Neuropsychological Deficits in Adolescents with Psychopathic Characteristics: Callous and Unemotional Symptoms

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NEUROPSYCHOLOGICAL DEFICITS IN ADOLESCENTS WITH PSYCHOPATHIC
CHARACTERISTICS: CALLOUS AND UNEMOTIONAL SYMPTOMS

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ABSTRACT

NEUROPSYCHOLOGICAL DEFICITS IN ADOLESCENTS WITH PSYCHOPATHIC CHARACTERISTICS: CALLOUS AND UNEMOTIONAL SYMPTOMS

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Dissertation supervised by Professor: Jeffrey Miller, Ph.D., ABPP

The most consistent neuropsychology literature in psychopathy is dysfunction in selective attention (Blair et al., 2006; Hiatt et al., 2004; Kosson, 1998; LaPierre et al., 1995; Pham et al., 2003; Roussy & Toupin, 2002; Sellbom & Verona 2007; Vitale et al., 2007). The following areas have been profiled in the literature, but have shown mixed results: sustained attention (Gorstein, 1982; Kosson, 1998; Pham et al., 2003), shifting attention (Gorstein, 1982; Kosson, 1998), verbal ability (Mayer et al., 2006; Raine et al., 1990), planning and cognitive shifting (Mahmut et al., 2008; Pham et al., 2003; Roussy & Toupin, 2000; Sreenivasan et al., 2008), and visual spatial skills (Pham et al., 2003; Raine et al., 2005). The response set modulation hypothesis (RM; Newman, Schmitt & Voss, 1997) and the integrated emotion system (IES; Blair, 2005) are the most empirically supported cognitive models of psychopathy. The purpose of this study was to examine the cognitive profile of adolescents with psychopathic characteristics, looking at
executive functions and how they differ in individuals who score high on callous/unemotional traits (CU; Cleckley, 1941; Frick et al., 1994; Hare, 1991, 1993). Then apply these findings to the cognitive models. Literature has not examined the connection between executive functions and CU traits. Based on the shared neurological systems (Blair, 2005; Blair et al., 2006; Soderstrom et al., 2002), it was hypothesized that CU traits would affect performance on attention and executive processes measures. Sixty two adolescent males ages 14 to 19 from a preexisting database were included in the sample. The results showed that planning significantly accounted for unique variance in CU traits. Those who had higher CU traits had higher planning skills. There were no differences between high and low psychopathy groups on measures of attention and executive processes. These results support the IES model. The three and four factor models of psychopathy were supported in the follow up analyses. While these findings add to the literature base, additional research is needed to clarify neuropsychological profile of psychopathy in connection to specific characteristics in order to develop successful interventions to improve the prognosis and outcome of psychopathy.
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CHAPTER I

INTRODUCTION

In criminal cases, the most extreme and violent type of offenders often manifest characteristics consistent with psychopathy. Psychopathy is a disorder associated with predatory violent and aggressive behaviors that are typically unresponsive to treatment (O’Neill, Lidz, & Heilbrun, 2003; Porter, Birt, & Boer, 2001). In addition, these individuals commit a large percentage of the violent crimes, and are more likely to reoffend violently than individuals classified as nonpsychopaths (Corrado, Vincent, Hart, Cohen, 2004; Gacono & Hughes, 2004; Serin, 1996).

Personality characteristics of psychopathy begin in childhood and remain stable into adulthood and are empirically supported within children and adolescents, (Lynam, Casp, Moffit, Loeber, & Stouhamer-Loeber, 2007). Lynam, et al. (2007) examined psychopathy from early adolescence into early adulthood and found from the age of 13 to the age 24, psychopathy remained stable. Characteristics at 13 that were related to the development of psychopathy include impulsive and antisocial behavior. These findings indicate that other traits may occur later in development (Lynam et al. 2007). Similarly, Gretton, Hare, and Catchpole (2004) found that adolescents who offended and scored high on measures of psychopathy when in adolescence, continued the trend of violent crimes into adulthood. Because researchers have demonstrated that psychopathy remains fairly stable from childhood to adulthood, it is vital to understand how it manifests in children and adolescence. An in depth understanding of psychopathy is needed order to develop possible treatments and prevention methods to halt the future development of psychopathy into adulthood.
Knowing how stable the presence of psychopathy is in individuals throughout their lives gives rise to the question of how prevalent psychopathy is within society. Psychopathy is typically present within 1% of the world’s population; however, the percentage of those with psychopathy greatly increases from to 20% within criminal justice settings. In youth offenders, the prevalence rate is reported to be 21.5%, which is similar to the rate of adults (Salekin, Leistico, Neumann, DiCicco, & Duros, 2004). Approximately 10% of males on probation rate high on psychopathy. This disorder is evident across ethnic groups and cultures and is not present in one population more than another (Schmitt, McKinnon, Harprett, & Brownlee, 2006). Gender, on the other hand, has been related to psychopathy. Typically males present with higher incidents of psychopathy compared to females (Grann, 2000; Schmitt et al., 2006).

Psychopathy is not only present in incarcerated populations; it occurs within the general population as well. Few studies have attempted to examine psychopathy in the general population due to the limited availability of samples. The studies that have measured psychopathy in the general population frequently have not used psychometrically sound methods, thus limiting their findings. However, it is hypothesized that these individuals may be very different than incarcerated samples and initial studies report that these individuals have higher callous and unemotional traits and less impaired cognition in the general population, thus should be examined more carefully (Ishikawa, Raine, Lenca, Birhrle, & LaCasse, 2001; Vanman, Mejia, Dawson, Schell, & Raine, 2003).
Significance of the Problem

In recent years, researchers have measured the recidivism rates of adults who scored high on psychopathy. Overall, researchers conclude that those high on psychopathy have a very high rate of recidivism compared to nonviolent offenders. Several researchers have found that psychopaths are more likely to be repeat offenders (Corrado et al., 2004; Salekin et al., 2004; Serin, 1996; Serin & Amos, 1995). Serin (1996) found that 85% of psychopaths, 40% of nonpsychopathic offenders, and 51% those who had some characteristics of psychopathy were more likely to be repeat offenders. Particularly, they are more likely than nonpsychopathic offenders to commit violent offences. Serin & Amos (1995) found that 5% of nonpsychopaths and 25% psychopaths were likely to recommit violent crimes. Salekin et al. (2004) added to this finding indicating that that 63.3% of those with psychopathy recommitted crimes and 31% of those crimes were violent crimes.

Moreover, it is vital that youth offenders be further understood because the safety of communities may be compromised (Gacono & Hughes, 2004; Lynam, 1997; Salekin et al., 2004). Due to recidivism rates, prognosis, and stability into adulthood, it is important to further understand the construct of psychopathy in adolescents. In addition, linking specific personality characteristics to a cognitive and emotional profile to differentiate between those with conduct disorder only and those with psychopathic traits is important as their treatment and prognosis vary between the two groups.

Construct of Psychopathy

The definition used to classify psychopaths has undergone a variety of changes. The most commonly used definition of psychopathy is Cleckley’s (1941) definition.
Cleckley uses personality characteristics including lack of remorse or shame, absence of nervousness/psychoneurosis, inadequately motivated antisocial behavior, general poverty in major affective reactions, and a failure to follow any life plan to describe those with psychopathy (Cleckley, 1941). Researchers have broken down Cleckley’s work into several factors. Hare (1991) uses Cleckely’s original construct to define psychopathy based on behavioral, interpersonal, and affective characteristics. The basis of this personality definition refers to twenty different traits including: interpersonally charming, absence of nervousness, unreliability, insincerity, lack of shame, poor judgment, egocentricity, affectively impoverished, and interpersonally unresponsive. In the same study, Hare (1991) broke down Cleckley’s construct of psychopathy into two factors: personality and antisocial traits that has been empirically supported and validated Using item response theory. The first factor, personality factor, includes the characteristics of self centered, callous, and manipulative personality. Specifically, it includes the traits of lying, manipulation, callousness, lack of affect, guilt, remorse, and empathy. The second factor, antisocial traits, is composed mainly of behavioral components and includes a need for stimulation, poor behavioral controls, lack of realistic long term goals, and juvenile delinquency.

In addition to the Hare’s two factor model of psychopathy, additional researchers have examined three and four factors models of psychopathy. Cooke and Michie (2001) developed the three factor model and Neumann and Hare (2005) developed the four factor model of psychopathy. Some argue that the four factor model is better than the three factor model because it incorporates 18 of the 20 traits whereas the 3 factor only includes 13 traits. In particular, Neumann, Kosson, Forth, and Hare (2006) examined the
factor structure of psychopathy within incarcerated adolescents in the United States and Great Britain to search for an answer to the question on the best factor structure for psychopathy. Their results show that both models are a good fit for psychopathy, but the authors suggest that the four factor model is a better fit for use with Hare’s construct of psychopathy because it uses more of Hare’s psychopathy’s trait measures and it is more robust than the three factor model. Amato, Cornell, and Fan (2008) also examined the factor structure of psychopathy in adolescents finding that both the three factor model of Cooke and Michie (2001) and the four factor model parceled solution from Hares original two factors above provided an excellent fit for their data; however, the three and four factor models from the PCL YV did not provide an adequate fit.

Although controversial, these adult personality characteristics and the construct of psychopathy have been applied to children and adolescents. The construct has been empirically supported for the use in children and adolescents associated with risk of violence (Cooke & Michie 2001; Neumann & Hare, 2004). Although the factor structure in adults is also supported in children, the adult criteria cannot simply be applied to children because of concerns comorbidity in children, temporal stability, applicability of the construct, sampling concerns and negative connotations of the term psychopath (Salekin, 2006).

In order to solve this problem, several researchers have examined the construct looking at specific traits of psychopathy that are present within children. Frick, O’Brien, Wootton, and McBurnett (1994) found two factors in children that are identified as psychopathic characteristics: impulsivity/conduct problems (I/CP) and callous/unemotional characteristics (CU). Frick et al.’s CU factor was related to factor 1
and I/CP was related to factor 2 in Hare’s model. Because of the separation of these two factors, the authors suggested that conduct disorder and psychopathy are two different, but related constructs.

In order to understand psychopathy further, researchers have examined neurological characteristics in those with psychopathy to help determine an etiology. Furthermore, neurochemical and neuroanatomical abnormalities have been related to psychopathy. Serotonin (Minzenberg & Siever, 2006) and dopamine (Buckely, 1999) are implicated in psychopathy. Low levels of serotonin and dopamine are related to aggression, a common characteristic of psychopathy (Gurviitus, Koengsber, & Siever, 2000; Klitenberg, 1996; Weller, 1986). An additional neurotransmitter that has been involved in psychopathy is noradrenaline (Blair, 2006b). Noradrenaline is related to amygdala dysfunction that is associated with the affective characteristics of psychopathy (Blair, 2006b).

