with psychopathic traits. Stevens, Charman, and Blair (2001) evaluated boys (aged 9-15 years; *n* = 37) recruited from schools for students with emotional and behavioral disturbances using the PSD (Frick & Hare,

2000) and four subtests from the Diagnostic Analysis of Nonverbal Accuracy (DANVA; Nowicki & Duke, 1994). The DANVA subtests were used to assess accuracy recognizing child and adult facial expressions, as well as child and adult emotional language (paralanguage) across four emotions (happiness, sadness, anger, fear). The paralanguage subtests involved 24 auditory stimuli of child and adult voices repeating a standardized sentence with intonations reflecting the four emotions, intending to measure the participants' ability to recognize emotional saliency in language. In all four subtests, participants were given a list of emotions from which to choose. Results indicated that those with behavior problems and high levels of psychopathic traits were less able to label sad and fearful faces, as well as sad vocal tones. As such, deficits in emotion recognition appear to span beyond facial expressions to language intonation as well.

In extending this research and studying vocal tones in isolation, Blair, Budhani, College, and Scott (2005) again examined boys (aged 11-15 years; n = 43) recruited from schools for students with emotional and behavioral disturbances using the APSD (Frick & Hare, 2001) and the Vocal Affect Recognition Test (Scott, Young, Calder, Hellawell, Aggleton, & Johnson, 1997). In this task, participants were asked to listen to six bisyllabic concrete nouns selected for their neutral meaning and varied phonetic properties (e.g., carpet, flour). Six native English speakers (equal male and female) spoke the words in five different intonations intended to convey the emotions of happiness, disgust, anger, sadness, and fear. Due to significant correlations between IQ and abilities to recognize emotion affect, IQ was included as a covariate in all analyses. Overall, boys with psychopathic traits showed impaired labeling of fearful vocal tones when compared to boys without psychopathic traits, with no significant differences found with regard to any other emotion.

Muñoz (2009) further expanded upon the emotional processing literature in individuals with psychopathic traits, and examined a community sample of adolescent boys' (aged 8-16 years; *n* = 55) abilities to label the feelings conveyed in both facial expressions and body postures (presented separately) from six possible choices (happy, sad, fear, angry, surprised, disgusted). The author used a pure measure of CU traits, the Inventory of Callous-Unemotional Traits (ICU; Frick, 2004b), to examine the effects of these traits in isolation. Overall, high levels of CU traits were related to fewer accurately labeled fear faces and body postures. Further, boys with the highest levels of CU traits (1 standard deviation above the mean) were the least accurate in identifying fear faces and body postures, and the interaction between accuracy on labeling fear faces and postures explained 16% of the proportion of variance in CU traits. This study provides the first evidence that deficits in emotion recognition in individuals with CU traits extend to the processing of body postures as well.

In sum, studies of facial affect and emotion recognition in individuals with psychopathic and CU traits provide evidence in support of the IES Model, showing that these individuals are often deficient in their identification of fearful and sad facial expressions, often confusing them with other basic emotions and requiring more intense expressions, or specific instructions (e.g., look at the eyes), to correctly identify the emotion. These individuals are also deficient in their identification of fearful and sad vocal tones, as well as fearful body postures. This is in contrast to individuals with conduct problems, but without CU traits, who tend to identify neutral faces as angry, which is consistent with theories of hostile or negative attribution biases in antisocial youth (e.g., Dodge & Pettit, 2003). However, not all research supports the idea that individuals with psychopathic and CU traits are deficient in their processing of fear, with one study (Woodworth & Waschbusch, 2007) finding that these traits may facilitate the detection of fear.

The following section will review other aspects of emotion processing as they relate to children and adolescents with psychopathic and CU traits.

Extensions of emotion processing. Studies examining psychopathy in adults have found evidence for deficits in linguistic processing of affective stimuli (Blair, Mitchell, Richell, Kelly, Leonard, & Newman et al., 2002; Herve, Hayes, & Hare, 2003). When presented with a series of letter strings and asked to determine if they are words or not (called the Lexical Decision Task; Williamson, Harpur, & Hare, 1991), typical adults respond faster to strings that spell emotional words (e.g., cure) than non-emotional words (e.g., cup). However, adults with psychopathic traits do not show this “emotional advantage,” and respond less quickly to emotion words, particularly negative emotion words (e.g., kill). In line with this, Loney, Frick, Clements, Ellis, and Kerlin (2003) found evidence of this same deficit in adolescent boys (aged 12-18 years; $n = 60$) referred to a juvenile diversion program that provided day treatment to individuals referred from juvenile court. They used the APSD (Frick & Hare, 2001) as a measure of psychopathic and CU traits, and the Lexical Decision Task as a measure of language recognition for emotional words. Consistent with the adult literature, adolescents with psychopathic traits, and specifically, those with CU traits, evidenced slower reaction times to negative emotional words compared to other adolescents with conduct problems but without these traits. This indicates that adolescents with CU traits show a “lack of facilitation” to these emotional words, evidencing a dampened reactivity to negative emotional stimuli.

Using the Emotional Dot-Probe Task (Loney, 2003), a computerized task that measures response time to a “dot probe” (asterisk) following the presentation of positive, threat, distress, or neutral nonfacial pictures, Kimonis, Frick, Fazekas, and Loney (2006) documented a similar “lack of facilitation” to emotional stimuli in individuals with psychopathic traits using pictures instead of words. In typical children, there is generally a tendency to respond faster to probes following emotional pictures than neutral pictures. In this study, the authors recruited a community sample of boys and girls (mean age = 9.3 years; *n* = 50) to determine if the same was true for individuals with psychopathic traits (measured via the APSD; Frick & Hare, 2001). The authors also measured levels of reactive and proactive aggression through the Aggressive Behavior Rating Scale (ABRS; Brown, Atkins, Osborne, & Milnamow, 1996) to determine if aggression also played a role in the processing of emotional stimuli. Results indicated that only individuals with psychopathic traits who were high on measures of aggression evidenced slower response times to the dot probe (i.e., reduced orienting responses) following distressing pictures when compared to children without psychopathic traits, and youth with psychopathic traits who showed low levels of aggression. In particular, only proactive aggression was significantly associated with reduced emotional facilitation to distress pictures. Further, though the authors were unable to focus on the subscales of the APSD due to low internal consistency, there was evidence to suggest the CU subscale was largely responsible for the observed results, accounting for the most unique variance in predicting responses to distressing stimuli.

In studies that have specifically examined the impact of CU traits and response to distressing stimuli on aggression, Kimonis, Frick, Munoz, & Aucoin (2007) studied detained adolescent males (aged 13-18 years; *n* = 88) using the ICU (Frick, 2004) and the Emotional Dot Probe Task (Loney, 2003) to examine the combined effect of these on levels of aggression (measured via the Peer Conflict Scale [PCS]; Kimonis, Marsee, & Frick, 2004). The authors suspected that the influence of high CU traits and reduced responses to distressing cues may influence the individuals to engage in higher levels of aggressive behavior. Consistent with previous research, and with the hypothesized outcomes, males with CU traits, who also show these reduced response times to distressing pictures, show the highest levels of aggression (particularly proactive aggression) and violent delinquency. In extending this research, Kimonis, Frick, Munoz, and Aucoin (2008), using the same sample of individuals, found that those with high CU traits, reduced orienting to distressing cues, and high levels of aggression also showed the highest levels of exposure to violence in their communities. Interestingly, however, youth high on CU traits, but with *faster* response times to distressing pictures, had stronger histories of abuse, supporting the possibility that there may be environmentally influenced pathways in the development of these traits.

Some research is also beginning to emerge that involves emotional memory in individuals with psychopathic traits. In typically developing individuals, emotional arousal enhances memory for events; however, studies have shown that adult violent offenders with antisocial personality disorder show impairments in emotional memory, perhaps because they are less aroused by these events (Dolan & Fullam, 2005; Christianson, Forth, Hare, Strachan, Lidberg, & Thorell, 1996). To date, there appears to be one study that has evaluated this phenomenon in adolescent offenders. Dolan and Fullam (2010) evaluated eighty-four male youth (aged 14-18 years) who were incarcerated in secure care or prison. Psychopathic traits were measured through the Psychopathy Checklist: Youth Version (PCL: YV; Forth, Kosson, & Hare, 2003). Emotional memory was evaluated using the Emotional Memory Task (EMT; Cahill & McGaugh, 1995), during which participants watch a slide show of an emotionally arousing story, with beginning slides displaying neutral information, middle slides with negative emotional information, and ending slides with neutral information. Participants were asked a series of multiple-choice questions about the slide show two hours after administration. Results indicated that taken together, the entire sample showed better memory for emotional events, in line with typical samples. However, individuals with high levels of CU traits evidenced significantly less recall accuracy for emotional events when compared to youth with low levels of CU traits. This is consistent with studies of adults with amygdala damage (Cahill & McGaugh) and psychopathic traits (Dolan & Fullam, 2005), and lends support to the IES model and suggested amygdala abnormalities in youth with CU traits.

Taken together, studies of emotion processing in adolescents with psychopathic and CU traits are consistent with those of facial and emotion recognition, showing that these youth exhibit dampened or reduced reactivity to distressing stimuli, slower responding to distressing cues, and reduced emotional memory for negative events. These findings are consistent with research that is emerging that suggests individuals with psychopathy have reduced emotional attentional capabilities (Blair & Mitchell, 2009). Further, the above studies indicated that the combination of CU traits and reduced responding to distress cues may lead to higher levels of aggression, violent delinquency, and exposure to community violence. This research is in support of the IES Model, as these processes are dependent upon activation of the amygdala and related circuitries. The following section will review a separate body of literature concerning abnormalities in areas of the prefrontal cortex in individuals with psychopathy and CU traits.

Orbital and Ventrolateral Frontal Cortex Dysfunction

In addition to abnormalities in the amygdala and related circuitries, the IES model posits that individuals with psychopathy present with irregularities in the orbital (OFC), ventrolateral frontal (vlPFC), and recently, ventromedial (vmPFC) areas of the prefrontal cortex (Blair, 2005, 2010), as they often have difficulty in tasks that require the use of these areas. The OFC is located on the underside of the frontal lobe, sitting right above the eyes, with connections extending to the sensory areas, amygdala, entorhinal cortex, hippocampus, and the inferior temporal cortex (Kringelbach & Rolls, 2004). It is predominately responsible for the processing of reward and punishment, decision-making, and has been shown to be key in the forming of stimulus-reinforcement associations (Rolls, 2000). The vlPFC and vmPFC are located near the lateral and medial sections of the OFC and become activated when individuals make decisions that they are uncertain about, choices that usually involve communication with the emotion sections of the brain (e.g., amygdala and limbic system; Bechara, 2004; Rolls, Hornak, Wade, & McGrath, 1994).

Research concerning these areas is varied, as they are highly connected and their functions not always easily separable (Mitchell, Richell, Pine, & Blair, 2008). Further, much of the literature describing dysfunction in these areas has come from examining individuals who develop lesions or have diffuse structural damage to their frontal lobe, making it difficult to pinpoint exactly from where difficulties or irregularities in functioning arise. The following sections will discuss these areas, beginning with a description of each brain area and its associated functions, followed by a discussion of the literature to support dysfunction in these areas from both neuroimaing studies and psychological studies. Due to the very small literature using samples of youth in these areas, some studies using adult literature will be used to supplement discussion.

The orbitofrtonal, ventrolateral and ventromedial prefrontal cortices. Lesions and injury to the OFC have been implicated in changes in personality, behavior, and emotion (Kiehl, 2006) with one of the most famous cases being that of Phineas Gage (Harlow, 1848). These lesions can also lead to a term known as “acquired psychopathy” (Damasio, 1994), during which individuals exhibit difficulties with motivation, empathy, planning, organization, insight, responsibility, and behavioral inhibition (Malloy, Bihrle, Duffy, & Cimino, 1993), behavior that is markedly similar to those with ‘developmental psychopathy,’ or those who seem to have an organic basis to their psychopathy (Blair & Cipolotti, 2000). Additionally, individuals with damage to the OFC also show increased levels of reactive aggression (Blair et al., 2005; Grafman, Schwab, Warden, Pridgen, & Brown, 1996), as the OFC has been implicated in the monitoring and regulation of the basic response to threat, or the mechanisms that generally precede a reactively aggressive response to provocation (Blair, 2004; Gregg & Siegel, 2001). However, it should be noted that some of the findings concerning individuals with OFC damage do differ from psychopathic individuals. In particular, individuals with psychopathy generally exhibit highly instrumental aggression that is motivated by perceived reward; while they do exhibit reactive aggression, it is usually in response to high levels of frustration and is generally not attributed to a threat response (Blair, 2010b).

Stemming from the literature on OFC functioning, recent research has begun to examine possible abnormalities in the vlPFC and vmPFC in individuals with psychopathy in attempts to further distinguish which areas influence which behavioral response (Bechara, 2004). Studies of individuals with lesions in the vmPFC have shown they exhibit abnormal processing of emotions, have difficulty using emotions to guide their day-to-day lives (Bechara, Damasio, & Damasio, 2000), and have difficulty using both positive and negative information to examine future consequences of their behavior, often relying only on immediate prospects to make decisions (Bechara, Tranel, & Damasio, 2000). While few studies have looked specifically at the impact of vlPFC and vmPFC functioning on performance of psychopathic individuals during reversal learning tasks, recent research has highlighted its importance in these situations with healthy adults. Neuroimaging studies have shown that areas of the vlPFC and dorsomedial prefrontal cortex (dmPFC) significantly increase in activation when individuals stop responding to a previously rewarded stimulus and switch to another (reversal errors) during reversal learning tasks (Budhani, Marsh, Pine, & Blair, 2007; Cools, Clark, Owen, & Robbins, 2002). In contrast, however, the vmPFC shows reduced activity during these reversal errors in healthy adults (Budhani et al., 2007), indicating that both areas may be involved in this task, perhaps one to influence the inhibition of responding to a previously punished stimulus, and one to increase responding to a newly rewarded one.

Studies in support of OFC, vlPFC, and vmPFC dysfunction. There is some evidence to support prefrontal cortex dysfunction in individuals with psychopathic traits in adult populations, though support for this dysfunction in children is mixed (Kiehl, 2006). It should be noted that this research generally involves the use of two paradigms: response reversal tasks, during which individuals must change their response to a stimulus as a function of a change in contingency (i.e., stop responding to a stimulus that was previously rewarded, though now is punished; Rolls, 2000), and card-playing tasks, during which individuals must use punishment and reward information gained from picking cards to aid in learning and avoid making risky card selections; both tasks have been shown to implicate the OFC, vmPFC, vlPFC, and related structures (Bechara, Damasio, Damasio, & Anderson, 1994; Blair et al., 2005; Mitchell et al., 2008).

In a study of 51 adult men (mean age 31 years) from high-security prisons in the London area, men with psychopathy made significantly more errors on a response reversal task and significantly more risky decisions on a card-playing task than men without psychopathy (Mitchell, College, Leonard, & Blair, 2002), indicating likely dysfunction in the OFC and related areas. Similarly, in a study of 31 adult men, also from high-security prisons in the London area, men with psychopathic tendencies made more errors on response reversal tasks, despite comparable performance to controls during the initial acquisition phase of the task (Budhani, Richell, & Blair, 2006).

Very few studies have examined the performance of children with psychopathic traits on response reversal paradigms. In a study of younger males (aged 9-17 years; n = 43) recruited from schools in the UK for students with emotional and behavioral disturbances, Blair, College, & Mitchell (2001) found that young males with psychopathic tendencies exhibited deficits on the card-playing task only, and not on the task involving response reversal. However, in a separate sample of younger males (aged 9-17 years; n = 41) also recruited from schools in the UK for students with emotional and behavioral disturbances, boys with psychopathic tendencies did not show impairment in a response reversal task when the contingency change was large (e.g., stimulus 1 was rewarded 100 percent of the time, stimulus 2 was rewarded zero percent of the time), but showed significant impairment as the cues became less salient (e.g., stimulus 1 was rewarded 70 percent of the time, stimulus 2 was rewarded 30 percent of the time), indicating less ability to detect these subtle changes in contingency (Budhani & Blair, 2005).

To date, only one neuroimaging study has examined the impact of these areas on reversal learning tasks in children with psychopathic traits (Finger, Marsh, Mitchell, Reid, Sims, & Budhani, et al., 2008). In this study, children (aged 10-17 years; n = 42) were assessed with the APSD (Frick & Hare, 2001) and a response reversal task while undergoing an fMRI paradigm. In the response reversal task, youth were presented with pairs of images and were asked to select one. Youth received positive or negative feedback depending on the accuracy of their selection. Results indicated that youth with psychopathic traits did not exhibit differences in the percentage of reversal errors when compared to children with ADHD and controls. However, these youth did exhibit significantly abnormal activity in the vmPFC during these errors, often exhibiting the reverse pattern of both groups of comparison children; no differences were found among groups for the dmPFC or vlPFC. Follow-up analyses indicated that CU traits predicted variance in the activity in the vmPFC. From these findings, the authors concluded that children with psychopathic traits may not accurately process their errors during this paradigm, which likely impairs their ability to detect contingency changes, consistent with Budhani and Blair (2005).

Given the mixed results and with so few studies, it remains unclear the extent to which children with psychopathy traits show deficits in prefrontal cortex functioning. It is possible that the dysfunction seen in adults represents the end of a developmental phenomenon; children with psychopathic traits may just be beginning to show signs of this dysfunction, and will not show the full manifestation until later in life (Blair, 2005), which may account for the varied outcomes. However, there is a small, but compelling literature that suggests youth with psychopathy exhibit deficits in their abilities to detect and use contingency changes (e.g., reward versus punishment) to modify their behavior, a process that relies upon intact functioning of these areas.

The OFC, vlPFC, and response control. Independent of the literature on response reversal exists a body of research that concerns the role of the prefrontal cortex in response control paradigms, or tasks in which individuals must respond to one set of stimuli and withhold responding to another, *without* expectation of reward or punishment (Blair et al., 2005). One of the most popular is the go/no-go task, which has been shown to implicate the vlPFC and the OFC in adults (Casey, Forman, Franzen, Berkowitz, Braver, & Nystrom et al., 2001). In typically developing children, research has shown an increase in dmPFC activation with age on this task, though the processes involved in inhibiting a response as it relates to emotion regulation may change as children mature (Lewis, Lamm, Segalowitz, Stieben, & Zelazo, 2006). This task is unique in that while it requires use of the prefrontal areas, it does not require computation of reward/punishment contingencies, and thus provides a non-emotion-based test of motor control and behavioral inhibition (Blair et al., 2005). Very few studies have examined the performance of individuals with psychopathy on response control tasks, only one of them with juveniles.

Lapierre, Braun, & Hodgins (1995) examined the performance of incarcerated adults with and without psychopathy (mean age 33 and 32 years, respectively) on a go/no-go task. Here, participants were asked to press the space bar when they saw one set of stimuli (e.g., white crosses; the "go" cues), but not when they saw others (e.g., white squares; the "nogo" cues). Outcome variables included the number of correct "hits" (responding correctly), omissions (failing to respond), commissions or "false alarms" (responding incorrectly), and reaction times. Overall, psychopaths made significantly more errors of commission than non-psychopaths, as they were often unable to inhibit responding to the incorrect stimulus; no other differences on other outcome variables were observed. Kiehl, Smith, Hare, & Liddle (2000) also examined the performance of adults on a go/no-go task, comparing three groups of incarcerated adults: schizophrenic patients, nonpsychotic psychopaths, and nonpsychotic non-psychopaths. While the psychopaths did not evidence impairment in performance, they showed reduction in event-related potential (ERP) responses on the no-go trials, indicating dampened brain processing during trials involving the inhibition of a response.

Roussy and Toupin (2000) provide the only study to date that examines the performance of psychopathic and non-psychopathic juvenile offenders on a go/no-go task. Participants were 54 males, aged 14-19 years (mean = 16.5 years), currently incarcerated and convicted of at least one violent offense in the past year. Multiple tests of neuropsychological functioning were administered, examining both orbitofrontal and dorsolateral prefrontal functioning. Similar to Lapierre et al. (1995), results indicated that psychopathic offenders made more errors of commission on the go/no-go task than non-psychopathic offenders; psychopaths also made more errors of commission on a stop task, another measure of response control. The two groups did not differ on any of the other measures.

As such, taken together, there is emerging evidence to indicate that individuals with psychopathy present with difficulty changing patterns of responding in response reversal tasks, and when inhibiting a response during measures of response control. These separate, but highly related findings provide further insight into other areas of dysfunction in individuals with psychopathy; over and above pure amygdala and emotion processing deficits, individuals with psychopathy likely present with irregularities in their abilities to use emotion to guide responding, inhibit behavioral responding, and change behavior patterns when punished, consistent with the IES Model. However, given the dearth of literature in these areas, and particularly concerning juvenile offenders, much more research is needed to further develop these theories.

Summary and Study Rationale

Youth involved in the juvenile justice system represent a population in need of continued research and intervention, and researchers from both the juvenile justice and psychological areas have attempted to group youth based on risk factors to better understand possible groups of youth that may go on to more severe and persistent patterns of behavior. However, this literature, while compelling, has been unable to fully explain the extent or range of impairment in these youth, or the mechanisms through which these risk factors may influence different patterns of antisocial development. Moffit’s (1993) theory of early- vs. adolescent-onset antisocial behavior has proven to be an effective way of characterizing these youth, with an extensive literature showing that those with an early-onset to their behavior display different patterns of development, risk factors, neuropsychological correlates, and outcomes in adulthood.

In extending this theory, however, recent research has begun to further categorize youth with early-onset antisocial behavior, using the presence or absence of Callous-Unemotional (CU) traits to indicate a group of youth that may go on to show a severe, persistent, and often violent trajectory of antisocial behavior. CU traits represent a downward extension of the affective component of psychopathy in adults, and the presence of these traits in youth has been associated with more instances in violent offending, aggression, conduct problems, and the emergence of psychopathy later in life. These traits have been shown to be relatively stable across childhood, and from childhood to adulthood, though they have been shown to be malleable and are not absolutely predictive of psychopathy in adulthood. In addition, CU traits are substantially heritable, and show distinct developmental correlates that separate them from other youth with conduct problems. In contrast to you with CU traits, those with an early-onset to their behavior, but without CU traits, have been shown to exhibit difficulties with emotion regulation, with their behavior under less genetic contribution and sharing more relationships to environmental context (e.g., neighborhood, parenting style).

In reaction to the inabilities of many previous theories to fully explain the concept of psychopathy, Blair developed the Integrated Emotion Systems Model (IES; 2005). This cognitive neuroscience theory identifies the amygdala and prefrontal cortex as core areas of dysfunction in psychopathy. According to this model, deficits in these brain areas impair emotional learning and socialization; youth are unable to correctly process the negative emotions of others, hindering the development of empathy, and have difficulty using emotional information to guide their future behavior. CU traits seem to be most related to amygdala dysfunction, with other aspects of psychopathy (e.g., behavioral inhibition) more related to the prefrontal cortex. However, these areas are highly related, and there is evidence to show that the connectivity of these areas is an important area worthy of future research. In particular, research aimed at understanding the pathways that can lead to the development of CU traits may have clear implications for treatment (Blair, 2005; Frick, 2006; Woodworth & Waschbusch, 2007); studies focusing on examining the specific impairments seen in youth with CU traits, as well as the possible reasons for these impairments, have the potential to influence more focused prevention and intervention efforts.

In support of the IES Model (Blair, 2006), research suggests that youth with CU traits demonstrate deficits in identifying fearful facial and sad expressions (Blair & Coles, 2000; Blair, Colledge, & Mitchell, 2001; Leist & Dadds, 2009; Munoz, 2009), fearful body postures (Munoz, 2009), and fearful and sad vocal tones (Blair et al., 2001), tasks that are dependent upon intact functioning of the amygdala. These youth often confuse fear and sadness with other basic emotions, and require more intense expressions, or specific instructions (e.g., “look at the eyes”), to correctly identify the emotion. Further, studies of emotion processing in adolescents with psychopathic and CU traits note that these youth exhibit dampened or reduced reactivity to distressing stimuli, slower responding to distressing cues, and reduced emotional memory for negative events. In addition to this, there is emerging evidence that suggests youth with CU traits demonstrate deficits on tasks that require the inhibition of a response, an aspect of cognitive control dependent upon intact functioning of the prefrontal cortex (Blair, 2005; Budhani & Blair, 2005; Roussy & Toupin, 2000).

However, while this research lends support to the IES Model (Blair, 2005), there are limitations and gaps in the literature. To begin, many of the reviewed studies use community-based samples of adolescents; as such, their findings may be influenced by the lack of variety in youth antisocial behavior and may not generalize to samples of more violent, antisocial youth who are currently incarcerated. Given this, future research should test these findings in samples of juvenile offenders to examine how the observed findings extend (or do not extend) to youth with higher levels of antisocial behavior. Along these lines, many of the studies reviewed involved samples spanning a wide age range often involving younger children (e.g., 8-18 years). As the areas of the brain responsible for emotion regulation (e.g., amygdala) and cognitive control (e.g., prefrontal cortex) develop rapidly throughout adolescence (Ernst, Pine, & Hardin, 2005; Steinberg, 2010), using such a wide age range may diminish findings that may be specific to a particular age group. As such, future studies may look test these findings in samples of older youth with a tighter age range.

In addition to these limitations, there is a large gap in the literature with regard to the relationship between emotion recognition and behavioral inhibition in individuals with CU traits. Taken together, these constructs represent an aspect of emotion regulation, namely the ability to inhibit behavioral responding in the face of an emotionally charged situation, and represent an area of the brain that is highly interconnected (i.e., the limbic system). While studies have documented deficits specific to each construct in individuals with CU traits, to date, no study has examined the relationship between these two aspects within one paradigm. Given this, further evaluation of the abilities of youth with CU traits to detect and respond (or inhibit responding) to various facial expressions may not only illustrate more specific dysfunctions in these individuals, but can also inform and affect intervention and prevention efforts. Additionally, in testing the performance of these individuals on tasks that tap into both amygdala and prefrontal cortex function, researchers can also assess both aspects of Blair's IES Model simultaneously.

To combine facial expression recognition with behavioral inhibition, the use of a relatively new behavioral paradigm known as the Emotional Go/NoGo may be beneficial (EGNG; Hare, Tottenham, Davidson, Glover, & Casey, 2005; Hare, Tottenham, Galvan, Voss, Glover, & Casey, 2008). The EGNG is similar to the original go/nogo paradigm, but involves detection and inhibition of responses to various facial expressions (fearful, happy, sad, angry, and neutral), in this way measuring behavioral inhibition and emotion recognition within an emotionally-laden task. This paradigm has been shown to activate both the amygdala and areas of the prefrontal cortex (Hare et al., 2005; Hare et al., 2008; Schulz, Clerkin, Halperin, Newcorn, Yang, & Fan, 2009), and has been used in studies of depression and anxiety (Ladouceur, Dahl, Williamson, Birhmaher, Axelson, & Ryan et al., 2006), as well as with Romanian orphans who were previously institutionalized (Tottenham, Hare, Millner, Gilhooly, Zevin, & Casey, 2010; Tottenham, Hare, Quinn, McCarry, Nuse, & Gilhooly et al., 2009).

Aims. The current study seeks to fill some of the extant gaps in the literature and examine the performance of incarcerated male adolescents with CU traits on the EGNG. To begin, many of the previous studies related to emotion recognition and behavioral inhibition in youth with CU traits have used samples of youth that span a wide age range (e.g., 8-18 years). Given the significant changes that occur in the brain throughout adolescence (Steinberg, 2010), the current study involves youth from a more restrictive age range (16-18 years) in order to examine how youth with CU traits from this age group compare to previous samples. In addition, as emotion recognition and behavioral inhibition have often been assessed separately in the literature, the current study aims to examine these two constructs simultaneously in youth with CU traits. Specifically, as youth with CU traits have been shown to exhibit difficulty detecting fearful faces, Hypothesis One will evaluate whether they show impaired detection of these faces within this paradigm, particularly as it compares to their ability to detect other facial expressions (angry, sad, and happy). Further, as these youth have been shown to exhibit impaired behavioral inhibition and response control, Hypothesis Two aims to explore if youth with CU traits respond more or less impulsively to different facial expressions. Lastly, as past research has shown dampened reactivity to negative emotions among individuals with psychopathy and CU traits, Hypothesis Three will explore the speed with which youth with CU traits react to negative faces (e.g., fearful, sad, angry) within the EGNG. The specific hypotheses follow in methodology.

Chapter III

Methodology

Participants

As part of a larger group-counseling intervention study, 268 participants were recruited from Rikers Island Correctional Facility in New York City, where individuals ages 16 and older are detained or incarcerated. In this study, male youth, ages 16-18, were recruited from ten housing areas; the census of each area was approximately 30 to 40 youth on any given day. Fifty-five percent of the youth in this sample were sentenced to a year or less; forty-five percent were detained and awaiting trial or release.

Procedures

All procedures were approved by the New York University Internal Review Board (IRB) and the New York City Department of Corrections IRB. Participants were invited to participate in the project through monthly recruitment sessions held in their dorms. At the beginning of each intervention cycle (roughly every 4-5 weeks), research staff introduced the study to all youth in the dormitory common room. Youth who had at least six weeks remaining on their sentence or estimated length of stay were invited to fill out an information sheet asking for their name, dormitory, date of birth, and anticipated release date. Research staff met with eligible youth in a private space to further explain the study, answers questions, and obtain informed consent. Parental consent was obtained for all youth aged 16 or 17 who were not legally emancipated.

Prior to their involvement in the group sessions, youth were asked to complete a 2.5-hour computer-based baseline interview, conducted in a private space with a trained interviewer; two interview sessions were provided if youth were unable to complete it in one session. Interviews were conducted on a laptop using the Questionnaire Development System (QDS; Nova

Research, 2000) and an audio-computer assisted self-interview format (A-CASI), which read each question aloud to the participants. All participants wore headphones to ensure privacy and confidentiality of responses. The majority of the interview involved assessment measures that used Likert-type or open-ended responses, during which youth answered questions about a wide variety of topics (e.g., demographic information, mental health, substance use, exposure to violence, history of offending, sexual health, CU traits, family environment). Youth who reported any suicidal ideation, intent, or action within the past three months were referred to appropriate mental health services. Following the interview, three computerized tasks were administered that were programmed outside of the QDS platform. All participants received $25.00 in their commissary accounts for participation in the interview.