In addition to neurochemical abnormalities, there are also neuroanatomical abnormalities in those with psychopathy. Several areas of the brain are implicated in the development of antisocial behavior including the ventro-lateral section, the orbital frontal cortex, and the amygdala (Blair, 2005; Blair, 2006b; Blair, Mitchell, & Blair, 2005, Rogers, 2006, Rolls, 1997) as well as the ventral striatum, cingular gyrus, and hippocampus (Soderstrom, Hultin, Tullberg, Wikkelso, Ekholm, & Forsman, 2002). Each of these areas has various supports. Specifically, the orbital frontal cortex and the amygdala have show to have the most empirical support for their involvement in psychopathy (Blair, 2005; Blair, 2006b; Blair et al., 2005; Rogers, 2006; Rolls, 1997).
Cognitive Models of Psychopathy

Several models have been developed to explain the cognitive functioning of those with psychopathy, but the Response Set Modulation Hypothesis (RM) of psychopathy is the most supported cognitive model of psychopathy as described in the literature (Blair et al., 2006; Hiatt, Schmitt, & Newman, 2004; Kosson, 1998; LaPierre, Braun, & Hodgins, 1995; Pham, Vanderstukken, Philippot, & Vanderlinden, 2003; Roussy & Toupin, 2002; Sellbom & Verona 2007; Vitale, Brickley, Hiatt, & Newman, 2007). The response set modulation hypothesis states that the ability to shift attention towards goal-directed behavior is compromised in psychopathy (Vitale, et al., 2007).

Supporting this model, the majority of neuropsychological research has focused on selective attention deficits in those with psychopathy. The definition of the model and selective attention are very closely related. Selective attention/inhibition is defined as the ability to focus on relevant stimuli while ignoring irrelevant stimuli (Lezak, Howieson, & Loring, 2004; Mirsky, Anthony, Duncan, Ahern, & Kellam, 1991). In the theory, inhibition and selective attention are used interchangeably. For example, Baddeley (2003) breaks down the central executive into four areas: selective attention or inhibition, shifting/coordination, strategy use, and long term memory (Lezak et al., 2004; Mirsky et al., 2001). In addition to theory, data-based evidence the literature also supports this finding. Several authors use the term inhibition (Baddeley, 2003; Lezak et al., 2004; Mirsky et al., 2001; Newman, Wallace, Schmidt, & Arendt, 1997), while others use selective attention (Blair et al., 2006; Hiatt et al., 2004; Kosson, 1998; LaPierre et al., 1995; Mayer, Kosson, & Bedrick, 2006; Pham et al., 2003; Roussy & Toupin, 2002;
The authors who describe inhibition as behavioral inhibition derive this term from J.A. Gray’s (1985) neuropsychological model of anxiety. In this system there is the behavioral inhibition system (BIS) and the behavioral activation system (BAS). In Gray’s model, the motivation systems serve to increase nonspecific arousal, and they are reciprocally related such as the activation of one inhibits the other. Furthermore, Gray describes the processes that mediate automatic checking of goal directed behavior and the shift to controlled processing (Newman et al., 1997). This same explanation is used by Baddeley (2003) to explain selective attention/inhibition: the ability to focus on relevant stimuli while ignoring irrelevant stimuli (Lezak et al., 2004; Mirsky et al., 1991).

Neuropsychology and Psychopathy

To better understand psychopathy, several researchers have examined the neuropsychological profile of those with psychopathy. Research in this area is incomplete and often is inconsistent, especially in adolescents. For example, few studies have examined orbital frontal functioning in those adolescents with psychopathic characteristics. Some researchers found differences in orbitofrontal functioning and selective attention (Roussy & Toupin, 2000; Christian, Frick, Hill, Tyler, & Fraiser, 1997), although others have not (Bauer & Hesselbrock, 1999). Thus, it is vital to understand how executive functions develop in children before they are discussed in relation to psychopathy.
Executive Functions and Attention

Before discussing the specific executive function test score profile seen in those with psychopathy, it is important to understand the construct of executive functions and attention that will be examined in this study. Executive functions are complex, but are generally defined as purposeful and goal directed behavior. Furthermore they are described as capacities that enable a person to engage successfully in independent, purposeful self serving behaviors (Lezak et al., 2004).

Baddeley’s (2003) model of working memory was used to define executive functions and related functions of attention. This model is the most current and empirically supported model. Baddeley’s (2003) model includes four components: the phonological loop, the visuospatial sketchpad, the episodic buffer, and the central executive. The central executive, which several authors use synonymously with executive functions, is fractionated by researchers into several subcategories (Mirsky et al., 1991; Zoelch, Seitz, & Schumann-Hengsteler, 2005). Zoelch et al. (2005) broke down the central executive into the areas of inhibition, shifting/coordination, strategy use, and retrieval from long-term memory.

Based on these fractionated research of the central executive (Mirsky’s et al., 1991; Zoelch et al., 2005), Baddeley’s (2003) view that the central executive is an attentional system, and the consistency with Posner and Raichle’s (1994) attention research, the central executive will include selective attention, sustained attention, and shifting attention. Selective attention/inhibition is the ability to focus on relevant stimuli while ignoring irrelevant stimuli (Lezak et al., 2004; Mirsky et al., 1991). Maintaining attention over time is known as sustained attention (Lezak et al., 2004; Mirsky et al.,
Shifting attention is defined as the ability to transfer focus easily from one task to another (Lezak et al., 2004; Mirsky et al., 1991).

The constructs of broad attention and executive processes, as described by Mather & Woodcock (2001), were examined. Broad attention is a construct where an individual has to focus on certain stimuli in order to process information. Broad attention includes attention capacity, divided attention, selective attention, and sustained attention. The executive processes strategy use such as construct measures the ability to plan, have interference control and the ability shift mental sets.

**Development of Executive Functions**

To extend the neuropsychological literature of psychopathy to children and adolescents the developing brain needs to be taken into consideration. The brain is a complex mechanism that continues to develop into late adolescence and early adulthood. Functions of the frontal lobes including attention and executive functions are some of the last cognitive functions to be fully developed. Executive functions are thought to develop in early adolescence (Anderson, 1998).

Attention and executive functions have been examined in longitudinal studies to help determine the age in which they have reached an adult level of functioning. The development of these skills parallels the development and growth of the frontal lobes. Furthermore, cerebral development is hierarchical and occurs in three major stages. These stages occur from birth to age two, from age seven to age nine and then from age sixteen to age nineteen (Anderson, 1998). Development of executive functions is seen in children as young as three. One of the largest changes was seen between the age of four and five in concept generation and mental flexibility in children ages three to seven years.
(Smidts, Jacobs, & Anderson, 2005). Frontal lobes develop late into puberty, but executive functions such as goal directed behavior are seen as early in development at twelve months (Anderson, 1998).

Depending on the types of tasks, executive functions and attention occur during different stages of development. Some of the earliest skills that develop are mental flexibility and impulse control, which were formed by the ages of ten to twelve. Planning and sequencing of information are formed by age twelve. Skills that are reached by fifteen years were working memory, planning, and shifting sets. However, problem solving, inhibition and concept formation develop over time (Anderson, 1998). Huizinga, Dolan, and van de Molen (2006) found that inhibitory control, working memory, planning, concept formation, and shifting attention developed around the age of fifteen.

Attention develops similarly to executive functions. For example, sustained attention matures by middle childhood with significant improvements between the ages six to ten years (Zhou, Yang, & Zhang, 2006). However more complex tasks may require development into adolescence (Zhou et al., 2006). Betts, McKay, and Maruff (2006) found that selective attention develops throughout childhood with the most development occurring with ages eight to nine and reaching adult levels around the ages of eleven to twelve. These two studies suggest that attention tasks, like executive function tasks develop in late childhood to early adolescence and thus the results of this sample should be similar to the results seen in adults.

Specific Neuropsychological Findings

Neuropsychological research has examined the neuropsychological profile of psychopathy using modifications of the Stroop task, Go/go/no task, D-II cancellation
task, and Porteus maze task, to demonstrate deficits in selective attention in criminal offenders with psychopathy. However, the selective attention deficit is not seen on all measures of selective attention (Blair et al., 2006; Hiatt et al., 2004; Kosson, 1998; LaPierre et al., 1995; Pham et al., 2003; Roussy & Toupin, 2002; Sellbom & Verona 2007; Vitale et al., 2007). Those with psychopathy perform better on tasks that differ when spatially separated, but worse on spatially integrated tasks compared to offenders without psychopathy. They perform well on top down processes, but not on bottom up processes. In other words, they are able to see and understand things by looking at the minute details, but have difficulty looking at something as part of a larger whole (Dvorak-Bertsch, Sadeh, Glass, Thornton, & Newman, et al., 2007). The deficit seen on these measures supports the idea that psychopaths are able to redirect attention and facilitate top down processing in response to bottom up detection of mismatches. The majority of the research supports behavior inhibition deficits in those with psychopathy that has also been seen in adolescents ages fourteen to eighteen with high scores on psychopathy measures compared to those without high scores (Roussy & Toupin, 2000). Also supporting this idea Hiatt et al. (2004) and Blair (2006a) both evidence that they only fail to process the information when it is spatially peripheral to their focus of attention.

Other neuropsychological deficits have been explored in those with psychopathy. Specifically, sustained attention, shifting attention, verbal deficits, and visual spatial deficits have been examined in the literature. Sustained attention is defined as maintaining attention over time (Lezak et al., 2004; Mirsky et al., 1991) and shifting attention is defined as the ability to transfer focus easily from one task to another (Lezak
et al., 2004; Mirsky et al., 1991; Sreenivasan, Walker, Weinberger, Kirkish, & Garrick, 2008). Visual spatial tasks are defined as the ability to see, understand, and synthesize visual patterns and verbal tasks measure the comprehension of individual words and relationships (Mather & Woodcock, 2007). However, research is limited and fails to come to any consistent conclusion regarding these variables (Mayer et al., 2006; Raine et al., 2005; Raine et al., 1990). Future research needs to explore these areas further to develop a more complete cognitive model of psychopathy.

Connecting Neuropsychology to Callous and Unemotional Traits

One of the next steps in understanding psychopathy is to connect the cognitive models of neuropsychology with callous and unemotional traits, the core descriptor of psychopathy (Cooke & Michie, 1997). Due to the overlap in the following two areas the brain systems, research’s next goal is to examine the link between the following two systems and psychopathy. Both executive function and emotions rely heavily on the orbital frontal cortex and its connection to the amygdala. Moreover, there have been additional links to deficits in attention further connecting executive and emotional dysfunction in those with psychopathic characteristics to neurological dysfunction of the amygdala and the orbital frontal cortex, suggesting that there is an interplay between the above brain structures and their connecting systems in psychopathy (Blair et al., 2006; Desimone & Duncon, 1995; Hiatt et al., 2004, Kosson, 1998, Pham et al., 2003; LaPierre et al., 1995; Roussy & Toupin, 2000; Sellbom & Verona 2007; Vitale et al., 2007).