Measures

Background and demographic measures. As part of the interview process, participants reported on a number of variables, including their age, race/ethnicity, history of incarceration, school history, and gang affiliation (yes/no). Official criminal records (i.e., charges at the time of baseline interview) were obtained for most youth, with the exception of those who had committed their crime prior to the age of 16 (in these cases, the criminal file is "sealed"). As these files are public record, an Internet search was performed for each youth to obtain charge information.

Wide Range Achievement Test-- Third Edition (WRAT-3; Wilkinson, 1993). The Word Reading subscale from the WRAT-3 was used as an estimate for verbal IQ/cognitive ability. Participants were asked to read aloud from a list of single words that increased in difficulty (e.g., "dog"). In clinical populations of children referred for academic difficulties, the WRAT-3 has shown moderate to high correlations with IQ, ranging from $r = .55$ to $r = .71$

(Smith et al., 1995; Vance & Fuller, 1995), and has shown adequate concurrent validity with other academic measures (Flanagan et al., 1997).

Self-Report of Offending (SRO). The SRO (Huizinga, Esbensen, & Weiher, 1991) represents an adaptation of the Self-Report of Delinquency Questionnaire and the Self-Report of Antisocial Behavior Questionnaire used in The Project on Human Development in Chicago Neighborhoods; it was further adapted for the current study to measure the youths' account of involvement in antisocial and illegal activities. Youth reported whether they had engaged in a particular activity (yes/no) across 10 items, and if so, the age at which they first engaged. This provided an account of the different types of crimes committed by the youth (e.g., theft, assault, public disorder). Information about lifetime and past-year involvement in delinquent and criminal behaviors was obtained, with follow-up prompts designed to obtain information about age of onset and date of recent involvement. Other factors such as police involvement or solitary versus group offending were included. The items assessed both violent (e.g., assault, attempts to kill) and non-violent crimes (theft, drug sales). This measure has been used extensively in the literature to document levels of antisocial behavior both antisocial and community populations (e.g., Knight, Little, Losoya, & Mulvey, 2004; Piquero, MacIntosh, & Hickman, 2002).

In the current, study, the information obtained from the SRO was used to validate the antisocial nature of the sample and compare reports of crimes to CU traits. Violent and non-violent crimes were summed separately to: **1)** indicate how many youth engaged in violent crimes, non-violent crimes, or both across their lifetimes (i.e., 150 youth reported committing both types of crimes) and **2)** to provide a count of the different types of crimes committed, for violent, non-violent, and a total number (i.e., one youth reported committing three types of violent crimes [assault, murder, attack with a deadly weapon) and two types of non-violent crimes [stealing, disorderly conduct] in his lifetime, for a total of five different types of crimes committed in his lifetime).

Inventory of Callous-Unemotional Traits (ICU).

Description of scale. The ICU (Kimonis, Frick, Skeem, Marsee, Cruise, & Aucoin et al., 2008) is a 24-item self-report questionnaire designed to provide an assessment of callous-unemotional traits in youth. Answers were recorded on a four-point Likert scale ranging from 0 (*not at all true*) to 3 (*definitely true*). Twelve positively worded items (items 1, 3, 5, 8, 13, 14, 15, 16, 17, 19, 23, 24) required reverse scoring before calculation of the subscale scores. The ICU captures three dimensions of CU traits: callousness (e.g., "The feelings of others are unimportant to me," "I do not care who I hurt to get what I want"), unemotional (e.g., "I do not show my emotions to others," "I hide my feelings from others"), and uncaring (e.g., reverse scored items: "I feel bad or guilty when I do something wrong," "I do things to make others feel good"), and sums these to provide a total score (See Table 2 for all items and subscales). Although there are parent, teacher, and self-report versions of the ICU available, only the self-report version was used in the current study.

Table 2: Inventory of Callous-Unemotional Traits and Subscales (Kimonis et al., 2008)

Item	Subscale
*1. I express my feelings openly.	Unemotional
6. I do not show my emotions to others.	Unemotional
*14. It is easy for others to tell how I am feeling.	Unemotional
*19. I am very expressive and emotional.	Unemotional
22. I hide my feelings from others.	Unemotional
3. I care about how well I do at school or work.	Uncaring
*5. I feel bad or guilty when I do something wrong.	Uncaring
*13. I easily admit to being wrong.	Uncaring

*15. I always try my best.	Uncaring
*16. I apologize ("say I am sorry") to persons I hurt	Uncaring
*17. I try not to hurt others' feelings.	Uncaring
*23. I work hard on everything I do.	Uncaring
*24. I do things to make others feel good.	Uncaring
4. I do not care who I hurt to get what I want.	Callous
7. I do not care about being on time.	Callous
*8. I am concerned about the feelings of others.	Callous
9. I do not care if I get into trouble.	Callous
11. I do not care about doing things well.	Callous
12. I seem very cold and uncaring to others	Callous
18. I do not feel remorseful when I do something wrong.	Callous
20. I do not like to put the time into doing things well.	Callous
21. The feelings of others are unimportant to me.	Callous
2. What I think is "right" and "wrong" is different from what other people think.	*(omitted)*
10. I do not let my feelings control me.	*(omitted)*

*denotes reverse scored item

Background and validity. The ICU represents an improvement and extension of a previous measure of CU traits in youth, the six-item CU scale of the Antisocial Process Screening Device (APSD; Frick & Hare, 2001). Validity for this self-report ICU has been demonstrated in multiple studies, with significant associations found with measures of aggression, delinquency, empathy, positive affect, internalizing and externalizing behaviors, and conduct problems (Essau, Sasagawa, & Frick, 2006; Kimonis et al., 2008; Lawing, Frick, & Cruise, 2010).

The total score and subscales of the ICU have shown adequate internal consistency reliability estimates in samples using a wide variety of youth. Cronbach's alpha estimates are presented below in Table 3.

Table 3: Internal Consistency Reliability Coefficients for the ICU in Past Studies

ICU Variable	*Essau et al., 2006*[a]	*Kimonis, et al., 2008*[b]	*Fanti et al., 2009*[c]	*Roose et al., 2010*[d]
Total Score	.77	.81	.81	.83
Callous	.70	.80	.79	.79
Uncaring	.73	.81	.78	.77
Unemotional	.64	.53	.68	.73

a. Essau et al., 2006: Sample = community sample of German boys aged 13-18 years
b. Kimonis et al., 2008: Sample = detained American boys aged 12-20 years
c. Fanti et al., 2009: Sample = community sample of Greek boys aged 12-18 years
d. Roose et al., 2010: Sample = community sample of Dutch youth aged 14-20 years

Importantly, the factor structure of ICU indicates that use of either the total scale or subscales is justified, as each subscale appears to measure a separate, yet related, construct (Essau et al., 2006; Kimonis et al., 2008). As such, in the current study, the subscales of the ICU were used rather than the total score to determine if there was variability in responding on the EGNG in youth who may be higher or lower on certain subscales. In line with past studies of detained adolescent boys (e.g., Kimonis et al., 2008; Kimonis, Frick, Munoz, & Aucoin, 2008), items 2 and 10 were deleted due to low corrected item-total correlations. The remaining 22 items were summed for total subscale scores.

In the current sample, reliability estimates were adequate for the Uncaring and Callous subscales, with Cronbach's alpha coefficients of $\alpha = .83$ and $\alpha = .76$, respectively. However, the Unemotional subscale had inadequate reliability ($\alpha = .33$), and thus was excluded from analyses. Further exploration indicated that there were no items influencing this statistic (e.g., with a low item-total correlation). Given this, the reasons for the low reliability are unclear; it may be due to the low number of items (n =6) for this subscale, or may be related to youths' poor motivation on questions related to emotionality.

The Emotional Go/No-Go (EGNG).

Description of the task. In the EGNG paradigm (Hare et al., 2005), participants were shown a series of faces presented one at a time and were asked to respond if they saw a specific facial expression (the "go" or target expression) and withhold responding if they saw any other expression (the "nogo" or distracter expression). In total, there were 8 conditions or "blocks," each consisting of one emotional expression (happy, fear, angry, or sad) and a neutral expression. Notably, depending on the block, the emotional expression could serve as either the "go" or "nogo" expression. The following blocks were used: Angry Go/Neutral NoGo, Fearful Go/Neutral NoGo, Happy Go/Neutral NoGo, Sad Go/Neutral NoGo, Neutral Go/Angry NoGo, Neutral Go/Fearful NoGo, Neutral Go/Happy NoGo, and Neutral Go/Sad NoGo.

To better illustrate this paradigm, in the "Fear Go/Neutral NoGo" block (i.e., when fearful faces were the "go" expression and neutral faces were the "nogo" expression), participants were instructed to press a button when they saw a fearful face but not to respond to any other faces. Participants were then presented with a series of 30 faces (20 fearful faces and 10 neutral faces) in random order, and had to either respond or not respond based on the expression. "Go" faces occurred frequently (20/30 faces), creating a tendency for youth to respond that they had to inhibit for the "no-go" cues (10/30 faces), thus measuring the ability to inhibit a prepotent response under emotional stimulation. The set of facial stimuli were color images of 10 individuals (5 male, 5 female) drawn from the NimStim set (available at www.macbrain.org) from the following races: African-American, Asian, and Caucasian. Faces were pseudo-randomized across the block to control for order of presentation and the order of the 8 blocks was randomized across subjects. Stimulus duration was 500 msec with an interstimulus interval of 1500 msec. Practice trials were administered to ensure that participants understood the task and could execute the responses.

Background and validity. The EGNG task represents an extension of the original go/nogo task, a measure of response control and behavioral inhibition administered via computer. In the original task, participants are asked to press the space bar when they see one set of stimuli (e.g., white crosses; the "go" cues), but not when they see others (e.g., white squares; the "nogo" cues; LaPierre, Braun, & Hodgins, 1995). While outcome variables vary from study to study, they are generally provided in terms of the number of correct "hits" (responding correctly), omissions (failing to respond), commissions or "false alarms" (responding incorrectly), and reaction times. Research using fMRI data to document brain activity during this original task in adults has shown that the ventrolateral prefrontal cortex is used to resolve the conflict between responding to "go" cues and inhibiting responding to "nogo" cues (Casey et al., 2001).

Schulz, Fan, Magidina, Marks, Hahn, & Halperin (2007) tested the convergence of the original go/nogo task and the emotional go/nogo task with a group of 85 college students to determine if the addition of an emotion context affected the ability of the task to measure behavioral inhibition. The go/nogo tasks were found to show a moderate correlation (r = .51-.74), indicating that even with an emotional addition, the intended measurement of behavioral inhibition was preserved. Further, the authors concluded that the emotional go/nogo task was particularly suited for testing behavioral inhibition in "settings where emotional processing must be measured simultaneously" (p. 159). As such, this task represents a unique instrument that can be used to examine how emotional processing and behavioral inhibition function together neurologically.

In validating the use of the EGNG as a measure of these constructs, Hare et al. (2005) measured the performance of a small sample of normal adults on the EGNG. Results indicated that responses to fearful faces tended to be slower than responses to happy or neutral faces. Further, these adults tended to make more errors of commission (i.e., were less behaviorally inhibited) when asked to inhibit responding to happy faces, as compared to neutral or fearful faces. In extending this work, this same group of researchers (Hare et al., 2008) examined fMRI data from children (aged 7-12 years, n = 12), adolescents (aged 13-18 years, n = 24), and adults (aged 19-32 years, n = 24) during the EGNG to assess the development of individual differences in emotion regulation from childhood to adulthood. In accordance with their earlier study, participants, regardless of age, responded faster to happy faces than to fearful or calm faces.

Data Preparation and Main EGNG Variables

In order to examine the relationships between CU traits and variables of interest on the EGNG, several preliminary and secondary variables for the EGNG were created. First, a discussion of the preliminary variables is provided, followed by the composite variables proposed for analysis and specific hypotheses.

Preliminary variables.

1) Hit rate. In each emotion condition (e.g., "fearful"), there are 20 possible correct answers, where the participant accurately selected (clicked on the mouse), or "hit," on the desired emotion. The hit rate represents the proportion of correct responses, or the participants' number of correct responses divided by 20.

2) Miss rate. The miss rate represents the proportion of missed responses, or the number of instances when the participant was supposed to "hit" on the desired emotion, but did not. This proportion is calculated by subtracting the number of hits from 20, and then dividing this by 20.

3) False alarm (FA) rate. In each trial, there are 10 possible False Alarms, or items that represent incorrect responses. Here, the participant "hit" on a distracter emotion. The FA rate represents the proportion of incorrect responses, or the participants' number of incorrect responses divided by 10.

4) Mean reaction time for hits (RT). Reaction times were calculated for all emotions, both when emotion faces were the "go" and "nogo" stimuli. RTs were calculated only for trials in which the participants responded correctly, and are in milliseconds.

Composite variables proposed for analysis.

1) D-prime. Represents an accuracy index that accounts for response bias. Hit Rate is not used to index accuracy, as it is possible that individuals can "hit" on every face presented, regardless of the task instructions (i.e., creating 20/20 for hit rate, but 10/10 for FA rate). In this scenario, their accuracy index is incorrectly inflated due to the number of false alarms. D-prime is used to correct this, and is calculated by subtracting the z-transformed FA rate from the z-transformed Hit Rate to normalize scores across Hit and FA Rate. As it is a difference score, D-prime provides an index of the magnitude of difference between hits and false alarms within each condition. D-prime serves as an index of emotion recognition and discrimination, and was calculated for all emotion faces (happy, sad, fear, angry) and conditions, creating eight D-prime variables indexing accuracy at detecting each emotion in the go and nogo conditions. Higher D-prime values index greater accuracy of responding (Tottenham, Hare, & Casey, 2011).

2) Miss rate. Similar to hits, the miss rate provides an index of recognition and was calculated as described above. However, as it does not include false alarms, it solely provides an index of the number of missed responses, or the number of instances when the participant was supposed to "hit" on the desired emotion, but did not. It was calculated for all emotion faces (happy, sad, fear, angry) and conditions (go and no go). Importantly, it was included as a variable to be analyzed to enhance the validity of D-prime and to provide confirmation of whether or not youth were able to discriminate among emotions. In this study, relationships among EGNG variables and CU traits were hypothesized to include both recognition and inhibition (see below), and thus it is possible that the true relationship between hits and false alarms in the data (whether they were in line with the hypotheses or not) would diminish findings related to CU traits, depending on the direction of the relationship as it occurred in the data. As such, miss rate was included to provide further evidence for an emotion recognition deficit. Hit rate was not used due to the possibility of response bias, noted above.

3) False alarm (FA) rate. Was calculated as described above, and serves to index emotion regulation, cognitive control, and impulsive responding in the face of an emotionally salient situation. FA Rate was calculated for all eight conditions, both when emotion faces were the “go” and “nogo” stimuli. Higher FA Rates equal greater impulsivity in responding.

4) Mean reaction time (RT). Was calculated as described above, and serves to index speed of responding to emotion stimuli, as well as speed of responding to neutral stimuli when emotion faces serve as distracters. Mean RT was calculated for all eight conditions. Higher RTs indicate slower speed of responding.

Data Analysis Plan

These four main composite variables represent the EGNG variables for analysis, though as they represent different constructs, must be analyzed separately. For each analysis (D-prime, Miss Rate, False Alarm Rate, Mean Reaction Time), there are four levels of the emotion condition (happy, fear, angry, and sad), always paired with a neutral face. If the emotion face was the stimulus, the condition was labeled a “go” task; if the emotion face was the distracter, the condition was labeled a “nogo” task. As such, there were two within-subjects factors: Emotion (4 levels) and Stimulus Task (2 levels). To examine relationships among performance on the EGNG and ICU Callousness and Uncaring, four repeated measures general linear models (GLM) were performed, one for each EGNG composite. These analyses considered within-subjects effects of emotion (happy, sad, fear, angry), stimulus task (Go vs. Nogo), levels of CU traits, and interactions, controlling for Age and Reading Level, with Race/Ethnicity as a between-subjects factor. Post-hoc univariate analyses, *t*-tests, and partial correlations were calculated based on significant GLM interactions.

Hypotheses

Hypothesis 1: facial recognition. CU traits, as measured by the ICU variables Uncaring and Callous, will be inversely related to the identification of fearful facial expressions when fearful faces are the “go” cues (the Fear Go/Neutral NoGo condition). Specifically, individuals higher on CU traits will be less accurate at identifying fearful facial expressions than individuals lower on CU traits within this condition. This finding will be evident in both the models of D-prime (lower D-prime values in youth higher on CU traits) and in Miss Rate (higher miss rate in youth higher on CU traits).

Hypothesis 2: emotion regulation. CU traits will be inversely related to the FA rate when negative emotion faces are the “nogo” cues (the Neutral Go/Fear NoGo, Neutral Go/Sad NoGo, Neutral Go/Angry NoGo conditions). Specifically, individuals higher on CU traits will make fewer false alarms when asked to inhibit responding to negative faces when compared to individuals lower on CU traits within these conditions.

Hypothesis 3: emotional reactivity. Youth higher on CU traits are hypothesized to have faster reaction times (smaller RTs) in emotional “nogo” conditions when negative faces are the distracters, as compared to youth lower on CU traits (i.e., youth lower on CU traits will be more distracted by negative faces, and thus respond slower to neutral faces). Specifically, CU traits will be inversely related to mean reaction time when negative faces are the “nogo” cues, controlling for reaction time to other emotion faces, age, and estimated IQ.

Chapter IV

Results

Descriptive Statistics

Demographic variables. Due to missing questionnaire data, 5 participants were excluded from analyses. Descriptive statistics for the final 263 participants are provided in Table 4. Over half of the youth were 18 years of age (55.5%), with the majority of the sample reporting to be African American (44.9%). The mean reading level of the participants was estimated to be at the 7^{th} grade. The mean age of onset of offending behavior was 12.31 years (SD = 2.9), with a mode of 10 years old. Fifty-six percent of youth reported committing both violent and non-violent crimes. Youth reported committing roughly five different types of crimes within their lifetimes (Mean = 5.12, SD = 3.87), though reported committing more types of non-violent crimes (Mean = 3.87, SD = 2.57) than violent crimes (Mean = 1.41, SD = 1.58). Over half (57.5%) reported being gang affiliated.

Public records of the youths' criminal charges at the time of enrollment in the program were obtained for the majority of participants (73.5%); youth whose cases were sealed by the court (e.g., due to youth offender status) were unable to be accessed. Of those whose records were obtained, over half (62%) were charged with a violent felony (e.g., murder, assault, robbery, burglary), with a lesser number charged with non-violent felonies (e.g., attempted burglary, conspiracy; 23%), misdemeanors (e.g., petit larceny, resisting arrest; 10%), or other less severe charges (e.g., violations; 5%). The mean length of stay at Rikers Island from the participants' time of arrest to date of baseline data collection was 112 days (SD = 131 days; range 7 days – 953 days).

Table 4: Descriptive Statistics

Age (years)	***Frequency***	***Percentage***
16	36	13.7
17	81	30.8
18	146	55.5
Race/Ethnicity	***Frequency***	***Percentage***
Black/African American	118	44.9
Hispanic/Latino	73	27.8
Multiracial/Other*	72	27.4
*predominantly Black and Hispanic		
Education History	***Frequency***	***Percentage***
Percentage with GED	17	11
In School at Time of Incarceration	153	58.6
	Mean	***Range***
Estimated Reading Level	7th Grade	1st- Post High School
Lifetime Criminal History	***Frequency***	***Percentage***
Any Violent Crime (e.g., assault)	151	56
Any Non-Violent Crime (e.g., stealing)	225	84
Both Violent and Non-Violent Crimes	150	56
	Mean (SD)	***Range***
Sum of Types of Violent Crimes Committed	1.41 (1.58)	0-5
Sum of Types of Non-Violent Crimes Committed	3.71 (2.57)	0-9
	Mean (SD)	***Mode***
Age of Onset of Offending Behavior (in years)	12.31 (2.9)	10
Gang Affiliated in Lifetime	***Frequency***	***Percentage***
Yes	154	57.5
No	103	38.4
Not reported	6	4.1

Demographic variables, including age, race/ethnicity, and estimated reading level were first correlated with EGNG to determine relationships amongst the variables. Age, estimated Reading Level, and Race/Ethnicity were correlated with multiple EGNG variables, ($p < .05$), and thus were included as covariates or between-subjects variables for all analyses. Within Race/Ethnicity, the majority of those included in the “Multiracial/Other” category were biracial, mostly Black/African American and Hispanic. Levels of CU traits did not differ among Race/Ethnicity, Age, or Estimated Reading Level (p > .10). There were no differences among Race/Ethnic groups in estimated Reading Level or Age (p > .10). See Table 4 for bivariate correlations among demographic variables.

Table 5: Bivariate Correlations Among Demographic Variables

	Age	Reading Level	Race	Uncaring	Callous
Age	1				
Reading Level	0.044	1			
Race	.129*	0.106	1		
Uncaring	-0.091	0.005	-0.08	1	
Callous	-0.108	-0.052	0.059	.183**	1
Happy Go D-prime	.160*	.133*	0.024	-0.116	-.162*
Sad Go D-prime	.128*	0.021	0.01	-0.118	-0.124
Fear Go D-prime	0.109	0.082	0.11	-0.035	-0.07
Angry Go D-prime	.124*	0.052	0.093	-0.108	-0.125
Happy NoGo D-prime	0.033	.196**	.134*	-0.091	-0.1
Sad NoGo D-prime	0.082	0.112	.139*	-0.04	-0.008
Fear NoGo D-prime	0.078	0.016	0.104	-.130*	-0.068
Angry NoGo D-prime	.139*	.230**	0.043	0.027	-0.091
Happy Go False Alarms	-.168**	-.136*	0.046	0.057	0.068
Sad Go False Alarms	-0.022	-0.003	0.056	0.101	0.101
Fear Go False Alarms	-0.026	-0.001	.0000	-0.009	-0.009
Angry Go False Alarms	-0.048	-0.025	-0.006	.179**	0.039
Happy NoGo False Alarms	0.03	-.214**	-0.037	0.048	0.069
Sad NoGo False Alarms	0.024	-0.023	-0.012	0.019	-0.081
Fear NoGo False Alarms	-0.05	-0.031	-0.051	.238**	0.041
Angry NoGo False Alarms	-0.031	-.124*	0.06	-0.077	-0.004
Happy Go Reaction Time	-0.075	0.002	-.175**	-0.014	0.042
Sad Go Reaction Time	-0.117	-0.023	-0.101	-0.023	0.034
Fear Go Reaction Time	-.197**	-0.053	-.130*	0.108	0.088
Angry Go Reaction Time	-0.097	0.001	-.137*	0.045	0.011
Happy NoGo Reaction Time	-.145*	-0.066	-.145*	0.057	0.064
Sad NoGo Reaction Time	-0.066	-0.046	-.131*	-0.006	0.008
Fear NoGo Reaction Time	-.157*	-.132*	-.172**	0.07	0.044
Angry NoGo Reaction Time	-0.091	-0.048	-.135*	0.079	0.067

***Note*:** *p<.05, **p<.001

Inventory of callous-unemotional traits. Descriptive statistics for the ICU are presented in Table 6, along with a comparison of this sample to other studies. Following this, a brief synopsis of how the participants in this study relate to samples from other studies, as well as how their levels of CU traits relate to the types of crimes they committed, is provided.

Table 6: Descriptive Statistics for the ICU and Comparison of Means

ICU Variable	*Current Study Mean (SD)*	*Range*	*Essau et al., 2006[a]*	*Kimonis et al., 2008[b]*	*Fanti et al., 2009[c]*	*Roose et al., 2010[d]*
Callous	5.87 (4.3)	0-26	8.57 (4.6)	6.21 (4.49)	6.44 (4.09)	8.01 (5.24)
Uncaring	10.79 (5.12)	0-24	8.93 (4.2)	9.28 (4.93)	7.98 (4.86)	9.13 (4.05)
Unemotional	8.70 (2.5)	1-15	7.65 (2.6)	8.08 (2.94)	7.22 (3.06)	6.92 (3.11)

a. Essau et al., 2006: Sample = community sample of German boys aged 13-18 years
b. Kimonis et al., 2008: Sample = detained American boys aged 12-20 years
c. Fanti et al., 2009: Sample = community sample of Greek boys aged 12-18 years
d. Roose et al., 2010: Sample = community sample of Dutch youth aged 14-20 years

Overall, subscale scores from this sample are generally consistent with previously reported samples, though some differences do exist. However, it is important to note that the current sample had a more restricted age range than other samples, which makes comparisons to these other samples difficult. Nonetheless, the current sample appears to report less Callousness, higher levels of Uncaring, and roughly equivalent levels of Unemotional as previously reported samples with both delinquent and community samples of youth. Importantly, in the current sample, further analysis of the Callous subscale showed that it was significantly positively skewed (skewness = 1.35/standard error = .16), with more values in the lower end than a normal distribution, indicating overall low reported levels of callousness. Kurtosis was also significant for Callousness and indicated a highly peaked distribution with heavy tails (kurtosis = 2.977/standard error = .31). Further analysis of the Uncaring subscale indicated that it was generally evenly distributed (skewness = .19/standard error = .15; kurtosis = -0.03/standard error = .31).

When examining CU traits in relation to variety of crimes committed, a greater variety of violent crimes were associated with higher levels of Uncaring (*partial r* = .14, p = .03; controlling for variety of non-violent crimes and Callousness), as well as higher levels of Callousness (*partial r* = .13, p = .04; controlling for variety of non-violent crimes and Uncaring). However, neither Uncaring nor Callousness was significantly associated with variety of non-violent crimes (p > .10). Interestingly, CU traits were not associated with charge information obtained at the time of baseline interview (p > .10); youth who were charged with committing non-violent felonies had similar rates of CU traits as youth who reported committing violent felonies.

Emotional go/nogo. Descriptive statistics were obtained for EGNG variables and are presented below in Tables 7-10. To the author's knowledge, the current study represents the first time the EGNG has been done with a population of incarcerated youth, and thus a short discussion of how the performance of this sample relates to other studies is included.

Table 7: Descriptive Statistics for the EGNG: D-Prime (Accuracy)

D-Prime for Emotion Faces	*Mean*	*Std. Deviation*
Go Conditions		
Accuracy Happy as Target	3.17[a]	1.31
Accuracy Sad as Target	2.01[b]	1.08
Accuracy Fear as Target	2.61[b]	1.36
Accuracy Angry as Target	2.01[b]	1.16
NoGo Conditions		
Accuracy Happy as Distracter	1.91	1.81
Accuracy Sad as Distracter	1.35[d]	1.25
Accuracy Fear as Distracter	2.13[c]	1.34
Accuracy Angry as Distracter	1.51[d]	1.16

**Note:* Higher mean values indicate more accurate responding
a/b: values significantly differ, p < .05; c/d: values significantly differ, p < .05

Table 8: Descriptive Statistics for the EGNG: Miss Rate Proportion (Accuracy)

Miss Rate for Emotion Faces	Mean	Std. Deviation
Go Conditions		
Accuracy Happy as Target	0.09[a]	0.20
Accuracy Sad as Target	0.18[b]	0.20
Accuracy Fear as Target	0.14[b]	0.24
Accuracy Angry as Target	0.21[b]	0.23
NoGo Conditions		
Accuracy Happy as Distracter	0.20	0.27
Accuracy Sad as Distracter	0.22	0.26
Accuracy Fear as Distracter	0.19	0.25
Accuracy Angry as Distracter	0.21	0.26

**Note:* Higher proportions indicate more misses, or less accurate responding
a/b: values significantly differ, p < .05

Table 9: Descriptive Statistics for the EGNG: False Alarms (FA's)

False Alarms Variable	Mean	Std. Deviation
Go Conditions		
Proportion FA's Happy as Target	.14	1.9
Proportion FA's Sad as Target	.25	.23
Proportion FA's Fear as Target	.19	.2
Proportion FA's Angry as Target	.23	.23
NoGo Conditions		
Proportion FA's Happy as Distracter	.27[b]	.26
Proportion FA's Sad as Distracter	.39[a]	.24
Proportion FA's Fear as Distracter	.24[b]	.24
Proportion FA's Angry as Distracter	.36	.24

**Note:* Higher mean values indicate more false alarms (worse inhibitory ability)
a/b: values significantly differ, p < .05

Table 10: Descriptive Statistics for the EGNG: Reaction Time (msec)

Reaction Times (RT) Variable	Mean	Std. Deviation
Go Conditions		
RT Happy as Target	410.16[a]	111.68
RT Sad as Target	455.62[b]	100.74
RT Fear as Target	435.03[b]	115.49
RT Angry as Target	458.41[b]	109.44
NoGo Conditions		
RT Happy as Distracter	447.57	114.45
RT Sad as Distracter	464.73	113.62
RT Fear as Distracter	449.53	105.13
RT Angry as Distracter	457.97	111.63

**Note:* Higher mean values indicate longer reaction times
a/b: values significantly differ, $p < .05$

Overall, results for the EGNG are consistent with other studies using typically developing or "normal" populations (e.g., Hare et al., 2005; Hare et al., 2008). However, to date, only one study has reported on the D-prime variable in the EGNG with a normal population (Tottenham, et al., 2011). Consistent with this previous study, participants in the current study evidenced overall lower D-prime rates during emotional NoGo conditions than Go conditions, indicating better emotion recognition for emotional faces as compared to neutral faces. This finding was also replicated in the Miss Rate model (fewer misses on emotion face trials than neutral faces trials). Further, also consistent with Tottenham et al., participants in the current study were most accurate at identifying happy faces during the emotional "go" trials, as compared to fearful [t (260) = 6.61, $p < .001$], sad [t (260) = 15.70, $p < .001$], and angry faces [t (260) = 13.12, $p < .001$]; again, this was replicated in the Miss Rate model. Finally, during the emotional "nogo" trials, participants were most accurate at distinguishing neutral faces when paired with fearful faces, as compared to sad [t (260) = 7.01, $p < .001$] and angry faces [t (260) = 6.81, $p < .001$]; there was no significant difference in identifying neutral faces during fearful and happy "nogo" trials [*t* (260) = 1.41, p = 1.59]. This latter finding is also consistent with Tottenham et al. and with results from the Miss Rate model of the current study.