Two recent studies have been completed to examine the connection between these two structures and their connecting system. Malterer, Glass, and Neumann (2008) examined emotional trait intelligence (EI) in relation to the RM hypothesis of
psychopathy. Howard and McCallagh (2007) also examined attention in relation to emotional processing. Both studies suggest that a connection between emotional processing deficits and attention in those with psychopathy.

**Problem Statement**

Recently, authors have strived to focus on the connection of neuropsychological functioning to callous and unemotional traits due to the overlap in neurotransmitter systems in those with psychopathy (Blair, 2005); however, to date, only one of the cognitive models has integrated the specific deficits that have been demonstrated separately by the literature (Blair, 2005). As a result of this need to examine further the linking of the emotional and cognitive functioning of psychopathy, the relationship between neuropsychological functioning and callous and unemotional traits in adolescent offenders was explored. Moreover, several researchers have linked specific executive function deficits to those with psychopathy and also support a genetic etiology (Blair, 2006b; Carlson et al., 2003; Larsson et al., 2006; Lilienfield & Andrews, 1996; Rhee & Waldman, 2002) with orbital frontal and amygdala dysfunction (Blair et al., 2006; Pham et al., 2003). Specifically, selective attention/inhibition and possible sustained deficits have been seen in the neuropsychological literature (Blair et al., 2006; Hiatt et al., 2004, Kosson, 1998, Pham et al., 2003; LaPierre et al., 1995; Roussy & Toupin, 2002; Sellbom & Verona 2007; Vitale et al., 2007). Also deficits have been reported in the emotional literature with regard to attention (Desimone & Duncon, 1995). Overall, dysfunction in common neurological systems between cognition and emotion are likely to account for these deficits.
Research in this area is relatively limited and most of the results have been on adults and Stroop task measures of selective attention/inhibition. Specifically, this study examined the cognitive profile of adolescents, looking at executive functions and broad attention measures and how they differ in individuals who score high verses those who are low on psychopathy measures. In addition, the amount of variance of the CU factor that is explained by attention and executive functions was examined. Those who have high CU factors will also be explored in their measures of attention. Lack of empathy is often referred to as a key developmental component in the development of the callous/unemotional trait (Cleckley, 1941; Frick et al., 1994; Hare, 1991, 1993). Thus, examining these characteristics may help understand how adolescents process information in relation to emotion and give light to future interventions.

Neuropsychological functioning of individuals who score high verses low on callous and unemotional traits were compared. Currently, no studies have attempted to examine the construct of psychopathy in this manner; however, there is preliminary support for this relationship from Howard and McCallagh (2007) and Malterer et al. (2008).

Research Questions and Hypotheses

Based on the abnormalities seen neuroanatomically and neurochemically in the control of executive functions as related to specific characteristics of psychopathy, several research questions were formed to be examined. To date literature supports certain broad attention deficits (Blair et al., 2006; Hiatt et al., 2004, Kosson, 1998, Pham et al., 2003; LaPierre et al., 1995; Roussy & Toupin, 2002; Sellbom & Verona 2007; Vitale et al., 2007), but not executive function deficits in those with psychopathy (Blair et al., 2006; Pham et al., 2003; Vitale et al., 2007). In addition, the literature does not
differentiate between specific characteristics that might contribute to this impairment (Blair, 2005). The four factor model of psychopathy has the strongest empirical support. One particular factor, affect or callous and unemotional, of the factors will be examined in their relationship to neuropsychological correlates (Cooke & Michie, 1997).

The first set of research questions addressed the differences between executive functions and attention, and the overall construct of psychopathy

1. Research Question 1: Do those with high or moderate psychopathy scores perform differently than those with low psychopathy scores on measures of attention including the Woodcock Johnson III (WJ III COG NU) tests of pair cancellation, numbers reversed, auditory attention, and auditory working memory?

   Hypothesis: Those who score moderate/high on psychopathy measures would display deficits in some attention tasks while not displaying deficits on others.

   Those who score moderate/high on psychopathy measures would display deficits in selective attention on the WJ III COG NU auditory attention task compared to those with low psychopathy scores. Those who score moderate/high on psychopathy measures would display deficits on divided attention tasks as measured by auditory working memory compared to those with low psychopathy scores. Those who score moderate/high on psychopathy measures would not display deficits of sustained attention as measured by pair cancellation compared on to those with low psychopathy scores. Those with moderate/high scores on
psychopathy would not display deficits in attention capacity as measured by numbers reversed compared to those with low psychopathy scores.

2. Research Question 2: Are there any differences between low and moderate/high psychopathy groups on measures of executive functions including the tests of concept formation and planning on the WJIII?

   Hypothesis: Those with moderate/high psychopathy will not display deficits in executive functions when compared to those with low psychopathy.

   Those with moderate/high psychopathy would not display deficits in concept formation compared to those with low psychopathy scores. Those with moderate/high psychopathy would not display differences in their scores on planning compared to those with low psychopathy scores.

   The second set of questions addressed the difference between a specific characteristic of psychopathy, callous and unemotional traits, which has been shown to account for the most variance in the construct of psychopathy (Frick, Cornell, Bodin, Dane, Barry & Loney, 2003b; Frick & Dantagnan, 2007).

3. Research Question 3: Do specific types of attention as measured by subtests of the WJIII broad attention construct (pair cancellation, auditory attention, auditory working memory, and numbers reversed) account for any of the variance in callous and unemotional traits?

   Hypothesis: Selective attention as measured by auditory attention would account for the most variance in the callous and unemotional trait compared to the other three measures.
4. Research Question 4: Do executive functions account for any of the variance in callous and unemotional traits?

Hypothesis: Executive functions would not account for the variance in callous and unemotional traits.
CHAPTER II
LITERATURE REVIEW

Aggression

Aggression in youth is a historical concern that relates to issues of crime and violence, thus it should be studied closely when examining these two factors. Furthermore, aggression has multiple dimensions, a diverse etiology, and several outcomes. Being able to understand how aggression develops and takes course may provide for better treatment options for the most extreme offenders. Although aggression is a likely component of many crimes, it is not essential for all. In fact many criminals do not complete aggressive acts, especially criminals who are not caught. These individuals are described as having more personality characteristics of callous and unemotional traits that lead to their criminal behavior (Frick et al., 2003).

An essential and one of the most defining characteristics in those with psychopathic traits is aggression. Aggression is defined as a “forceful action or procedure such as an unprovoked attack, especially when intended to dominate or master” (Merriam Webster Online, 2008). Furthermore, aggression ranges from its association with survival, adaptive aggression to its association with violence, maladaptive aggression. It is important to distinguish adaptive and maladaptive aggression. Not all aggression serves the same purpose (Connor, 2002). Maladaptive aggression has negative consequences and represents dysfunction. Adaptive aggression on the other hand serves a natural function that involves aggression that is needed for survival. In other words, adaptive aggression is not typical of those who have behavior disorders. Maladaptive aggression is characteristic of several classic disorders. These disorders include oppositional defiant
disorder, conduct disorder, antisocial personality disorder, and psychopathy. Each disorder differs in severity and its characteristics (Connor, 2002).

Aggression is also divided into two other categories known as proactive and reactive aggression. Proactive aggression is known as instrumental or predatory aggression that has a desired goal or outcome. In this type of aggression, there is very little central nervous system arousal, irritability, anger, or fear. Reactive aggression, on the other hand, is an angry defensive reaction in response to a threat. The reaction is impulsive and not thought out (Connor, 2002). Instrumental aggression was defined by Feshbach (1971) as providing some reward or advantage to the aggressor that is unrelated to the victim’s discomfort.

Disorders of Aggression

The first disorder that is associated with aggression is oppositional defiant disorder or ODD. This disorder is characterized as having a defiance that is associated with hostile behavior towards authority. Individuals with ODD commonly lose their temper, blame others for their own mistakes, and can become easily annoyed by others. To be diagnosed with this disorder; social, occupational, or academic functioning has to be affected for six months or more. Other features associated with ODD are low self esteem, mood, labiality, low frustration tolerance, swearing, and substance abuse. ODD occurs at a rate of 2-16%. The type of aggression that those with ODD have is typically related to verbal rather than physical aggression (DSM-IV-TR, American Psychiatric Association, 2000).

A more severe disorder associated with aggression is conduct disorder (CD). Conduct disorder is defined as that which causes impairment to social occupational, or
academic functioning in children and youth less than eighteen years of age. Some of the symptoms include aggression, deceitfulness, rule violations, and property destruction without the concern of others. Behaviors can include aggressive behaviors with harm to others and animals, property destruction, deceit, theft, or rule violations. At least three criterion behaviors must be present during the last twelve months with one behavior present in the last 6 months. Prevalence rates are less than 1% to more than 10%. Approximately 25-40% of children with CD continue these characteristics into adulthood and are then classified as having antisocial personality disorder. The prevalence rate of CD ranges from 0.9-8.7%. Half of the characteristics directly relate to aggression (DSM-IV-TR, American Psychiatric Association, 2000).

Antisocial personality disorder (ASPD) is an axis II disorder that begins in childhood and continues into adulthood. For an individual to be classified as having this disorder, he or she must be at least 18 years of age, have a history of conduct disorder, and have symptoms of conduct disorder before the age of fifteen. Individuals with APSD fail to conform to social behavior, they are deceitful and manipulative in order to gain pleasure, they may lie, they may be impulsive, they tend to be irritable and aggressive, they are irresponsible, they have disregard for the safety of others, and they show little remorse. This disorder is prevalent between 3-30% of the population (DSM-IV-TR, American Psychiatric Association, 2000).

The most severe and violent types of offenders are classified as having psychopathic characteristics. Furthermore, this group of individuals often encompasses the individuals who have less overt aggressive behaviors, but more personality characteristics that appear aggressive. This disorder coincides with the lack of emotional
reactivity often associated with the classic psychopath (Cleckley, 1976). Woodworth and Porter (2002) investigated whether psychopaths engage in more instrumental or reactive aggression.