With regard to False Alarms, in "nogo" conditions, participants in this sample made the most errors of commission (false alarms) when asked to inhibit responding to sad faces, which differed significantly from happy faces [*t* (260) = -6.23, p < .001], and fearful faces [*t* (260) = 9.01, p < .001]; there were no differences between false alarms to sad and angry faces [*t* (260) = 1.32, p = .187]. In previous studies, participants had more difficulty withholding responses to happy faces in "nogo" conditions (Hare et al., 2005; Hare et al., 2008). With regard to Reaction Times, within "go" conditions (responding to emotion faces), participants in this sample responded faster to happy faces than to sad [*t* (256) = -9.12, p < .001], fearful [*t* (252) = -4.48, p < .001], or angry faces [*t* (254) = -10.65, p < .001], consistent with previous studies (e.g., Hare et al., 2005; Hare et al., 2008).

In sum, results from the current study are generally consistent with the existing (though limited) normative data with regard to D-prime, Miss Rate, and Reaction Time findings. However, results from the current study differ from the normative data with respect to False Alarms. In the studies of typically developing youth, the highest number of false alarms occurred to happy faces (i.e., difficulty withholding a response when seeing a happy face); in the current study, youth had the most difficulty inhibiting their responses to sad and angry faces, as they made the most false alarms when asked to withhold responding to these faces.

Main Analyses

To examine relationships among the ICU and EGNG variables, a repeated measures general linear model (GLM) was calculated for each EGNG composite: D-prime (indexing emotion recognition), Miss Rate (indexing emotion recognition), False Alarm rate (indexing emotional/behavioral inhibition), and Reaction Time (indexing emotional reactivity/speed of responding). Follow up univariate tests, *t*-tests, and partial correlations were calculated based on significant GLM interactions. Results for each composite are presented separately, followed by a discussion of whether hypotheses were supported, and lastly, a brief conclusion.

Emotion recognition. A repeated measures GLM on the composite D-prime demonstrated no significant main effects for Emotion (happy, sad, fear, angry) [$F(3, 233) = 0.47$, $p = .71$] or Task (go vs. nogo) [$F(1, 235) = 0.02$, $p = .90$], indicating that with the addition of other variables to the model (i.e., age, WRAT, CU traits, Race) the differences between recognition of emotion during Go and NoGo conditions seen in the descriptive statistics are no longer significant; the relationships are better accounted for by interaction terms and more complex patterns (described below).

Hypothesis one. There were no significant two-way interactions between Task and Age [$F(3, 233) = 1.4$, $p = .24$], Task and Uncaring [$F(3, 233) = 0.08$, $p = .72$], or Task and Callousness [$F(3, 233) = 0.50$, $p = .48$]. There were no significant two-way interactions between Emotion and Age [$F(3, 233) = 0.06$, $p = .98$], Emotion and Uncaring [$F(3, 233) = 0.72$, $p = .54$], or Emotion and Callousness [$F(3, 233) = 0.85$, $p = .47$]. These results indicate that there were no differences in emotion recognition among ages and various levels of CU traits within the D-prime model. This finding was further supported through a GLM with the dependent variable of Miss Rate, which revealed no main effects for Emotion or Task, and no interactions with Emotion and Callousness [$F(3, 233) = 0.98$, $p = .40$], Emotion and Uncaring [$F(3, 233) = 1.90$, $p = .13$], Task and Callousness [$F(1, 235) = 0.58$, $p = 0.45$], or Task and Uncaring [$F(1, 235) = 0.25$, $p = .62$]. Taken together, these findings indicate that youth with higher levels CU traits do not appear deficient in their recognition of emotion facial expressions on the EGNG as compared to youth lower on CU traits. As such, Hypothesis One was not supported. Despite this, however, other significant two- and three-way interactions emerged within the D-prime model and are described below.

Emotion recognition and reading level. There was a significant two-way interaction between Emotion and Reading Level [$F(3, 233) = 3.31$, p = .02]; follow-up partial correlations revealed that Reading Level was significantly, positively associated with the detection of Happy (*partial* $r = 0.19$, p < .01) and Angry faces (*partial* $r = 0.11$, p < .01), but not to Fearful or Sad faces. Individuals with higher estimated reading levels were better able to recognize Angry and Happy faces than individuals with lower estimated reading levels. There was no interaction between Emotion and Reading Level within the Miss Rate model [$F(3, 233) = 1.43$, p = .24].

There was a significant two-way interaction between Task and Reading Level [$F(3, 233) = 3.8$, p = .05], such that individuals with higher estimated reading levels were significantly more accurate at discriminating Neutral from Emotion faces across NoGo conditions than individuals with lower estimated reading levels (*partial* $r = 0.17$, p < .01). This finding was also evident in the Miss Rate model, where there was a significant two-way interaction between Task and Reading level [$F(1, 235) = 4.21$, p = .04]; individuals with higher estimated reading levels missed fewer faces across NoGo conditions than individuals with lower estimated reading levels (*partial* $r = -.15$, p < .01).

Emotion recognition and race/ethnicity. Race/Ethnicity was included as a variable in all models and revealed some unanticipated, yet interesting findings within the D-prime model. Results demonstrated a significant three-way interaction among Emotion, Task, and Race/Ethnicity [$F(3, 233) = 3.05$, p < .01], indicating that the relationship between Emotion and Task varied by Race/Ethnicity. See Table 11 for Estimated Marginal Means for this interaction.

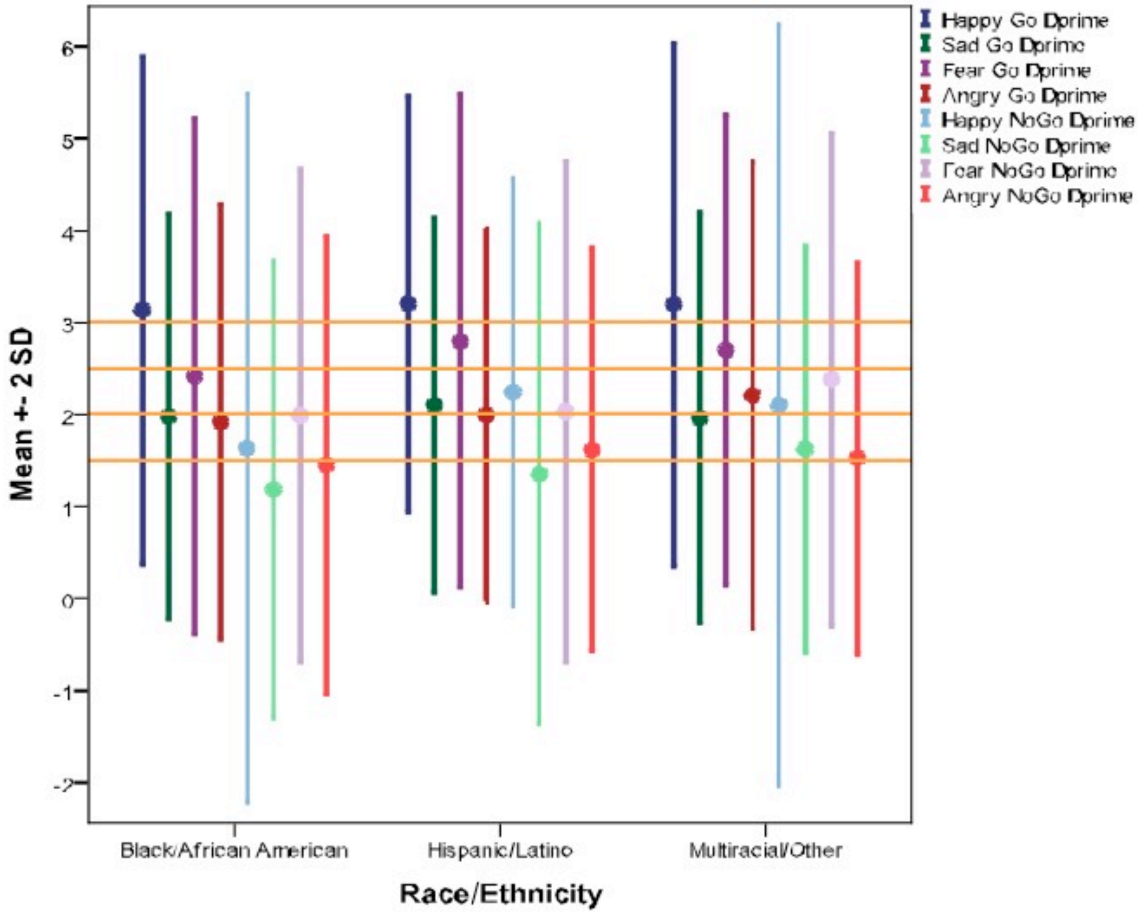
See Figure 2 for a visual representation of differences in D-prime among races. Both this table and the visual were used to guide follow up tests to further explore the nature of this interaction. Importantly, there was no interaction between Race/Ethnicity, Task, and Emotion in the Miss Rate model [$F(6, 468) = 1.63$, $p = .14$]. This indicates that while there may be no difference among youth of varying races in their abilities to detect and discriminate among emotions (miss rate), there do appear to be differences among races when their ability to inhibit responding to emotions (false alarms) is included as an index of recognition.

Table 11: Estimated Marginal Means for D-prime by Emotion, Race/Ethnicity, and Task

Race/Ethnicity	***Emotion***	***Task***	***D-prime Mean***	***Std. Error***
Black/African American	**Fear**	*Go*	2.491	.132
		NoGo	2.062	.133
	Happy	*Go*	3.304	.122
		NoGo	1.756	.172
	Sad	*Go*	2.050	.101
		NoGo	1.214	.121
	Angry	*Go*	1.946	.109
		NoGo	1.535	.109
Hispanic/Latino	**Fear**	*Go*	2.776	.164
		NoGo	2.003	.165
	Happy	*Go*	3.118	.151
		NoGo	2.232	.214
	Sad	*Go*	2.053	.126
		NoGo	1.296	.150
	Angry	*Go*	1.964	.135
		NoGo	1.556	.135
Multiracial/Other	**Fear**	*Go*	2.705	.167
		NoGo	2.430	.167
	Happy	*Go*	3.253	.154
		NoGo	2.158	.217
	Sad	*Go*	1.980	.128
		NoGo	1.640	.153
	Angry	*Go*	2.338	.138
		NoGo	1.572	.137

**Note:* Higher D-prime values indicate more accurate emotion recognition.

Figure 2: D-prime (Accuracy) Performance by Race/Ethnicity



Follow-up tests of d-prime and race/ethnicity. Based on Figure 2 and Table 9, univariate GLMs were conducted on conditions in which there appeared to be significant differences in variability or means among races (e.g., Angry Go D-prime). This test was chosen because it allows for the statistical control of other variables that were also controlled for in the larger model (e.g., Callousness, Uncaring, Age, WRAT), and also provides more statistical rigor and more stringent analyses when conducting follow up tests (i.e., as compared to *t*-tests). These follow-up analyses revealed *no significant differences* in the detection and discrimination of emotion faces among races in any condition. This is likely due to the small sample size and low power that results when multiple post-hoc tests are used. However, despite this, patterns of responding did emerge that, while non-significant, provide insight into how individuals from different races/ethnicities may perceive various facial expressions. These results will be described here to illustrate these differences; as they are not significant, they should be interpreted with caution. See Figures 3 and 4 for a visual of D-prime, by race/ethnicity and condition (go/nogo).

Figure 3: EGNG Go Condition, D-prime by Race/Ethnicity

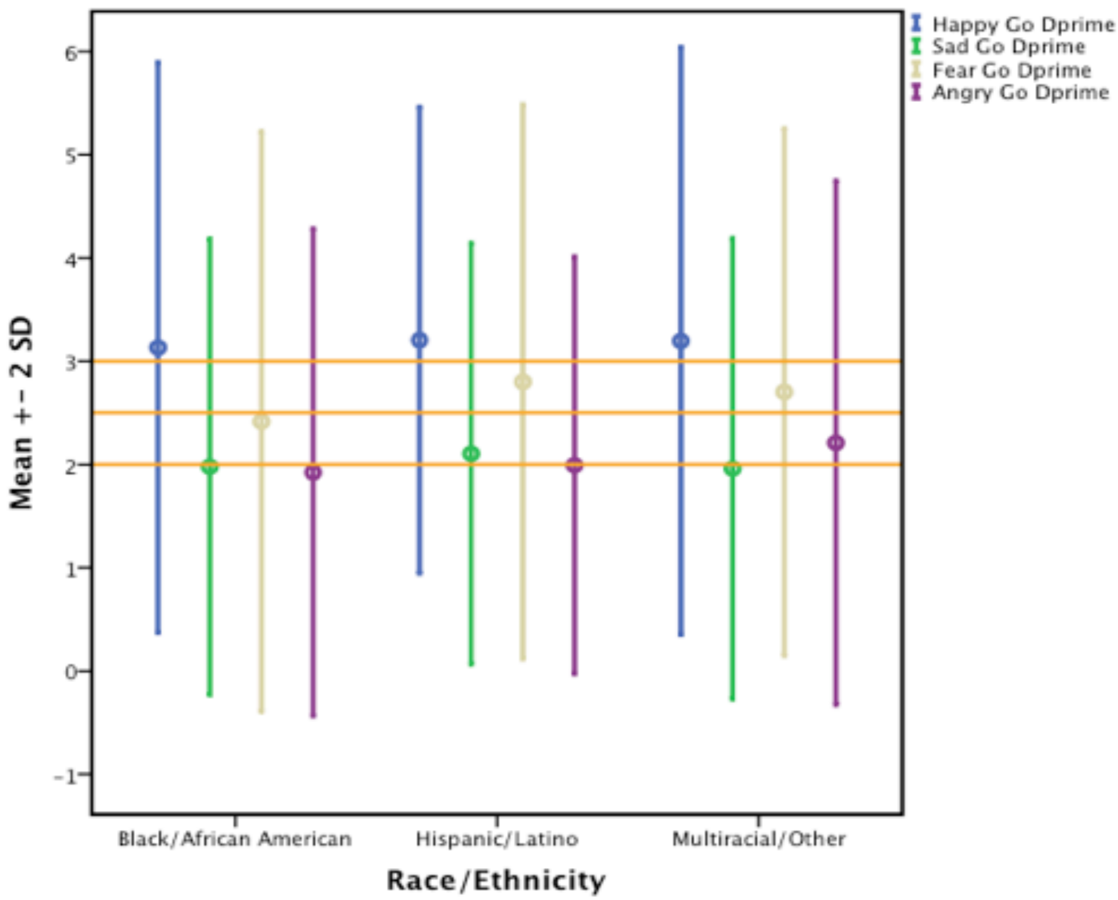
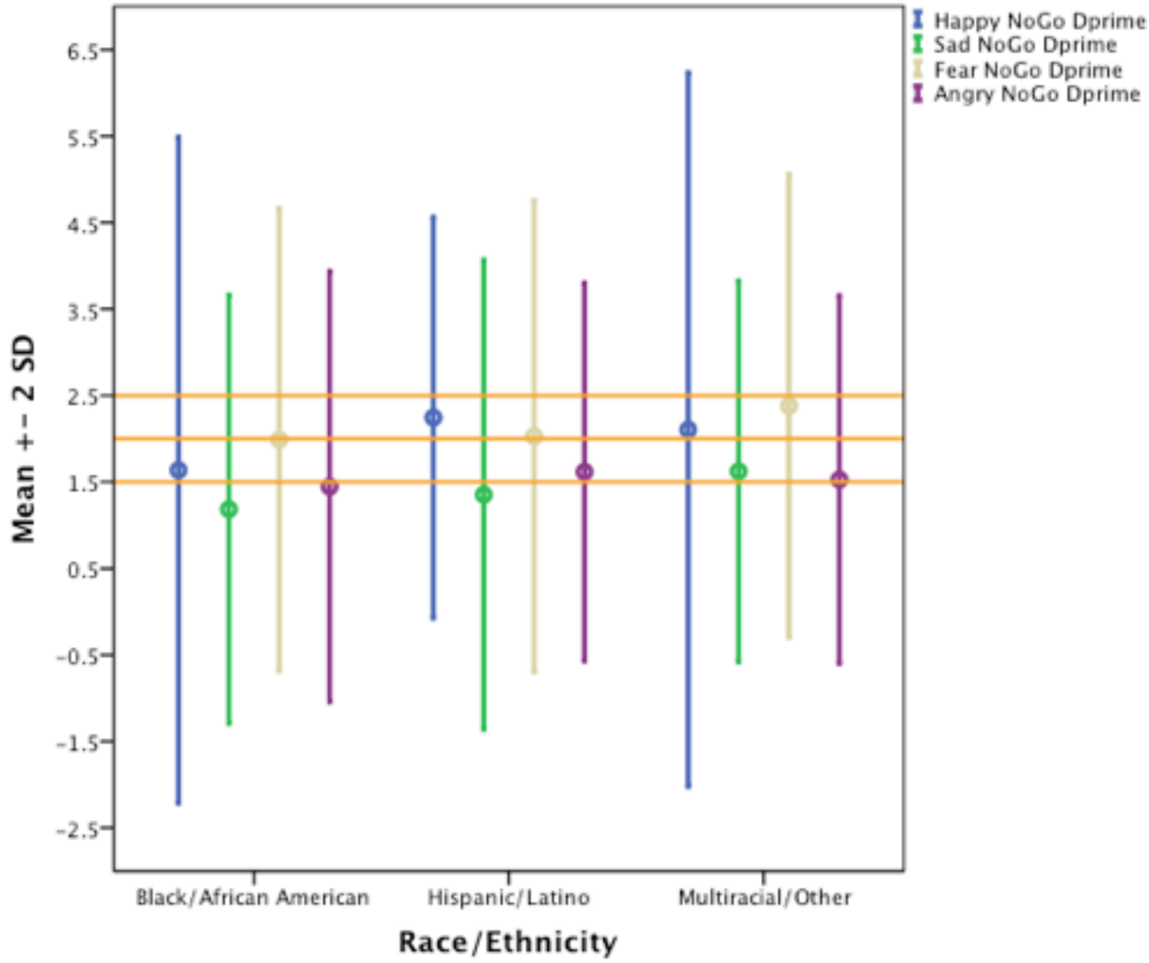


Figure 4: EGNG NoGo Condition, D-prime by Race/Ethnicity



As shown in Figure 3, in the Angry Go condition, Multiracial youth appeared more accurate at identifying Angry faces (*M* = 2.34, SD = 0.138) than both Black/African American youth (*M* = 1.95, SD = 0.109), and Hispanic youth (*M* = 1.96, SD = 0.135). Further, in the Fear Go condition, Black/African American youth appeared less accurate in their identification of Fearful faces (*M* = 2.49, SD = 0.133), as compared to both Hispanic (*M* = 2.78, SD = .0.164) and Multiracial/Other youth (*M* = 2.71, SD = 0.167).

As shown in Figure 4, in the Happy NoGo condition, Black/African American youth appeared less accurate at discriminating Neutral from Happy faces (*M* = 1.76, SD = 0.172), as compared to both Hispanic (*M* = 2.23, SD = 0.214) and Multiracial/Other youth (*M* = 2.16, SD = 0.217). Further, Multiracial youth also appeared more accurate at discriminating Neutral from Sad faces and Neutral from Fearful faces in NoGo conditions than Black/African American youth (see chart for means and standard deviations).

Separate race/ethnicity GLMs. Next, exploratory repeated measures GLMs were run on each race separately to determine if, within each race, patterns of responding emerged that would shed more light on the significant 3-way interaction.

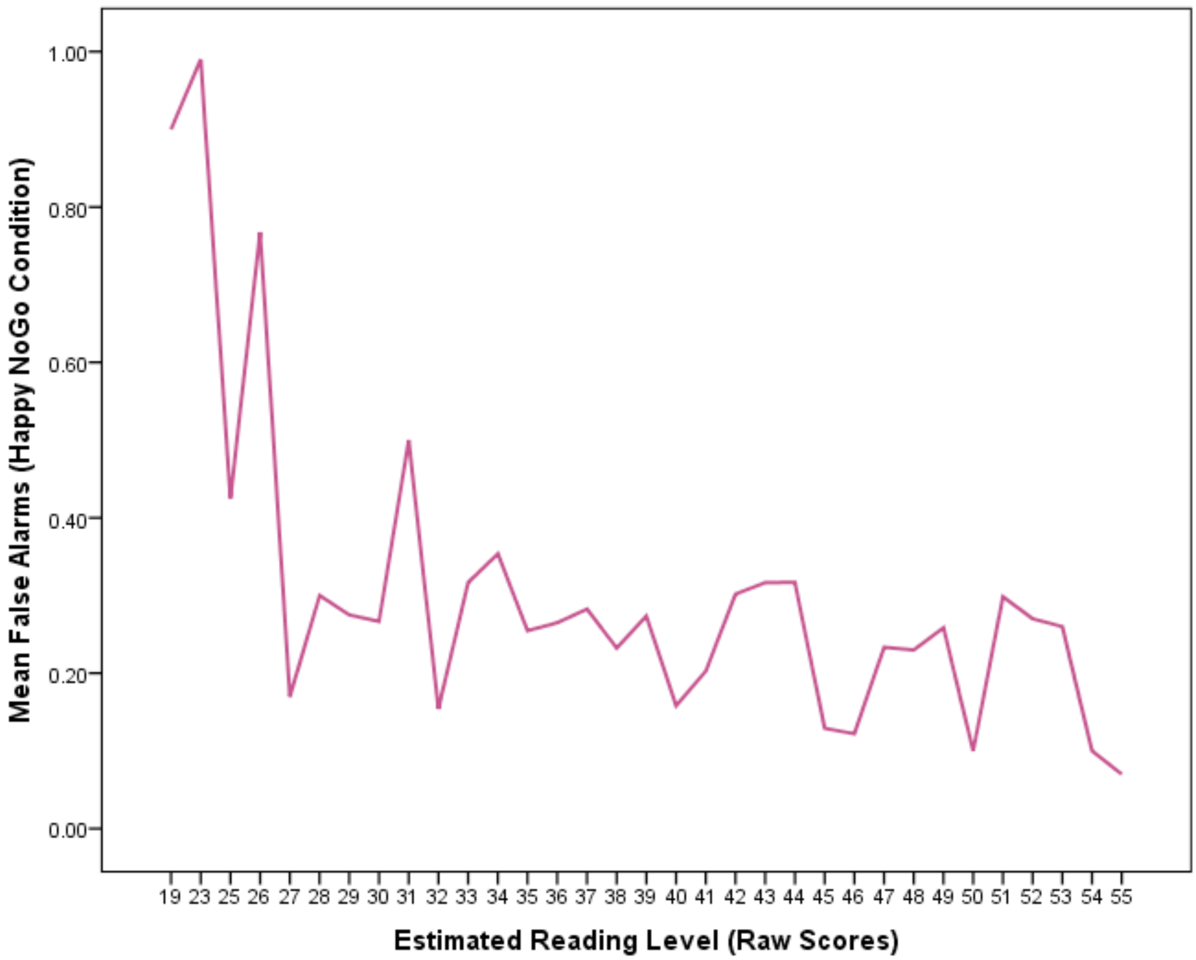
Black/African American youth. A follow-up repeated measures GLM performed only with youth who identified as Black/African American revealed no main effects for Emotion or Task. However, there was a significant two-way interaction between Task and Estimated Reading Level [$F(1,102) = 4.03$, $p = .05$]. Black youth with higher estimated reading levels were significantly better at discriminating Neutral from Emotion faces across all NoGo conditions than youth with lower estimated reading levels (*partial* $r = 0.26$, $p < .01$).

Hispanic youth. A follow-up repeated measures GLM performed only with youth who identified as Hispanic revealed no main effects for Emotion or Task. However, there was a significant two-way interaction between Emotion and Estimated Reading level [$F(3,62) = 4.69$, $p < .01$]. Hispanic youth with higher estimated reading levels were significant more accurate at recognizing Angry faces across conditions than youth with lower estimated reading levels (*partial* $r = 0.35$, $p < .01$). However, youth with higher estimated reading levels were significantly less accurate at identifying Fearful faces across conditions than youth with lower estimated reading levels (*partial* $r = -0.33$, $p < .01$). There were no significant differences regarding accuracy detecting Happy or Sad faces.

Multiracial/Other youth. A follow-up repeated measures GLM performed only with youth who identified as Multiracial or "Other" revealed no main effects for Emotion or Task. However, there was a significant three-way interaction among Emotion, Task, and Estimated Reading Level [$F(3,59) = 5.88$, $p < .01$], indicating that the relationship between Emotion and Task varied by Reading Level for this Race/Ethnic group. Multiracial youth with higher estimated reading levels were significantly *more accurate* when distinguishing Angry from Neutral faces in the NoGo condition than youth with lower estimated reading levels (*partial* $r = 0.39$, $p < .01$). However, youth with higher estimated reading levels were marginally *less accurate* at distinguishing Angry from Neutral faces in the Go condition than youth with lower estimated reading levels (*partial* $r = -0.25$, $p = .06$). An opposite, though non-significant pattern emerged for Fearful faces, wherein there was a positive relationship with reading level and accuracy in the Go condition (*partial* $r = 0.2$, $p = .15$), but a negative relationship with reading level and accuracy in the NoGo condition (*partial* $r = -0.21$, $p = .12$). There were no significant differences between youth regarding accuracy detecting Happy or Sad faces.

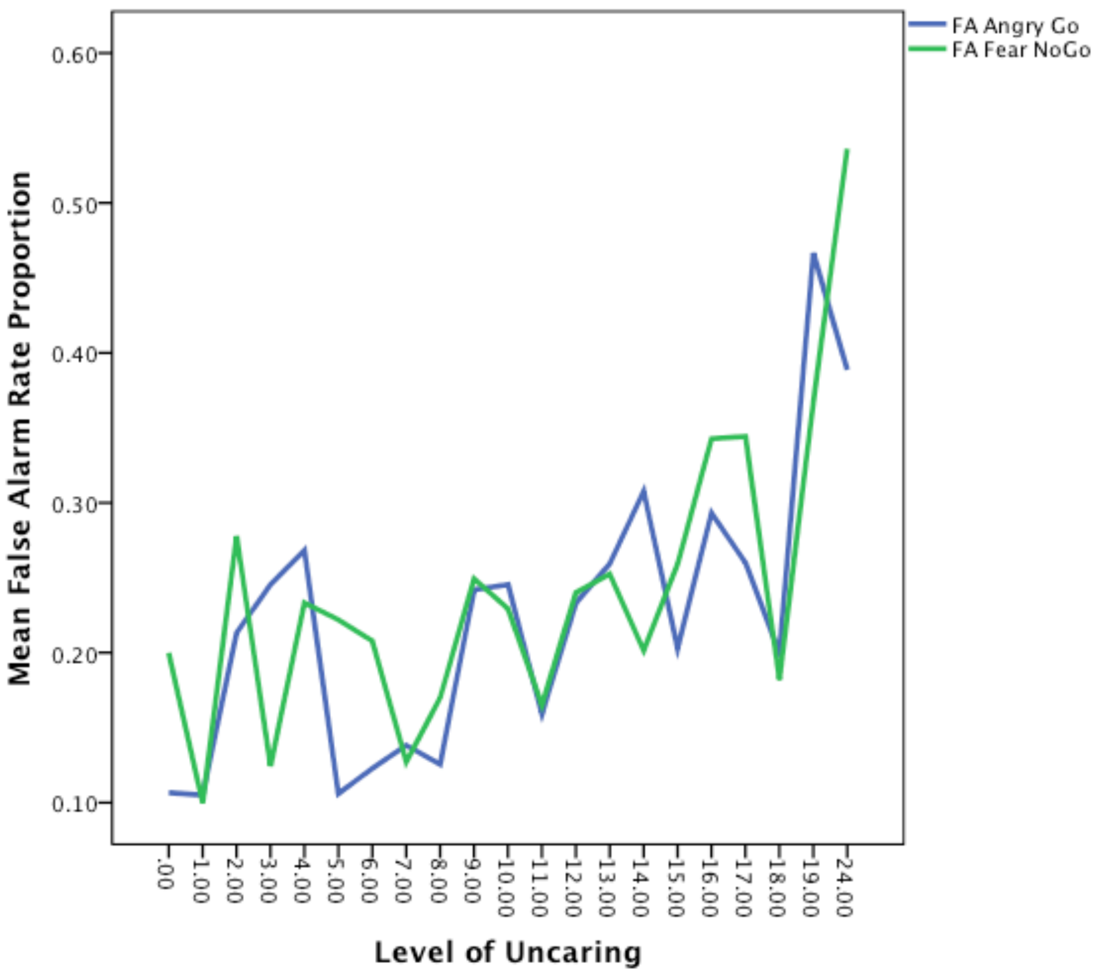
Emotional inhibition. A repeated measures GLM on the composite False Alarm Rate demonstrated no significant main effects for Emotion [$F(3, 233) = 0.72$, $p = .54$] or Task [$F(1, 235) = 0.36$, $p = .56$]. There were no significant two-way interactions between Emotion and Age [$F(3, 233) = 0.31$, $p = .82$], Emotion and Race [$F(6, 468) = 0.43$, $p = .86$], or Emotion and Callousness [$F(3, 233) = 0.39$, $p = .76$]. There were no significant two-way interactions between Task and Age [$F(1, 235) = 2.40$, $p = 0.12$], Task and Reading Level, [$F(1, 235) = 2.74$, $p = 0.10$], Task and Race [$F(2, 235) = 0.63$, $p = .53$], or Task and Callousness [$F(1, 235) = 0.54$, $p = .46$]. However, there was a significant two-way interaction between Emotion and Reading Level [$F(3, 232) = 0.41$, $p = .75$]. Follow-up partial correlations revealed that Reading Level was significantly, negatively associated with false alarms to Happy face conditions; individuals with higher estimated reading levels had fewer false alarms in Happy face conditions than individuals with lower estimated reading levels (*partial r* = -0.19, $p < .01$). See Figure 5 for a visual representation of this relationship.