Psychopathy

Models of Psychopathy

In order to understand psychopathy, many have tried to develop constructs and terms to define this small population of individuals. The term ‘psychopathy’ actually means “mental illness” and comes from the Greek words psyche meaning mind and pathos meaning disease (Hare, 1993). Psychopaths were first described by Philippe Pinel, a psychiatrist in the nineteenth century, who used the term insanity without delirium to describe individuals who lack remorse and ability to control their impulses (Hare, 1993). Since then, many have added to this explanation of psychopathy using other descriptive terms such as harmful, cruel, egocentric, callous, affectionless, and unfaithful. Weller (1986) described psychopaths as having minimal empathic understanding, callous disregard, low affiliation, inability to learn from experience, and lack of anxiety.

The preeminent historical definition of psychopathy comes from Cleckley’s (1941) book The Mask of Sanity. Cleckley’s construct consists of several personality traits including: lack of remorse or shame, absence of nervousness/psychoneurosis, inadequately motivated antisocial behavior, general poverty in major affective reactions, and a failure to follow any life plan (Cleckley, 1941). This definition and criteria is the most common and empirically supported construct of psychopathy (See Table 1).
Hare (1991) divided Cleckely’s original construct of psychopathy into several factors based on behavioral, interpersonal, and affective characteristics. This personality definition refers to twenty different traits including: interpersonally charming, absence of nervousness, unreliability, insincerity, lack of shame, poor judgment, egocentricity, affectively impoverished, and interpersonally unresponsive. Using item response theory, Hare (1991) classified psychopathy into two factors: personality and antisocial traits to develop an empirically supported model. The first factor in adults, personality factor, includes the characteristics of self centered, callous, and manipulative personality. It includes the traits of lying, manipulation, callousness, lack of affect, guilt, remorse and empathy. The second factor in adults, antisocial traits, is composed mainly of behavioral components and includes a need for stimulation, poor behavioral controls, lack of long term goals that are realistic, and juvenile delinquency (See Table 2).
Table 1

*Cleckley’s Psychopathy Characteristics*

<table>
<thead>
<tr>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>superficial charm/good intelligence</td>
</tr>
<tr>
<td>no delusions/irrational thinking insight</td>
</tr>
<tr>
<td>absence of nervousness/psychoneurosis</td>
</tr>
<tr>
<td>untruthfulness and insincerity with/without drink</td>
</tr>
<tr>
<td>lack of remorse or shame</td>
</tr>
<tr>
<td>inadequately motivated antisocial behavior</td>
</tr>
<tr>
<td>poor judgment/failure to learn</td>
</tr>
<tr>
<td>pathologic egocentric/incapacity for love</td>
</tr>
<tr>
<td>general poverty in major affective reactions</td>
</tr>
<tr>
<td>unreliability</td>
</tr>
<tr>
<td>unresponsiveness in general interpersonal relations</td>
</tr>
<tr>
<td>Fantastic and uninviting behavior with/without drink</td>
</tr>
<tr>
<td>Suicide rarely carried out</td>
</tr>
<tr>
<td>Sex life impersonal, trivial, and poorly integrated</td>
</tr>
<tr>
<td>Failure to follow any life plan</td>
</tr>
</tbody>
</table>
Table 2

*Hare’s Psychopathy Traits*

<table>
<thead>
<tr>
<th>Factor 1</th>
<th>Factor 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personality Traits</td>
<td>Socially Deviant Behaviors</td>
</tr>
<tr>
<td>pathological lying</td>
<td>need for stimulation/</td>
</tr>
<tr>
<td>callous/lack of empathy</td>
<td>proneness to boredom</td>
</tr>
<tr>
<td>glibness/superficial charm</td>
<td>irresponsibility</td>
</tr>
<tr>
<td>lack of remorse or guilt</td>
<td>parasitic lifestyle</td>
</tr>
<tr>
<td>shallow affecct</td>
<td>early behavioral problems</td>
</tr>
<tr>
<td>conning/manipulative</td>
<td>juvenile delinquency</td>
</tr>
<tr>
<td>failure to accept responsibility</td>
<td>poor behavioral controls</td>
</tr>
<tr>
<td></td>
<td>revocation of conditional release</td>
</tr>
<tr>
<td></td>
<td>promiscuous sexual behavior</td>
</tr>
<tr>
<td></td>
<td>impulsivity</td>
</tr>
<tr>
<td></td>
<td>criminal versatility</td>
</tr>
<tr>
<td></td>
<td>lack of realistic long-term goals</td>
</tr>
<tr>
<td></td>
<td>many short-term marital relationships</td>
</tr>
</tbody>
</table>

When examining Hare’s two factor model, Cooke and Michie (1997) found it to be a good fit for the construct of psychopathy using item response theory. The characteristics of lack of remorse or guilt and grandiose sense of worth provided the most discrimination for factor 1. On factor 2, impulsivity and need for stimulation provided the most discrimination. Although broken down into two factors, factor 1 provides much
more predictability than factor 2 of psychopathy. Factor one accounts for 74% of the variance and factor 2 accounts for 46% of the variance, suggesting that affective characteristics over behavioral are more characteristic of those with psychopathy alone (Cooke & Michie, 1997).

In addition to the two factor model of psychopathy that Hare originated, additional researchers have examined three and four factors models of psychopathy. Cooke and Michie (2001) developed the three factor model Cooke and Michie’s (2001) model includes the three factors of: Arrogant and Deceitful Interpersonal Style, Deficient Affective Experience, and Impulsive and Irresponsible Behavioral Style. Neumann and Hare (2005) developed the four factor model of psychopathy. Neumann and Hare’s model has interpersonal affective, lifestyle and antisocial factors. The item break down of each of these models can be seen in Tables 3 and 4 below.

Table 3
Cooke and Michie’s (2001) Three Factor Model

<table>
<thead>
<tr>
<th>Interpersonal Style</th>
<th>Deficient Affective Experience</th>
<th>Behavioral Style</th>
</tr>
</thead>
<tbody>
<tr>
<td>glibness</td>
<td>lack of remorse/guilt</td>
<td>need for stimulation</td>
</tr>
<tr>
<td>grandiosity</td>
<td>callous/lack of empathy</td>
<td>parasitic lifestyle</td>
</tr>
<tr>
<td>pathological lying</td>
<td>shallow affect</td>
<td>lack of realistic goals</td>
</tr>
<tr>
<td>conning/manipulation</td>
<td>failure to accept responsibility</td>
<td>impulsivity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>irresponsibility</td>
</tr>
</tbody>
</table>
Table 4

*Neumann and Hare (2005) Four Factor Model*

<table>
<thead>
<tr>
<th>Interpersonal</th>
<th>Affective</th>
<th>Lifestyle</th>
<th>Antisocial</th>
</tr>
</thead>
<tbody>
<tr>
<td>pathological lying</td>
<td>callousness</td>
<td>need for stimulation</td>
<td>juvenile delinquency</td>
</tr>
<tr>
<td>glibness</td>
<td>shallow affect</td>
<td>irresponsibility</td>
<td>poor behavioral controls</td>
</tr>
<tr>
<td>lying</td>
<td>lack of remorse</td>
<td>parasitic lifestyle</td>
<td>revocation of cond. Rel.</td>
</tr>
<tr>
<td>conning/manipulative</td>
<td>failure to accept resp.</td>
<td>lack of goals</td>
<td>criminal versatility</td>
</tr>
<tr>
<td></td>
<td></td>
<td>impulsivity</td>
<td>early behavior problems</td>
</tr>
</tbody>
</table>

Some argue that the four factor model is better than the three factor model because it incorporates 18 of the 20 traits whereas the 3 factor only includes 13 traits (Neumann & Hare, 2005). The four factor structure has also been supported in additional measures of psychopathy including the PCL –YV and the PCL-SV. Neumann, Kosson, Forth, and Hare (2006) examined the factor structure of psychopathy within incarcerated adolescents in the United States and Great Britain to search for an answer to the question on the best factor structure for psychopathy. Their results show that both models are a good fit for psychopathy, but they suggest that the four factor model is a better fit for use with Hare’s construct of psychopathy because it uses more of Hare’s psychopathy trait measures and it is more robust than the three factor model.

*Psychopathic Nonoffenders*

While psychopathy is associated and studied within the prison population, it is important to note is that psychopathy occurs within the general population as well. Few
studies have attempted to study psychopathy in the general population due to the difficulty obtaining a sample. The majority of the studies use a self report method to examine psychopathic characteristics in college age students. Even those who attempt to study psychopathy in a nonoffender population have not found individuals that meet criteria for psychopathy. In addition, many of these studies do not use a statistically supported method of assessing psychopathy (Dematteo, Heilbrun, & Marczyk, 2006). Although many individuals may not have met the criteria for psychopathy in nonoffender populations that is not to say that these individuals do not exist. Individuals in everyday life are able to manipulate others with their charm and wit at the expense of others.

The most widely supported research on psychopathy in the nonoffender sample is researchers’ work with the successful psychopath. The successful psychopath is one who has the personality characteristics of psychopathy, but refrains from serious antisocial behavior. Some thoughts about the nonoffender are that noncriminal psychopathy is a subclinical manifestation of psychopathy. Moreover, some researchers believe that they commit crimes and have the personality characteristics of psychopathy; they just do not commit crimes as often. It is not a different disorder; it is a moderated expression of the disorder. Researchers in this area suggest that the non offender and offender populations have the same risk factors that lead to the development of psychopathy, but the noncriminal offenders have some moderating effect that causes them to go the other way. The last idea of noncriminal psychopathy takes dual process perspective looking at the antisocial and the personality characteristics of psychopathy separately. Moreover, those with more personality characteristics are likely to be the “successful psychopaths” as they
can potentially carry about their psychopathy adaptively in the community without running into legal problems (Hall & Benning, 2006).

One study that examined characteristics of psychopathy in a normal population was Babiak (2000). This author discusses psychopathic characteristics within the workplace. A recent focus of industrial and organizational psychologists is to identify individuals that can be particularly harmful to an organization as a whole. However, due to this population’s ability to elude detection and the fact that these individuals often move from one victim to another quite frequently, they are hard to identify and study. The author goes on to describe how those with psychopathic traits obtain jobs due to their charm. Once they have infiltrated the system, they move onto those in the system they align with and manipulate. Eventually, they manipulate the entire system to their advantage.

Two additional studies have examined psychopathy in a nonoffender population using the empirically supported method of measuring psychopathy, the Psychopathy Checklist Revised (PCL-R; Hare, 1991; 2003). The first is Ishihawa, Raine, Lencz, Bihrl, and Lacasse (2001). These authors examined physiological responses during the Wisconsin Card Sorting Task (WCST), Wechsler Memory Scale-Revised subtests and childhood stressors between successful and unsuccessful psychopaths. Ishikawa et al. (2001) found that unsuccessful psychopaths performed poorer on stress measures, and the WCST. Their results indicate that successful psychopaths have less impaired neuropsychological and fear responses functions than nonsuccessful psychopaths. However, this study did not say how they classified the groups limiting their findings.
The second study is Vanman, Meja, Dawson, Schell, and Raine, (2003), which examined startle responses in relation to factor 1 and factor 2 of the PCL-R within a community sample. They found that startle responses were positively related to factor 2 and negatively related to factor 1, which suggest that there may be two types of psychopathy. This study had very sound methodology. However, as with any community sample there are no criminal records, which limit the accuracy of the PCL-R in these populations.

Other methods in addition to the PCL-R have been used in the assessment of this population. These methods include the Psychopathy Checklist Screening Version (PCL: SV; Hart, Cox, Hare, 1995), The Interpersonality Measure of Psychopathy (Im-P; Kosson, Steuerwalk, Forth & Kirkart, 1997), The Psychopathy Q-Sort (PSQ; Reise & Oliver, 1994), The Psychopathy Scan (P-Scan; Hare & Hereve, 1999), and The Business Scan (B-Scan; Babiak & Hare, in press). However, these methods do not have as strong psychometric properties as the PCL-R (Hall & Benning, 2006).

While those with psychopathic traits in everyday life are rare, it is important to be able to identify their characteristics. Overall, research has found that these individuals have similar empathy, impulsivity, socialization as the nonsuccessful psychopaths (Hall & Benning, 2006). Due to the characteristics and limited number of these individuals, there is very little research focusing on these individuals. More research is needed to determine additional characteristics of this subset of psychopaths and to develop better methods of assessment for this population.
Psychopathic Characteristics in Children and Adolescents

Although controversial, these adult personality characteristics and the construct of psychopathy have been applied to children and adolescents. The construct has been empirically supported for the use in children and adolescents associated with risk of violence. While the factor structure in adults is also supported in children, the adult criteria cannot just be applied to children because of concerns comorbidity in children, temporal stability, applicability of the construct, sampling concerns and negative connotations of the term psychopath (Salekin, 2006).

In order to solve this problem, several researchers have examined the construct with children using factor analysis. Frick et al. (1994) found two factors in children that identified psychopathic characteristics: impulsivity/conduct problems (I/CP) and callous/unemotional characteristics (CU). Frick et al.’s CU factor was related to factor 1 and I/CP was related to factor 2 in Hare’s model. Furthermore, the authors suggested that conduct disorder and psychopathy are two different, but related constructs and are similar to adult finding. Amato, Cornell, and Fan (2008) also examined the factor structure of psychopathy in adolescents finding that both the three factor model of Cooke and Michie and the four factor model parceled solution from Hares original two factors above provided an excellent fit for their data; however, the three, four, and two factor models from the PCL YV did not provide adequate fit.

As briefly previously introduced, the four factor model of psychopathy is the most widely supported in adolescents when using the PCL YV. The four factor model in adolescents mirrors the adult model. Neumann and Hare (2005) report when using Mplus (Muthen & Muthen, 2001) in a sample of 1,631 adolescent offenders the four factor
model of the PCL YV was the best fit for the data and explained the most variance in the construct.

*Life Course and Prevalence of Psychopathy*

Psychopathy is a serious disorder that is thought to begin in childhood and continue into adulthood, and has demonstrated empirical validity as a construct within children and adolescents. Researchers have found that behaviors and personality characteristics of psychopathy do not begin in adulthood, but rather, begin in childhood and remain stable into adulthood (Lynam, Casp, Moffit, Loeber, & Stouhamer-Loeber, 2007). Lynam et al. (2007) examined psychopathy from adolescence into early adulthood and found from the age of thirteen to the age twenty four, scores remained similar on psychopathy measures. However, scores at 13 were most related to impulsive and antisocial behavior accounting for 10% of the variance in psychopathy. Impulsive and antisocial behaviors were much better predictors of psychopathy compared to facets 3 (impulsivity) & 4 (poor behavioral control) indicating that some traits may occur later in development (Lynam et al., 2007). Similarly Gretton, Hare, and Catchpole (2004) found that adolescents who offended and scored high on measures of psychopathy when in adolescence, continued the trend of violent crimes into adulthood. Knowing that psychopathy remains fairly stable, it is vital to understand how it manifests in children and adolescents. This understanding of psychopathic characteristics in children and adolescents is needed so that possible treatments and prevention methods can be developed.

Psychopathy is present within 1% of the world’s population; however, the percentage of those with psychopathy greatly increases from 1% to 20% within criminal
justice settings. In youth offenders, the prevalence rate is estimated at 21.5%, which is similar to the rate of adults (Salekin, Leistico, Neumann, DiCicco, & Duros, 2004). Approximately 10% of males on probation rate high on psychopathic traits. This disorder is evident across ethnic groups and cultures and is not present in on population more than another (Schmitt, McKinnon, Harprett, Brownlee, 2006). Gender, on the other hand, has been related to psychopathy. Typically those with psychopathic traits are males present with higher incidents of psychopathy compared to females (Grann, 2000; Schmitt et al., 2006).

Disorders Comorbid with Psychopathy

Several DSM-IV diagnoses are comorbid with psychopathy. These range from drug disorders to axis 1 disorders. Hildebrand & Ruiter (2004) found that those with psychopathy are 3.5 times less likely to have an axis 1 disorder. Psychopathy is related to personality disorders and is most related to antisocial personality disorder (ASPD). Psychopathy also had trends with borderline, histrionic, and paranoid personality disorders.

In children and adolescents, comorbidity exists between several disorders and psychopathy. The primary diagnoses that overlap with psychopathic traits are conduct disorder (CD), oppositional defiant disorder (ODD), and attention deficit hyperactivity disorder (ADHD) (Hildebrand & Ruiter, 2004). Epstein (2002) found that alcohol dependency (61%), drug dependence (72%), ADHD (71%), dysthmia (22%), depression (52%), and posttraumatic stress disorder (19%) are also comorbid with psychopathic traits.
Although comorbid, CD and ASPD are not identical to psychopathy. Historically, ASPD has been used synonymously with the term psychopathy. Researchers (Feighner, Baran, & Furman, 1972) have argued that ASPD criteria be utilized because they are easily measured and central to psychopathy; however, it has been found that even though a part of it, they are not the central characteristics of psychopathy. Still, current researchers have found separate but related factors between those with psychopathy and those with ASPD. Specifically, psychopathy and ASPD vary in historical, theoretical, and definitional lines. ASPD was developed from the American Psychological Association (APA) and came from the social deviancy model and is defined in behavioral terms. Whereas, psychopathy is derived from psychiatric disorders related to histrionic, narcissistic, and borderline personality disorders (Widiger, Cadoret, Hare, Robins Rutherford, Zanarini, et al., 1996).

While the DSM-IV does not differentiate between antisocial personality disorder and psychopathy, they are two different constructs that need to be examined separately. Most offenders who meet criteria for psychopathy also meet the criteria for ASPD, but many of those with ASPD are not classified as psychopaths. The rate of ASPD is much higher than the rate of psychopathy and ASPD does not predict psychopathy (Hildebrand & Ruiter, 2004) For example, 50-80 % of forensic populations have ASPD compared to 15-25% who have psychopathy (Loving & Gacono, 2002). In addition, ASPD is strongly related to Factor 2, but not to the Factor 1 items. Due to the dangerous nature of psychopathy compared to antisocial personality disorder, it is important that the two are differentiated and the characteristics that separate them be identified (Gacono & Hughes, 2004).
As with adults, it is important to differentiate psychopathic traits from behavior disorders in children and adolescents. Approximately 30% of children diagnosed with ODD and CD are also diagnosed with psychopathy (Salekin & Frick, 2005). However, the key to differentiating between the two is to look at the symptoms. The diagnoses of CD and ODD primarily rely on behavioral symptoms rather than including personality and emotional characteristics. Cleckley’s definition of psychopathy is therefore much more appropriate than the DSM criteria for determining CD and ODD focusing on CU traits in identifying high psychopathy in children (Gacono & Hughes, 2004).

**Etiology of Psychopathy**

In order to understand psychopathic traits and to develop better treatment options for children and youth that are at risk to commit crimes, the genetic factors and environmental factors in the development of psychopathy need to be identified. The majority of the evidence indicates that there is a strong genetic connection to psychopathy with relatively weak association to environmental influences. Specifically, research has found these genetic factors are associated with temperament types that can lead to difficulty forming healthy attachment. In addition, both environmental and genetic characteristics can also contribute to unhealthy attachment, which may ultimately lead to the development of psychopathic traits into adulthood (Blair, 2006a; Blonigan, Carlson, & Krueger 2003; Larsson, Andershed, & Lichtenstein, 2006; Rhee & Waldman, 2002).

A large and growing amount of literature supports a genetic contribution of psychopathy. Researchers such as Schonfeld, Schaffer, O’Connor, and Portony (1988) and Weller (1986) found a genetic link between parents and children for psychopathic traits and CD. In addition to the genetic link between CD, there is a genetic link to the
emotional characteristics connected to psychopathic characteristics (Blair, 2006b; Blonigan et al. 2003; Larsson et al., 2006; Rhee & Waldman, 2002).

In a meta-analysis of 51 twins and their siblings, Rhee and Waldman (2002) examined the relationship between environment and genetic contribution to antisocial behavior. The study found that on average 41% of the variance in antisocial behavior is due to genetic factors, 16% is due to shared environmental factors, and 43% is due to non-shared environmental factors indicating that genetics and nonshared environmental factors have the largest effect on antisocial characteristics. However, the methods the authors used, including genetic typing methods and age affected the amount that each factor contributes to psychopathic traits. Thus, each of these should be examined when examining etiological factors of psychopathic traits to help determine more specific etiological factors.

Blonigan et al. (2003) expanded Rhee and Waldman’s (2002) research to the construct of psychopathy. The authors found a genetic contribution to psychopathy over nonshared and shared environmental factors in a single research study of 353 adult males using the Psychopathy Personality Index (PPI; Lilienfeld & Andrews, 1996). With structural equation analysis in monozygotic and dizygotic twins, the nonshared environmental, shared environmental, and genetic contributions were estimated in their contribution to the development of psychopathy. The authors found that at age seventeen and twenty four, the scales showed a moderate genetic influence and minimal environmental influences on psychopathic traits. At seventeen, there was more of a genetic contribution than at age twenty four. These results imply that even early on there is a strong genetic contribution to the development of psychopathic traits.
The genetic support was extended by Larsson et al. (2007) to include specific factors of psychopathic traits and how they relate to its development. Furthermore, a genetic contribution to the affective, behavioral, and interpersonal dimensions of psychopathic traits within 16-17 monozygotic, dizygotic, and opposite sex twin pairs was examined. Using the Youth Personality Inventory, the differences between sexes and types of twins on each of the personality dimensions and their contribution to psychopathy were measured. From the model derived, 43-56% of the variance in callous/unemotional traits and impulsive and behavioral dimensions were accounted for by genetics. Interpersonal factors were not significantly related. They found that genetic factors contribute 63% of the variance in the construct of psychopathy whereas, environment explains 37%. Moreover, genetics accounts for much of psychopathic traits, particularly callous and unemotional traits.