Figure 5: Mean FA's in Happy NoGo by Estimated Reading Level



Hypothesis two. There was a significant, three-way interaction among Emotion, Task, and Uncaring [$F(3, 233) = 8.12$, $p < .001$]. Follow-up partial correlations revealed two significant correlations with Uncaring: the Angry Go condition and Fearful NoGo condition (representing the interaction in Emotion and Task in varying levels of Uncaring). Youth with higher levels of Uncaring made more false alarms in the Angry Go condition than youth with lower levels of Uncaring (*partial r* = 0.17, $p < .01$); they had difficulty inhibiting their responses to neutral faces when Angry faces were the target. Further, youth with higher levels of Uncaring made more false alarms in the Fear NoGo condition than youth with lower levels of Uncaring (*partial r* = 0.23, $p < .01$); they had difficulty inhibiting their responses to Fearful faces when Neutral faces were the target. Given these findings, Hypothesis Two was partially supported. See Figure 6 for a visual representation of false alarm rate for Angry Go and Fear Nogo by Uncaring.

Figure 6: EGNG Angry Go and Fear NoGo FA's by Uncaring



Emotional reactivity. A repeated measures GLM on the composite Mean Reaction Time demonstrated no significant main effects for Emotion [$F(3, 212) = 1.06$, p = 0.37] or Task [$F(1, 214) = 0.29$, p = .59]. There were no significant two-way interactions between Emotion and Age [$F(3, 212) = 0.75$, p = .52], Emotion and Reading Level [$F(3, 212) = 1.51$, p = .21], Emotion and Race [$F(6, 424) = 0.93$, p = .47], or Emotion and Callousness [$F(3, 212) = 0.84$, p = .47]. There were no significant two-way interactions between Task and Age [$F(1, 214) = 0.01$, p = .93], Task and Race, [$F(2,214) = 0.19$, p = .83], Task and Uncaring [$F(1,214) = 1.74$, p = .19], or Task and Callousness [$F(1,214) = 0.06$, p = .81]. There was a significant two-way interaction between Task and Reading Level [$F(1,214) = 5.1$, p = .03]. Follow-up partial correlations indicated that individuals with higher estimated reading levels tended to respond faster to NoGo conditions (*partial r* = -0.07, p = .26) and slower to Go conditions (*partial r* = 0.03, p = .63) than individuals with lower reading levels. While the individual partial correlations were not themselves significant, the magnitude of the difference between them is significant, and is what accounts for the significant interaction term in the larger GLM.

Hypothesis three. There was a significant two-way interaction between Emotion and Uncaring [$F(3, 212) = .3.13$, p = .03]. Follow-up partial correlations revealed that Uncaring was significantly, positively associated with speed of responding to combined Angry and Fearful conditions, but marginally, negatively correlated with speed of responding in Sad conditions; individuals with higher levels of Uncaring responded slower in Angry and Fearful face conditions (*partial r* = .17, p = .01), but responded faster to Sad face conditions (*partial r* = -.13, p = .06) than individuals with lower levels of Uncaring. As such, Hypothesis Three was partially supported.

Summary of Hypothesis Testing

Hypothesis 1. Youth with CU traits will be less accurate at identifying Fearful facial expressions. This hypothesis was *not supported*; there were no significant relationships between levels of CU traits (Callous or Uncaring) and accuracy recognizing emotion faces of any kind (in D-prime or Miss Rate). However, as reported above, there were significant interactions with accuracy identifying emotion faces and other variables (e.g., Race/Ethnicity, Reading Level), which were not predicted.

Hypothesis 2. CU traits will be inversely related to the false alarm rate when negative faces are the “nogo” cues. This hypothesis was *partially supported*; there were significant relationships between levels of CU traits and false alarm rate to Fearful and Angry faces, but not in the hypothesized direction. Results indicated that youth with higher levels of Uncaring made *more* false alarms in the Neutral/Fear NoGo condition, and thus were more impulsive to fearful faces. Further, youth with higher levels of Uncaring made more false alarms to neutral faces in the Angry Go condition, and thus seemed primed to react by seeing Angry faces.

Hypothesis 3. Youth with CU traits are hypothesized to have faster reaction times (smaller RTs) in emotional “nogo” conditions when negative faces are the distracters, as compared to individuals lower on CU traits. This hypothesis was *partially supported*; youth with higher levels of Uncaring responded faster to Angry and Fearful face conditions, but slower to Sad face conditions. Notably, while it was hypothesized these findings would only exist in the “nogo” conditions, these results existed similarly across both “go” and “nogo” conditions.

Chapter V

Discussion and Future Research

This investigation sought to examine the performance of incarcerated male adolescents with Callous-Unemotional (CU) traits on an Emotional Go/NoGo task (EGNG; Hare et al., 2005), a relatively new computerized measure of emotion recognition and behavioral inhibition. To the author's knowledge, this study represents the first of its kind to examine the performance of incarcerated male youth on this task, and the first to simultaneously combine measures of emotion regulation with cognitive control in this type of sample. Given this, a brief summary of findings as they relate to the extant literature will be discussed, followed by theoretical and clinical implications for treatment and research, as well as limitations and directions for future study.

Summary of Findings

The study was conducted with incarcerated and detained male youth (aged 16-18 years) from New York City's Rikers Island Correctional Facility; 99% were youth of color and over half were charged with a violent felony at the time of baseline data collection. Based on a review of the literature and Blair's Integrated Emotion Systems Model (2006), it was hypothesized that individuals higher on CU traits would be less accurate at identifying fearful facial expressions, make fewer errors when inhibiting responses to negative faces, and would respond faster in negative face conditions than individuals lower on CU traits.

Emotion recognition. With regard to the main research focus, emotion recognition, results indicated that this sample of antisocial youth with CU traits did not demonstrate deficits in recognizing fear or any other emotion faces in the EGNG task, using two separate models of emotion recognition (D-prime and Miss Rate). This indicates that youth with CU traits may not be as deficient in detecting fear as previously thought. While these findings are in contrast to the majority of extant literature (e.g., Marsh & Blair, 2008; Frick, 2009; Frick & White, 2008), it is important to note that the task used in the current study to measure emotion recognition differs from the tasks used in other studies. In most of the previous studies, the emotion recognition tasks were “pure” recognition tasks, wherein youth were simply presented with a picture and asked to label it from a selection of responses (e.g., happy, sad, fearful, angry). In the current study, however, emotion recognition was paired with behavioral inhibition and measured simultaneously within one paradigm. Here, youth were asked to recognize and respond to target emotions (e.g., find the happy face) and inhibit their responding to non-target emotions. In this way, youth were assessed not only on their emotion recognition abilities, but also on their ability to inhibit behavioral responding in the face of an emotionally charged situation. With emotion recognition viewed in this way, results from the current study indicate that youth with high levels of CU traits were able to identify fear as well as youth with low levels of CU traits. Given this, the type of task used to measure emotion recognition may affect how well youth with CU traits are able to recognize and respond to certain emotions.

In support of this, results from Dadds and colleagues (Dadds et al., 2006) also indicate that the type of task used to measure emotion recognition may affect the abilities of youth with CU traits on such tasks. In two studies, these authors evaluated the impact of antisocial behavior, CU traits, and eye gaze on fear recognition in a community sample of boys. In the first study (boys aged 8-15 years), participants were asked to label the expression from a list of six emotions. In the second study (boys aged 9-17 years), two more trials were administered: the first instructed participants to specifically look at the eyes, and the second, to look specifically at the mouth. Consistent with the extant literature, results from the first study indicated that boys with the highest levels of CU traits were significantly less adept at labeling fearful facial expressions than boys with low levels of CU traits, often identifying them as neutral or disgust. However, in the second study, the performance of boys with high CU traits was no different from boys with low levels of CU traits *when instructed to look at the eyes* of the individual in the picture. These authors argued that while a deficit in fearful facial recognition may be present in youth with CU traits, it might be due, in part, to a lack of appropriate attention to emotionally salient cues (e.g., others' eyes); redirecting this attention may temporarily reverse these difficulties. Importantly, recent research from this same group (Dadds et al., 2011) indicated that youth with CU traits exhibited lower eye contact with their attachment figures, also lending further support to the hypothesis that youth with CU traits may not automatically attend to emotionally relevant cues of others. Importantly, both studies are consistent with neuroimaging research indicating that amygdala damage is associated with lack of attention to others' eyes (Adolphs et al., 2005), which would implicate amygdala dysfunction in these youth, consistent with Blair's IES theory (2006).

While subtle, this difference in task demands may provide insight into the findings of the current study. It may be possible that when presented with a more ambiguous recognition task (i.e., "What is this emotion?"), individuals with CU traits do not automatically focus on areas that would help them identify a facial expression; however, when asked to locate a specific facial expression or focus on a specific aspect (i.e., "Find the fearful face" or "Look at the person's eyes"), youth with CU traits may use these cues to aid them in accurate expression identification. As the current study was the first of its kind to evaluate the impact of this type of task on emotion recognition in youth with CU traits, future research is needed to evaluate the effects of different task demands on the abilities of youth with CU traits to recognize and inhibit responding to various emotions, particularly fear.

However, it is important to note that even if youth with CU traits are able, or can be redirected, to detect fear at a level equal to or above that of their peers, they do not necessarily feel fear or respond to it in the same way as individuals without CU traits do (Blair, Mitchell, Peschardt, Colledge, Leonard, & Shine et al., 2004; Woodworth & Waschbusch, 2007). This is in accordance with theories that suggest youth with CU traits do not use the feelings of others to guide their own behavior (Blair, Mitchell, & Blair, 2005), and recent findings suggesting that even though youth with elevated CU traits do not have difficulty judging whether their aggression will cause suffering in their victims, they simply don't care whether their victims suffer or not (Pardini, 2011).

Along these lines, one study has suggested that an increased ability of youth with CU traits to recognize fear may have adaptive purposes, particularly for predatory behavior and instrumental aggression. Using a sample of young (7-12 year old) males and females from a summer day camp for children with disruptive behavior problems, Woodworth and Waschbusch (2007) examined the ability of youth with CU traits to label emotions. Youth were shown adult faces depicting six emotions (happiness, anger, disgust, fear, sadness, surprise) and were asked to verbally identify the emotion. Here, the authors found trend results indicating that youth with CU traits were *more* accurate in their identification of fearful expressions than youth without CU traits, and suggested that this process may facilitate predatory behavior and instrumental aggression. These authors hypothesized that youth with CU traits may be able to recognize fear for their own purposes, but processing it otherwise, or understanding it at a more fundamental level, may be deficient. In this way, enhanced recognition of fear may serve as reinforcement for antisocial behavior, and thereby facilitate aggressive acts, but only when it helps to accomplish a goal that is salient to the youth. However, it should be emphasized that these results were trend effects, and similar to the above suggestion about the type of task used to measure recognition, more research is needed to examine under what conditions youth with CU traits can "see" fear accurately in others.

Emotional inhibition and reactivity. Despite the non-significant findings related to emotion recognition, several other findings related to emotional inhibition and reactivity emerged within the current study. Overall, youth with higher levels of Uncaring traits (lack of guilt/lack of concern for self and others) appeared more susceptible to emotional interference from negative emotional faces (Fear, Angry, and Sad) as compared to happy faces, making more false alarms (errors of inhibition) and responding at different speeds within these emotion trials. Importantly, these findings lend support to Blair's IES Model (2006), which implicates both the amygdala and areas of the prefrontal cortex in psychopathy and CU traits. The amygdala is implicated in the recognizing and regulation of emotions (Davidson et al., 2007; DeLisi et al., 2009; LeDoux, 2000), and the ventrolateral and orbitofrontal areas of the prefrontal cortex are involved in the regulation of responses to stimuli (i.e., respond to one set of stimuli and withhold responding to another; Casey et al., 2001). Given that results from this study demonstrated variation in how well youth with CU traits were able to inhibit their responding, and how quickly they were able to correctly respond depending on the type of emotion, these results lend support to the idea that both the amygdala and prefrontal cortex are involved.

Results showed that youth with higher CU traits exhibited faster response times in sad face conditions than youth with lower levels of CU traits, indicating that sad faces may facilitate speed of responding and reactivity in these youth, as compared to youth with lower levels.

Importantly, even though sad faces elicited the lowest response times of all emotion faces across participants and conditions, these findings indicate youth with higher CU traits may not be as distressed or distracted by sad faces as other youth, which is consistent with hypotheses, and extends studies that have shown youth with CU traits exhibit diminished responsiveness to distressing stimuli (Kimonis et al., 2006; Kimonis et al., 2007; Loney et al., 2003).

In addition, results indicated that youth with CU traits exhibited deficits in behavioral inhibition that varied depending upon the type of emotion. In this study, youth with higher CU traits evidenced difficulty with the inhibition of responses to neutral faces when angry faces were the targets (responded incorrectly to neutral faces), and to fearful faces when neutral faces were the targets (responded incorrectly to fearful faces), making more false alarms in these conditions. Moreover, youth with higher levels of CU traits exhibited slower response times across angry and fearful face conditions (both go and nogo), indicating an interference effect of these particular emotions. These results are consistent with and extend upon a small group of studies indicating youth and adults with CU traits have deficits in behavioral inhibition, making more false alarms than those without CU or psychopathic traits (Lapierre, Braun, & Hodgins, 1995; Roussy & Toupin, 2000). However, within emotionally laden conditions, this deficit in inhibitory control may be specific to certain emotions (Fear and Angry).

In elaborating on these findings, it appears that once primed by angry faces, youth with higher CU traits have difficulty regulating their responses to neutral faces, perhaps evidencing carryover or perseveration of their responses to angry faces. Interestingly, as there was no emotion recognition deficit for angry faces, this finding does not appear to be due to a misattribution of expression, consistent with research showing youth with CU traits are less likely to show a hostile attribution bias than other antisocial youth (i.e., seeing neutral faces as angry; Frick et al., 2003). Similarly, youth with higher CU traits had difficulty inhibiting their responses to fearful faces. Taken in conjunction with the findings of the current study that youth with high CU traits did not differ from youth with low CU traits in their recognition of fear, this may point to an interesting conclusion: even though these youth are not deficient in the recognition of fear, when they do see it, they have difficulty controlling their responses to it. A deficit in the ability to control responses to angry and fearful faces (more false alarms and slower responding in certain angry and fearful conditions) may impact the occurrence of antisocial behavior in these youth.

Overall, findings from this study demonstrate that while youth with higher levels of CU traits may not necessarily exhibit deficiencies in emotion recognition, they may be primed and affected by negative emotion faces in ways that differ from youth with lower levels of CU traits. In addition, not all negative emotions affected youth with CU traits in the same way, and their responses seemed to depend on the emotion (angry, fear, sad) and task (go, nogo) at hand. Extending this to real-life situations, it may be that the level at which youth with CU traits respond to the negative emotions of others depends on the situation and their own goals. In particular, when the goal is predatory behavior and instrumental aggression, increased responsiveness to the negative emotions of others may facilitate antisocial behavior.