Viding, Blair, Moffitt and Plomin (2007) furthered genetic research to help support Larsson et al.’s (2006) results in the area of callous and unemotional factors. Viding et al. (2007) used genetic typing done by DNA typing of 8-10 microsatellite polymorphism and a parent questionnaire in 3,500 seven year old twin pairs to determine how callous and unemotional factors related to the development of psychopathic characteristics. When needed, a more extensive genetic polymorphism test was done to determine genetic typing. The authors found little environmental influences and a moderate heritability of callous and unemotional and conduct disorder characteristics as rated by their teacher. Moreover, genetics contributes to both behavior and affective characteristics of psychopathy.
With the majority of the etiological evidence pointing to genetic effects on personality characteristics of psychopathy, temperament is also likely to be affected. Recent literature has begun to focus on temperament and its relation to psychopathy. Temperament is defined as individual differences that relate to personality and is thought to be heritable. Furthermore, temperament is important to child and adolescent development in the areas of the development of behavior problems, ability to adapt to social systems, and the development of social attachments. Knowing the temperamental style of a child can help develop certain interventions based on goodness of fit (Seifer, 2000).

When examining personality characteristics of psychopathy in children, it is likely that temperament is also affected. Taylor, Loney, Bobadilla, Iacono, and McGue (2003) examined monozygotic and dizygotic twin pairs in relationship to temperament. Genetics was determined by a parent interview of zygosity, points of similarity, and a genetic algorithm. If there were any discrepancies, a blood serological examination was done to determine if the twins were monozygotic or dizygotic pairs. Participants completed the Minnesota Temperament Inventory and found that the antisocial and the detachment characteristics of temperament were related to genetics. The monozygotic twins had a higher correlation than the dizygotic pairs to these characteristics. In other words, genetics are related to psychopathic characteristics of an inability to form relationships with others, self-centered behavior, lack of emotions, lying, and lack of guilt. This type of temperament can lead to problems adapting and relating people as well as social systems in which they belong. Farrington (2005) in a review of literature also suggests that those who score high psychopathy have a hard to socialize temperament.
A more recent study also supported early temperament in relation to adult psychopathic characteristics. Glenn, Raine, Venables, and Mednick (2007) connected temperament at the age of three to psychopathy at the age of twenty eight. This study used a measure of inhibited/disinhibited temperament characterized by crying behaviors, sociability, approach avoidance, verbalizations, social involvement with other children, and ease with the experimenter. Children who were less fearful and inhibited and showed higher arousal at the age of three, related to psychopathic characteristics at the age of twenty eight. Specifically, those characterized as having psychopathy at twenty eight were more talkative, had more social involvement, was friendlier to the examiner, and also had longer reaction times during fear provoking situations at the age of three than those without those characteristics.

These studies suggest that there are innate characteristics that relate to psychopathy that are present early in life continue into adulthood. Typically developing children will show some hesitation at the age of three with unfamiliar adults, whereas those with psychopathic characteristics will not. While they are friendly at the age of three, children with psychopathic characteristics have difficulty forming meaningful relationships with others. In addition, they do not have response to fear. While typical children will develop a fear response to different forms of punishment, children with psychopathic characteristics will not form the association between the misbehavior and punishment and will continue maladaptive behaviors. This information on temperament gives researchers incite on how to respond to develop interventions for children. Parents may need to be trained during infancy through age four, to help learn how to best respond
to their child’s unique temperament style and behavioral treatments that work with children who do not respond to punishment and reinforcement (Glenn et al., 2007).

Further, attachment styles are likely also be affected in those with psychopathic traits. Children with psychopathic traits are characterized as amoral, affectionless, and self centered, which leads research to suggest that attachment is related to later moral development. In turn, empathy is related to moral development and can be demonstrated early in development through crying and showing signs of response to the distress of others as infants. Around the age of two, typically developing toddlers begin to comfort those in distress and continue to further understand the feelings of others. However, not all individuals develop empathy such as those with psychopathic traits. Children with poor attachment styles fail to develop empathy with their caregivers and they continue this pattern throughout life. For example, as infants they may not respond through head turns and crying to others’ distress. As toddlers, they may not respond and comfort others. They continue this egocentric view with very little understanding of others and insecure relationships throughout development. While even as children they may be charming and people may like them, their relationships will be shallow (Saltaris, 2002).

Although the majority of reviewed studies do not give support for environmental factors being involved in the development of psychopathy, some researchers have connected psychopathy with environmental characteristics including: antisocial parents, males, low socioeconomic status, and antisocial friends (Schonfield et al., 1998). However, many of these studies examine ASPD rather than psychopathy, giving question to their application to psychopathy. Specifically, Raine (1993) linked socioeconomic status and ASPD. Hare (1993) also made this connection with aspects of ASPD and
psychopathy characteristics that overlap being effected by environmental influences. Taylor et al. (2003) found that unshared environmental experiences contribute to emotional detachment. Frick, Kimonis, Dandreaux, & Farell (2003) found that conduct problems, SES, family, and the quality of parenting were predictors of psychopathic traits. The impact of these factors can be significant on development leading to psychopathic and antisocial characteristics. However, the results and application of these studies are questionable due to the methodology. More studies need to examine environmental factors related to psychopathy alone.

In addition, the family environment has also had implications in the development of psychopathy and CD. Parental, specifically maternal relations to a child have been implicated as one of the causes of psychopathy. It is reported that those with psychopathy typically grow up in a home filled with conflict and maltreatment compared to those who grow up in a more supportive environment (Farrington, 2005). Specifically, detached and indifferent mothers relates to the development of criminal behavior as well as low parental involvement, broken homes, loss of the father, and parental neglect. Similarly, Kimbrel, Nelson-Gray, and Mitchell (2007) found that low maternal care relates to the onset psychopathic characteristics. Each of these examples can lead to problems with attachment. More parenting characteristics also relate to psychopathy including parental discipline, parental antipathy as well as child antipathy to parents (Marshall & Cooke, 1999).

There is also evidence that psychopathic characteristics relates to physical and emotional abuse (Campbell, Porter, & Santor, 2004; Farrington, 2005; Marshall & Cooke, 1999; Poythress, Skeem, & Lilienfeld, 2006), but not to sexual abuse in childhood.
(Christopher et al., 2007; Marshall & Cooke, 1999). Poythress et al. (2006) examined dissociative symptoms in 615 male offenders and their relationship to abuse. In relation to psychopathic traits, abuse had no effects on interpersonal or affective characteristics, but did relate to irresponsible and impulsive behaviors. Thus, abuse may relate to behavioral more than personality characteristics of psychopathy (Marshall & Cooke, 1999; Poythress et al., 2006).

These environmental risk factors can also lead poor attachment with caregivers. Poor attachment is often associated with emotional withdrawal and insecure relationships with others. Often those with psychopathy have disinhibited attachment (Glenn et al., 2007) or they can seek comfort when distressed, but it tends to be indiscriminate. This attachment style characteristic of children with psychopathic characteristics often leads them to have difficulty in adulthood with finding meaningful relationships and taking into perspective their feelings (Zeanah, Boris, & Bieberman, 2000).

In addition, peer and school relations also were correlated with the onset of psychopathy. Marshall and Cooke (1999) found that negative school and institution experience and also negative social experience might lead to the onset of psychopathic symptoms later in life. These poor relationships in school and with others may be a result of temperament and poor attachment styles. These factors need to be examined more in their relation to the development psychopathic traits.

**Neurochemistry and Neuroanatomy of Psychopathy**

Two other factors that are related to the onset of psychopathic traits include neurochemical and neuroanatomical abnormalities. Research supports a genetic etiology, and allows for a better understanding of the onset and development of psychopathic traits.
Several abnormalities in neurotransmitters are associated with the development of psychopathic traits. However, the majority of these disturbances are related to antisocial characteristics (Factor 2 on Hare’s model) rather than affective and interpersonal relationships (Minzenberg & Siever, 2006). Moreover, a relationship has been shown connecting serotonin, dopamine and norepheneprhine to in aggression, but the data is limited for processing of social and emotional information.

One of the most widely supported neurotransmitter abnormalities in psychopathy is serotonin (Minzenberg & Siever, 2006). Furthermore, serotonin is related to impulsivity, and aggression that can be common in those with psychopathy (Gurviitus, Koengsber, & Siever, 2000; Klitenberg, 1996; Weller, 1986). Serotonin has also been implicated in regulation of dopamine, which also has some support in psychopathy. Low levels of dopamine have also been related to aggressive behavior (Buckley, 1999).

In addition to serotonin and dopamine, tryptophan, monoamine oxidase inhibitors, norepheneprhine, testosterone, cortisol, and thyroid hormones have all been shown to have abnormal levels in psychopathic offenders (Klitenberg, 1996). Norepheneprhine and higher levels of testosterone may be related to aggression, and they show a low level of cortical activity in reaction to stressful situations, and low levels of MAO is related to impulsive behaviors (Klitenberg, 1996). However, support for each of these neurotransmitters is limited in its application to psychopathic traits (Minzenberg & Siever, 2005).

Blair (2006b) hypothesized that there is neurochemical connection to interpersonal and affective characteristics. Moreover, Blair (2006b) believes that there are polymorphisms, or genetic anomalies, that give rise to amygdala dysfunction and lead to
the development of psychopathy. Blair supports this hypothesis by suggesting that noradrenaline functioning is altered in those with psychopathic characteristics because it is related to the impact that aversive stimuli has on a person.

While neurochemical evidence is not clear, much more support exists for neuroanatomical abnormalities. Multiple areas of the brain are implicated in the development of antisocial behavior including the ventro-lateral section, orbital frontal cortex, amygdala (Blair, 2005; Blair, 2006b; Blair, Mitchell, & Blair, 2005, Rogers, 2006, Rolls, 1997) ventral striatum, cingular gyrus, and hippocampus (Soderstrom, Hultin, Tullberg, Wikkelso, Ekholm, & Forsman, 2002). The orbital frontal cortex and the amygdala have show to have the most support in their involvement in psychopathy (Blair, 2005; Blair, 2006b; Blair et al., 2005; Rogers, 2006; Rolls, 1997).

The frontal lobes are one of the most supported areas of pathology in those with psychopathy. For example, abnormalities in the prefrontal cortex and its connection to subcortical and cortical areas are common in those with psychopathy. The frontal lobes may involve emotion processing and regulation, a deficit commonly seen in those with psychopathy. In addition, those with psychopathy have difficulties on tasks controlled by the frontal lobes such as response control, go/no-go discrimination tasks, reward penalty tasks, and error monitoring (Rogers, 2006).

An area of the frontal lobes that has shown to be involved in psychopathy is the orbital frontal cortex. One of the major roles that the orbital frontal cortex is involved is response reversal (Blair et al., 2005). Response reversal is defined as changing a reaction to a stimulus based on a change in the contingency (Rolls, 1997). The individual now has to learn to change the previous response they had to a stimuli. For example, if they were
rewarded before for a particular response to a stimulus, they will now be punished. On neuropsychological measures, researchers have demonstrated deficits specific to orbital frontal dysfunction of the brain that will be discussed in a later section (Blair et al., 2006; Pham et al., 2003).

The amygdala is also a central area of the brain that is supported in the pathology of psychopathy. The malfunctioning of the amygdala has shown to be involved in the processing of emotions in both adults and children with psychopathy (Patrick, 1994). As those with psychopathy are described as callous and unemotional, it is important to understand the amygdala’s role in psychopathy further.

The amygdala composed of the basolateral (BLA) and the central nuclei (CeN). The BLA controls the activity of the CeN, which controls the hypothalamic and the nucleus. The BLA projects to the ventral stratum and the prefrontal cortex playing a role in goal directed behavior. The CeN then relays this information to other structures (Blair, 2005; Blair et al., 2005; Price, 2003). There are several systems involving the amygdala and its connection to three areas of the brain. The first system is a forebrain system that provides sensory input to the amygdala. This system includes the olfactory cortex, ascending taste/visceral pathways, posterior thalamus, and sensory association cortical areas provide sensory input to both parts of the amygdala that signals both to and from the amygdala and involves connection to the BLA and CeN (Price, 2003). The second system includes the brainstem and is involved in regulating visceral function related to emotional stimuli. This system is primarily part of the CeN (Blair et al., 2005). The last system is an addition forebrain system involving the ventromedial frontal, rostral insular, rostral
temporal cortex, medial thalamus, and the ventromedial basal ganglia. This system comes from the BLA and is related to goal directed behavior (Blair, 2005).

In addition to being involved with emotional processing, the amygdala is involved in three types of conditioned stimulus associations. Specifically, the amygdala is involved with connecting conditioned stimuli (CS) to unconditioned responses (UR). An Example of this behavior are salivation to food as in Pavlov’s dogs. The CeN is involved in this process. It is also related to connecting conditioned stimulus (CS) to affect stimuli or connecting an emotion to a stimulus (i.e. fear or the expectation of reward). This process involves the BLA and is related to emotional learning. Last, it is related to conditioned stimuli (CS) and sensory aspects of unconditioned stimulus (US), which occurs when the CS is associated with sensory characteristics of the US such as smell. The BLA is also involved in this process (Blair, 2005; Blair et al., 2005; Everitt, Cardinal, Parkinson, & Robbins, 2003).

The amygdala plays a central role in two cognitive processes, attention and instrumental learning. Adults who score high on psychopathy display deficits in both of these areas. In the area of attention, these deficits are described as the competition of stimuli to be represented in the brain (Desimone & Duncon, 1995). Adults who score high psychopathy display reduced reaction to emotional words compared to neutral controls. Adults who score high on psychopathy also do not show reaction time differences between emotional and neutral words suggesting a deficit in amygdala function related to attention processes.

Instrumental learning, controlled by the BLA, is also impaired in those with psychopathic characteristics. Instrumental learning is defined as the process in which an
individual learns to perform a certain action for a reward or withhold an action that will be punished. Researchers have demonstrated that individuals with psychopathic characteristics display problems with instrumental learning. They have show problems with passive avoidance tasks, but not on object dorsal medial or condition learning tasks that do not involve amygdala function (Blair, 2005; Blair et al., 2005; Everitt et al., 2003).

*Behavior Inhibition and Behavior Activation Systems*

Closely related to functioning of the amygdala are the behavior activation and the behavior inhibition system. The behavior inhibition system (BIS) and the behavior activation system (BAS) have been applied to the construct of psychopathy to help distinguish it from ASPD. The BAS and BIS systems derive from J. A. Gray’s (1985) neuropsychological model of anxiety. In Gray’s model, the motivation systems serve to increase nonspecific arousal, and they are reciprocally related such as the activation of one inhibits the other. Furthermore, Gray describes the processes that mediate automatic checking of goal directed behavior and the shift to controlled processing (Newman, Wallace, Schmidt, & Arendt, 1997). The role of the BIS is to monitor ongoing behavior, check that outcomes coincide with expectations, and to shift to controlled processing and initiation of self-regulation. Furthermore, the BIS is sensitive to punishment and initiates passive avoidance whereas, the BAS is sensitive to reward cues and takes a behavioral approach (Newman, MacCoon, Vaughn, & Sadeh, 2005).

Based on Gray’s model, psychopathy is broken into two different types: primary psychopathy and secondary psychopathy. Primary psychopaths are characterized as having problem with self-regulation, low anxiety, (Newman et al., 2005) fearlessness,
poor passive avoidance, and low response when punished (Lykken, 1995; Newman, Wisdom, & Mason, 1985). Primary psychopathy is also associated with disinhibition and boredom (Levenston, Kiehl, & Fitzpatrick, 1995). Moreover, those with primary psychopathy are thought to have a weak BIS and a normal BAS. Those with a weak BIS are less responsive to cues of punishment and would have difficulty monitoring and adjusting behavior in the changing environment (Newman et al., 2005). Secondary psychopaths have more behavioral characteristics and are often associated with ASPD. Behaviors such as impulsivity, impaired thinking abilities, neuroticism, sensation seeking, average levels of fear, and average passive avoidance response to fear are linked to those with secondary psychopathy (Lykken, 1995). Secondary psychopathy would be associated with a strong BAS and a normal BIS (Newman et al., 2005).

Moreover, the BAS and BIS systems allow researchers to distinguish psychopathy from ASPD. Primary psychopathy is more of the classic definition of psychopathy whereas secondary is more classic of ASPD. It is important to be able to distinguish primary and secondary psychopathy as they manifest differently and respond to treatment differently. Looking at specific characteristics in those with psychopathy will allow for better treatment and identification of those who are very at risk to harm others (Lykken, 1995).

**Neuroanatomy and Neurochemistry of the BIS/BAS**

The neuroanatomical and neurochemical characteristics of the BIS and BAS have been explored by researchers. There are several areas of the brain that have been implicated in the BAS and BIS systems based on each system’s purpose and function. These areas of the brain include the frontal lobes and amygdala, and their related circuits.
The BAS is most frequently associated with the left frontal lobes (Coan & Allen, 2003; Hewig, Hagemann, Seifert, Naumann, & Bartussek, 2005; Sutton & Davidson, 1997). Coan and Allen (2003) found that the BAS was associated with left middle gyrus in the frontal lobes. Similarly, Hewig et al. (2005) connected BAS activity to the frontal lobes. Both studies found that those with high BAS had higher front bilateral activity in response to cues to positive and negative reinforcement as compared to neutral trials. This data further supports bilateral frontal activity related to the BAS.

In addition to the frontal lobes, several authors have connected the BAS to other areas within the brain. Hewig et al. (2005) connected the frontal lobes to the frontal amygdala circuitry. Moreover, they noted the involvement of the frontal lobes, amygdala, and the basal ganglia in BAS functioning. Knyazev, Slobodskaya, and Wilson (2002) also extended the neuroanatomy of the BAS system to include the parietal regions of the brain. They found that the BAS is related to high delta and theta waves in parietal regions and is also associated with under arousal of cortical activity.

Because the frontal lobes and its associated circuitry are involved with the BAS, tasks that relate to these areas of the brain will also be influenced. Reuter, Stark, Hennig, Walter, Kirsh, Schienle, et al. (2004) went to examine this theory with working memory. In relation to executive functioning, Reuter et al. (2004) found that those with high BAS scores, have lower brain activity during working memory tasks.

Another function that is associated with the BAS and the frontal lobes is attention. Putnam, Hermans, and van Honk, (2004) examined the BAS in relation to attention. These authors found that BAS over focuses attention limiting response modulation. Furthermore, research supports that heightened anxiety is related to better selective
attention. Selective attention to emotional stimuli is associated with the Stroop emotional task. However this study found no relation to anxiety and Stroop tasks (Putnam et al., 2004).

The neuroanatomy of the BIS system has also been examined in research. Areas of the brain that have been implicated in the BIS system are the right frontal lobe (Coan & Allen, 2003; Sutton & Davidson, 1997), hippocampus, septum, and subiculum, (Coan & Allen, 2003; Hewig et al., 2005), and the ACC (Coan & Allen, 2003). Likewise, it is the frontal temporal circuitry that is involved in the BIS functioning as demonstrated by Knyaev et al.’s (2002) study. Moreover, these authors found that brain activity in the frontal, temporal, and parietal lobes are related to BIS activity.

The next step in the research was to apply the neuroanatomy of the BIS and BAS to emotional functioning. Specifically, Reuter et al. (2004) connected the BIS and BAS research and applied it to emotional functioning of disgust, fear, and eroticism. Based on Gray’s model, the authors examined the amygdala, medial prefrontal cortex, ACC, posterior cingulate, septum, hippocampus, thalamus, insula, OFC, basal ganglia, brainstem, and occipital cortex. Reuter et al. (2004) found that disgust and the BIS were related to the ACC in both hemispheres, the amygdala in the right hemisphere, the thalamus in left hemisphere, and the posterior cingulate in both hemispheres. BAS and disgust were only related to the left insula. Fear was related to the left ACC, left thalamus, and the right posterior cingulate cortex and the BAS was negatively related to insula functioning. Eroticism and the BIS involved the following regions: left ACC, thalamus, insula, left basal ganglia, and left brainstem whereas the BAS involved only the left hippocampus.
The neurochemical aspects of the BIS and the BAS have also been explored, but not to the extent as the neuroanatomy of these systems. Two neurotransmitters that have been implicated in these systems include dopamine and GABA. For example, Coan and Allen (2003) found that dopamine is released during the activation of the BAS. In addition, Leslie Shaw, McCabe, Reynolds, & Dawson, (2004) also explored GABA’s involvement. GABA retards extinction of aversive behavior and in turn facilitates the extinction of post reinforcement. GABA also helps to extinguish inappropriate behavior and reduce anxiety.