However, it is important to note that the current study should be viewed within a developmental framework, and that the disparities among the findings of the current study and those of the extant literature with regard to emotion recognition, regulation, and reactivity, may also be due to differences among the samples of youth. As previously mentioned, adolescence is a time of rapid brain growth and maturity, particularly in the areas responsible for emotion regulation (Ernst et al., 2006). Many of the previous studies involved youth spanning a wide age range, and thus it is possible that their findings may suppress the changes that youth experience at various stages of development. As the youth in the current study were from a more restrictive age range, it may be that the current findings are more reflective of patterns of emotion recognition and regulation among youth with CU traits between the ages of 16-18 years. Future research should evaluate possible age-related differences in emotion recognition and regulation among youth with CU traits.

Emotional go/nogo and sociodemographic factors. In addition to the main results on CU traits, results of this study revealed interesting and unpredicted findings regarding both Reading Level and Race/Ethnicity as they relate to Go/NoGo performance. As this study was the first to examine the performance of incarcerated youth on this task, a brief synopsis of these findings is provided. In general, youth with higher estimated reading levels, and likely higher cognitive abilities, appeared better able to recognize Happy and Angry faces, and were more successful at discriminating Neutral from Emotion faces in NoGo conditions than youth with lower reading levels. Further, youth with higher reading levels were better able to inhibit responding to Happy faces than youth with lower reading levels, exhibiting greater inhibitory control. Taken together, these findings suggest that reading level (and likely, cognitive ability) is positively related to emotion recognition and inhibitory control, and thus enhanced performance on the EGNG. This is consistent with research linking intelligence to indexes of cognitive control (see: Chuderski & Necka, 2010, for review). As these results are cross-sectional, inferences regarding directionality of this relationship cannot be made; however, individuals with higher cognitive abilities may be more likely to perform better on tasks requiring cognitive control in emotionally-laden situations.

Race/Ethnicity was also found to be a significant predictor of emotion recognition in one model (D-prime). While these results should be interpreted with caution given that follow-up tests did not reveal significant results, patterns of responding did emerge that shed light on this relationship. Black/African American youth appeared less accurate at identifying Fearful faces in the Go condition and in discriminating Neutral from Happy faces in the NoGo condition, as compared to Hispanic and Multiracial/Other youth. Further, Multiracial/Other youth appeared *more accurate* in their identification of Angry faces in the Go condition, and in their discrimination of Fear and Sad faces from Neutral faces in the NoGo conditions, as compared to both Hispanic and Black/African American youth. In addition to these findings, Reading Level appeared differentially related to Race/Ethnicity, and did not have the same effect on emotion recognition for each group. Among Black/African American youth, a higher reading level enhanced emotion recognition and discrimination across NoGo conditions. Among Hispanic Youth, higher reading level was associated with more accurate recognition of Angry faces, but less accurate recognition of Fearful faces, across conditions. In Multiracial/Other youth, higher reading level was associated with better discrimination of Angry from Neutral faces in the NoGo condition, but *less accurate* recognition of Angry faces in the Go condition.

Given these findings, there may be cultural, contextual, or individual-level factors influencing the youths' recognition and perception of various emotions. These cultural differences may be reflective of early histories of trauma or stress and thus, race/ethnicity may be a proxy for other developmental differences among youth. Along these lines, deficits and abnormalities in emotion recognition and regulation have been associated with stress and trauma in early childhood, such as orphanage care (Tottenhman, 2009; Tottenham et al., 2010), maltreatment (Leist & Dadds, 2009; Pollack, Cicchetti, Hornung, & Reed, 2000), and exposure to terrorism (Scrimin, Moscardino, Capello, Altoe, & Axia, 2009). Further, socioeconomic factors have been shown to influence cognitive abilities, such as reading and language development (Noble, Wolmetz, Ochs, Farah, & McCandliss, 2006), and have been shown to account for differences in various neurocognitive abilities (e.g., memory, spatial cognition, language, some executive functions; Noble, McClandliss, & Farah, 2007), implicating the role of SES in neurocognitive performance. Lastly, mental health factors have been shown to impact emotion regulation. Youth with depression, anxiety, and bipolar disorder have all been shown to exhibit difficulties recognizing and regulating responses to certain facial expressions (Easter, McClure, Monk, Dhanani, Hodgdon, Leibenluft, et al., 2005; Ladouceur, 2006; Rich, Grimley, Schmajuk, Blair, Blair, & Leibenluft, 2008), demonstrating the effect of mental health issues on emotion regulation. Notably, youth in the current study were asked about any past and current mental health issues; however, their report of the incidence of these issues was very low, and thus was not used in analyses.

Taken together, these studies support the idea that environmental or socio-demographic factors may interact to influence patterns of emotion recognition, and that the interaction of these factors is not necessarily consistent among cultures or races. However, as these variables were not the focus of the current study, these associations were not assessed; future research should examine the possible impact of these, and other factors contributing to emotion recognition and regulation, as well as possible interactions among these variables and CU traits within samples of incarcerated youth.

Theoretical and clinical implications. Theoretically, results from the current study are consistent with models of psychopathy that implicate the amygdala and prefrontal cortex as primary areas of dysfunction, namely Blair's Integrated Emotion Systems model (Blair, 2006).

While emotion recognition deficits were not found in this sample, emotional inhibition and reactivity were found to differ between youth high and low on CU traits, suggesting an interaction among brain areas responsible for these mechanisms. To the author's knowledge, this study represents the first of its kind to incorporate these behavioral measures in a sample of incarcerated youth, and as such, is further elucidates the complex neural and behavioral patterns seen in these types of samples and represents an important contribution to the literature.

In addition to extending theories of psychopathy and CU traits, results from the current study have significant clinical implications. Current diagnostic criteria for Conduct Disorder (CD) and Oppositional Defiant Disorder (ODD) do not include CU traits as a specifier for diagnosis (American Psychological Association, 2000), though recent research has highlighted the potential importance of using these traits in diagnostic criteria (McMahon et al., 2010; Pardini & Fite, 2010; Pardini et al., 2010). Results form the current study support this research, and highlight the importance of CU traits in further distinguishing among antisocial youth a more severe group; in this sample, higher levels of CU traits were associated with a greater variety of violent crimes committed and differing patterns of emotion regulation. As such, mental health clinicians may benefit from using measures of CU traits and psychopathy when evaluating youth for CD and ODD, and in particular, when planning and developing treatment programs to suit the unique characteristics of each youth.

Along these lines, findings from the current study may help to inform treatment efforts by determining for whom, when, and in what way treatment works for antisocial youth. Theoretical models have emphasized the identification of mediators and moderators in treatment response and their importance in determining outcomes (e.g., Kraemer, Stice, Kazdin, Offord, & Kupfer, 2001; Kraemer, Wilson, Fairburn, &, Agras, 2002). Given this, interventions targeted at antisocial youth may want to evaluate the impact of CU traits as a potential mediator/moderator of treatment response. Further, these studies may want to evaluate familial, environmental, and contextual predictors that may impact how youth with CU traits respond to treatment (Fontaine et al, 2011), and what factors, outside of treatment, may influence CU traits to change over time (Andershed, 2010).

It is important to note that research evaluating interventions for antisocial youth have come with mixed results, often finding that youth with CU traits do not respond as well to typical treatment and intervention (see: Salekin, 2010, for review). However, despite this, several recent studies have documented behavioral and psychosocial improvements in a variety of antisocial youth with CU traits post-treatment (Caldwell, McCormick, Umstead, & Van Rybroek, 2007; Caldwell, Skeem, Salekin, & Van Rybroek, 2006; Caldwell, Vitacco, & Van Rybroek, 2006; Haas, Waschbusch, Pelham, King, Andrade, & Carrey, 2011; Kolko & Pardini, 2010; McDonald, Dodson, Rosenfield, & Jouriles, 2011). These studies are promising, and show the possibility that with the correct intervention, treatment gains can be made, even among the most severely antisocial youth. These intervention studies emphasize multi-faceted treatment that focuses on interpersonal processes, social-skill acquisition, development of prosocial bonds, cognitive behavioral techniques, behavioral modification systems (particularly reward-based systems), and a long duration of treatment (Caldwell et al., 2007; Caldwell, Vitacco et al., 2006; Haas et al., 2011). In extending these, findings from the current study can be easily incorporated into existing treatments. Specifically, a focus on emotion regulation and regulation of responses to emotion in others (particularly fear and anger) may further benefit youth with CU traits and may help to regulate aggressive behavior (e.g., Dialectical Behavior Therapy and/or mindfulness meditation based interventions). While these previous intervention studies have successfully documented changes in behavioral manifestations and cognitions of these youth, adjusting the underlying patterns may prove to be more difficult, and research aimed at modifying these underlying issues represents an important area of future direction.

Limitations and directions for future research. Despite these potential research and clinical opportunities, it is important to view these findings in light of the study's limitations. Primarily, it is imperative that researchers and clinicians, alike, consider these results through the lens of the construct of CU traits, itself. As previously outlined in Chapter 2, while CU traits are generally stable, there is a degree of malleability and plasticity in most youth, as the frontal areas are still developing. Thus, the findings in this study should be interpreted within this developmental framework (Andershed, 2010). Although CU traits have proven to be valuable in short-term violence risk assessments, care should be taken to ensure that instruments are not misused, labels are not given, evaluations are comprehensive (including an assessment of protective factors and environmental influences) and done at multiple intervals, and that the information gained is used to plan treatment (Vitacco & Vincent, 2006). Extreme care should be taken to *not* view CU traits in youth as "fixed" factors that automatically lead to particular patterns of behavior (or to psychopathy in adulthood), especially concerning legal decisions and planning within the justice system (Vitacco, Salekin, & Rogers, 2010). In this way, CU traits are not viewed as an automatic hindrance to treatment or rehabilitation; rather, they can be interpreted as a sign that treatment should be more specific to the present symptoms.

Separate from this larger issue, there are other limitations within the current study. To begin, the nature of the sample used limits its generalizability to other populations. More specifically, while youth in this sample were charged with a variety of crimes, the distribution and type of crimes most present (i.e., violent felonies such as murder, assault, burglary, armed robbery) indicate that this sample represents a group of severely violent young men. Further, it should be noted that due to New York State law, these youth were held in an adult facility and tried in adult court. As such, results are limited to populations of similar youth, and may not generalize to youth from other settings, youth with less severe antisocial histories or without a history of antisocial or delinquent behavior, or youth of significantly different racial/ethnic makeup. Future research should explore these relationships in other samples of youth of varying levels of delinquency, as well as in other samples of youth of a different racial/ethnic makeup and regional area (e.g., southwest).

In addition, due to the nature of the study, collateral information about the youth, and in particular, their CU traits, was not able to be obtained. As such, the accuracy of their self-report data was not able to be validated. Further, a lack of association between CU traits and criminal charge at the time of baseline interview may indicate that youth were not being entirely truthful on these self-report measures. However, it is important to view the current charge information as a "snapshot" of what the youth were charged with at that point in time; it does not represent their history of violence, and may not be representative of their levels of delinquency. Notably, previous research using the ICU has documented its construct validity in a variety of populations (e.g., Essau et al., 2006; Kimonis et al., 2008), and the association between self-report CU traits and self-report variety of crimes in this sample points to the validity of the ICU as an instrument. Nonetheless, future studies should make efforts to supplement self-report of CU traits with other collateral information (e.g., full arrest histories, parent/caretaker information, etc.).

Along these lines, youth in this sample seemed to report lower levels of Callousness than youth in other samples, and their reporting of levels of Unemotional traits was not consistent enough to be used in analyses. As such, it would be of interest to evaluate whether there are other patterns of emotion regulation that occur in youth who report higher levels of Callousness, or more consistent levels across ICU dimensions. Some studies have shown that individual dimensions (i.e., Callousness, Uncaring) are differentially related to specific outcome factors (e.g., offending vs. aggression), and that even youth with high levels of CU traits can be grouped by other features (e.g., exposure to violence; Kimonis, Frick, & Skeem, et al., 2008; Kimonis, Frick, & Munoz, et al., 2008). Given this, future research should continue to evaluate whether youth with CU traits represent a homogenous group, or can be divided into more specific clusters based on individual differences. Further, as the effect of CU traits on EGNG performance varied by emotion and task, more research is needed to specifically characterize the cognitive and affective features of antisocial youth with CU traits. In particular, it would be interesting to evaluate how youth with CU traits interpret the *meaning* of fear, anger, sadness, and other negative emotions, both in themselves, as well as in others. Exploring these areas has the potential to inform future prevention and intervention efforts.

With regard to the EGNG, this study represents the first of its kind to explore the patterns of responding among incarcerated youth on this task. As such, conclusions about how this sample compares to other, typical samples, is difficult. It is possible that this sample is *not* typical of incarcerated youth, and future research should validate the use of this instrument in samples that are both similar and dissimilar to those in this study. In addition, this study is limited in its ability to draw inferences about discrimination *among* emotions, as emotion faces were always paired with neutral expressions. Future research should ask participants to discriminate among emotion faces (e.g., anger from fear; sadness from fear, etc.), and use a wider variety of emotions, as well as more/less intense expressions, to more fully evaluate the patterns of emotion recognition in these youth.

Likewise, it is important to note the setting in which these instruments were given, and the possible effect that completing an emotionally laden task *within* an emotionally laden setting had on the youths' performance. Imaging studies validating the use of the EGNG have highlighted its use as a tool for measuring the regulation of responses to emotion (Hare et al., 2005; Hare et al., 2008); however, to date, no study has evaluated its sensitivity to "state" versus "trait" emotions within the respondent. Future studies should evaluate the test-retest reliability of the EGNG, as well as patterns of responding during settings that induce certain emotions (e.g., after viewing a sad movie, after having a fight with a loved one). Perhaps more importantly, it is important to establish the ecological validity of the EGNG as it relates to behavioral outcomes, as there as been some concern around the lack of true social interaction in emotion research and the ability to draw conclusions from isolated tasks (Fischer & van Kleef, 2010). Given this, future research should incorporate behavioral outcomes measures and use more applied or "real-world" tasks to supplement arguments of neurocognitive deficit in various populations.

Further, it is important to note that youth in this sample were most likely not using drugs at the time of baseline interview. However, while the impact of drug use on neurocognitive performance is well documented (e.g., Fernandez-Serrano, Perez-Garcia, Schmidt Rio-Valle, & Verdejo-Garcia, 2010; Rogers & Robbins, 2001), no studies have evaluated the impact of past or current drug use on the EGNG. As such, future studies should examine possible links between drug use and patterns of responding on this task. In addition, as noted above, it is likely that the patterns of responding on the EGNG occurring in this sample with regard to reading level and race/ethnicity are the result of the combination of a multitude of factors. However, as these variables were not examined within this study, future research is needed to further clarify these relationships. In particular, studies should examine the role of cultural, family, and environmental factors with regard to emotion regulation and inhibitory control, as well as individual level factors (e.g., trauma history, exposure to violence) that may influence perception and responses to various emotions in samples of incarcerated youth.

Lastly, as this study was cross-sectional in nature, it is impossible to decisively establish the causal direction among study variables. Youth with CU traits often show strong histories of aggression (Frick et al., 2003), which may influence their level of reactivity to distress in others. On the other hand, there is evidence for a fairly substantial genetic contribution to CU traits (Viding et al., 2010). As such, future longitudinal research is needed to evaluate the validity and stability of the observed patterns of emotion regulation within samples of antisocial youth, as well as how this stability influences, or does not influence, future antisocial behavior.

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