*Frontal Lobes and Amygdala*

The same neuroanatomical and neurochemical systems implicated in BIS and BAS activity are involved in psychopathy. In regards to neuroanatomical regions of the brain in psychopathy, several researchers have suggested that the abnormalities seen in the frontal lobes and also within the amygdala are related due to their connection through neurological pathways from the frontal and the subcortical and limbic system of the temporal lobes. This cortico-striatal-thalamic loop is involved in control of cognitions and emotion regulation (Blair, 2006b). As a result of disruption to these pathways, dysfunction is seen in cognition and emotional processing.

Two systems have commonly shown dysfunction in those with psychopathy. One particular system within the frontal lobes that has shown to be involved is dysfunction of the ventral system. This pathway is composed of orbitofrontal prefrontal cortex, insula, ventral striatum, rostrocingulare cortex, and amygdala (Soderstrom et al., 2002). This pathway is involved in emotional processing. For example, Soderstrom et al. (2002) found that cerebral blood flow in thirty two violent offenders using brain imaging
techniques was abnormal within the frontal lobe and also in frontal-temporal connections. Specifically, the right side prefrontal cortex and both sides of temporal lobe were implicated in those with high psychopathy features with low hippocampal activity. Furthermore, interpersonal features, Hare’s Factor 1 and Cooke and Michie’s Factor 1 and Factor 2, were also related to these abnormalities suggesting that these areas of the brain may be involved in violent behavior. Similarly, Weller (1986) found similar structural abnormalities within the frontal lobes and temporal areas finding that frontal damage is related to impulsive behavior and also finding EEF abnormalities in temporal area.

An additional system that also is implicated is the dorsal system, which is composed of the prefrontal cortex, hippocampus, and ACC which mediates affective states. For example, Gordon, Baird, & End (2004) connected blood flow in frontal lobes to affective processing involved in the dorsal system. Although there is some support for the dorsal system, there is more evidence that suggests that the ventral pathway is more impaired in those with high psychopathy features than the dorsal pathway (Blair, 2005).

Cognitive Models of Psychopathy

Blair (2005) described four major models for explaining cognitive deficits seen in those who score high on psychopathy. These models are: frontal lobe dysfunction (Gorenstein, 1982), response set modulation (RM; Newman, Schmitt & Voss, 1997), fear dysfunction (Eysenck & Gudjonsson, 1989), violence inhibition mechanism (VIM; Blair, 1995) response models, the integrated emotion system (IES) model (Blair, 2005), and the language activation hypothesis (LHA; Kosson, 1998). Each model has limited support and contributes a small piece to understanding psychopathy; however, no one model has
come to explain all of the cognitive aspects of psychopathy to date. In a review Blair (2005) suggests IES model has the most support. While explaining the fear dysfunction and the VIM models, this model fails to consider the frontal lobe dysfunction, RM and lateralization hypotheses.

*Frontal Lobe Dysfunction*

One of the models of cognition that is used to explain neurocognitive deficits seen in those with high psychopathy is the frontal lobe dysfunction model. More specifically, this model focuses on impairments of executive functioning related to frontal lobe deficits (Blair, 2005; Gorenstein, 1982; Kosson, 1998; Pham et al., 2003; Vitale et al., 2007). Frontal lobe damage leads to problems with inhibition and working memory which leads to problems with aggression. Furthermore, evidence shows that individuals who are aggressive show impairments on frontal lobe imagining and that those with frontal lobe lesions present more aggression. In addition, those with frontal lobe damage also display deficits similar to psychopathy such as euphoria, irresponsibility, lack of affect, and lack of concern for the present and/or future (Blair, 2005; Pham et al., 2003; Vitale et al., 2007).

Several components of the frontal lobe may be responsible for the deficits seen in those with psychopathic characteristics. Current researchers are carefully examining neuropsychological and cognitive functioning to better understand areas that may be involved. Moreover, the frontal lobe is composed the medial frontal, orbitofrontal, ventrolateral, medial lateral, and dorsolateral prefrontal cortex, and ACC sections. Because imaging does not distinguish areas involved in psychopathy, other neuropsychological methods need to be used to further understand the frontal lobes’
involvement in psychopathy (Blair, 2005; Gorenstein, 1982; Kosson, 1998; Moffitt, 1993; Pham et al., 2003; Vitale et al., 2007).

Response Set Modulation Hypothesis

The next model is the response set modulation hypothesis (RM). In this model, the ability to shift attention (inhibition) to effortful organization and implementation of goal directed behavior is hypothesized to be compromised. Moreover, RM results in poor performance when a stimulus diverts attention from ongoing behavior (Newman et al., 1997). The response set modulation model may also involve the frontal lobes, and this model also needs to be compatible with current models of attention and processing deficits (Gorenstein & Newman, 1980; Kosson, 1998; Moffitt, 1993; Newman, 1998; Patterson & Newman, 1993; Pham et al., 2003; Vitale et al., 2007). Furthermore, the response modulation theory argues that because those with psychopathic characteristics are impulsive, they display cognitive processing deficits in goal directed behavior because they cannot pick up on contextual cues. In response set modulation, automatic attention regulates thoughts and behavior (Vitale et al., 2007). An area where this problem is demonstrated is in passive avoidance tasks (Farrington, 2005). In particular, individuals with psychopathic characteristics display impairment in their abilities to avoid tasks for which they are punished for such as in gambling tasks (Farrington, 2005).

Fear Dysfunction

Fear dysfunction is an additional model used to explain the cognitive characteristics of psychopathy. In this model, healthy individuals are frightened by punishment; however, in psychopaths this ability to connect between fear and punishment does not exist. A typical individual is frightened by punishment and associates fear and
thus is less likely to do the task in the future (Blair, 2005; Eysenck & Gudjonsson, 1989). One reason for the inability to connect fear with punishment is because they have less of an arousal to fear causing them to have weaker cognitive associations with punishment and thus are more likely to engage in risky behavior (Blair, 2005; Eysenck & Gudjonsson, 1989). In this hypothesis, the septal hippocampus region is suggested and also may be related to amygdala dysfunction in making fear associations (Blair, 2005). However, one of the problems with this hypothesis is that the septal hippocampal hypothesis system is not related to fear (Blair, 2005).

**Violence Inhibition Mechanism**

The violence inhibition mechanism model (VIM) is the next model that was developed to help what the previous models had failed to do, explain empathy and moral socialization (Blair, 1995). This model suggests that psychopaths do not get others cues for sadness and also show reduced autonomic responses to fear and distress (Blair, 1995; Blair, 2001; Blair et al., 2005). The VIM follows a classical conditioning model where distress cues are paired with the events that cause them. This pairing creates a relationship between the two items and activates the violence inhibition mechanism. This model accounts for instrumental aggression in that is common in those who score high on psychopathy, but does not completely discuss for example when in distress an individual should express generous emotional reactions not there in psychopathy. Furthermore, individuals who fail to develop these connections in certain social situations can be considered to have characteristics of psychopathy (Blair, 1995).
Left Hemisphere Activation

In the left hemisphere activation model (LHA) those who score high on psychopathy have difficulty processing cognitive material that is state-specific and only activates the left hemisphere (Kosson, 1998). Furthermore, when the left hemisphere is over activated by processing demands, the cognitive processing will be disrupted (Kosson, 1998). This hypothesis was developed by Hare and Jutai (1988) who thought that those with psychopathic characteristics may have deficits in the left hemisphere that limits the processing of language compared to those without psychopathic characteristics.

IES Model

The next model is the IES model and is currently one of the most widely used cognitive models of psychopathy. In this model, the amygdala does not function correctly during emotional memory. This model connects the theories of fear dysfunction and the VIM cognitive to explain more of the emotional and cognitive dysfunction seen in those with psychopathy. Furthermore, this dysfunction leads to the inability to form connections to aversive stimuli in those with psychopathic characteristics. As a result, they are not able to make conditioned stimulus connections and in turn are not able to make moral social references. This model also suggests orbital frontal and ventrolateral associations related to amygdala dysfunction (Blair, 2005).

Cognitive Neuropsychology Findings in Psychopathy

These neuropsychological research models have been applied to explain the deficits in the cognitive functioning of those who score high on psychopathy (Blair, 2006a; Gorenstein, 1982; Kosson, 1998; LaPierre et al., 1995; Mayer et al., 2006; Pham et al., 2003; Raine et al., 1990; Roussy & Toupin, 2002; Vitale et al., 2007). It is
important to understand the connection between the cognitive and emotional processes
because these deficits are central to understanding how psychopathic characteristics
manifest. If a person has information processing deficits, they are likely to also have
ing emotion processing deficits (Blair, 2006a). Specific cognitive deficits that have been
found are in the areas of attention (Blair, 2006a; Kosson, 1998; Mayer et al., 2006; Pham
et al., 2003; Vitale et al., 2007), language functioning (Hare & Jutai, 1988; Hiatt et al.,
2004; Kosson, 1998), reward seeking behavior is poor, bottom up hemispheric
integration, general executive and sustained attention deficits (Blair, 2005).

*Intelligence*

Intelligence has been an area that is commonly explored in those with
psychopathy. Adolescents with psychopathy typically have an average rate of intelligence
(Cleckly, 1976; Salekin et al., 2004); however, there is also support that those with high
psychopathy scores have some cognitive dysfunction and low IQ (Farrington, 2005).
Overall, there have been only two studies between adolescents and psychopathy looking
at intelligence (Salekin et al., 2004). Intelligence in many of these studies may have been
related to social class and race. Furthermore, low levels of cognitive functioning and
levels of cognitive dysfunction over a period of time are associated with CD and may not
have a relationship with psychopathy. However, some connections suggest that those
with psychopathy may not have lower IQs, but still may deficits in several areas of
cognitive functioning.

A recent study, Vitacco, Neumann, and Wodushek (2008), examined the overall
cognitive functioning in adults with psychopathy using the PCL SV. The four facets of
psychopathy: affect, interpersonal, antisocial, and lifestyle contributed to 25% of the
variance in overall IQ score. Specifically, affective and lifestyle had a negative relationship with IQ whereas interpersonal had a positive and antisocial had a moderately positive relationship with overall IQ giving further support to the relationship between specific aspects of psychopathy and cognition.

**Academic Functioning**

Neuropsychological differences in those with psychopathy may also account for variances in academic functioning. Specifically, Tramontana, Hooper, Curley, and Nardolillo (1990) found that neurological factors are related to 39% variance in reading, 18% in math, and 41% in total achievement. Also, academic behavior problems and being expelled from school are common in psychopathy (Campbell et al., 2004).

**Executive Functions**

One of the major areas of neuropsychological deficits in those who score high on psychopathy is in executive functioning. While many researchers have found deficits in this area, no clear consistency between researchers exists in this area. Some researchers have found differences within neuropsychological measures of the ventrolateral/orbitofrontal cortex (Blair et al., 2006), but not within tasks that involve the dorsolateral prefrontal cortex (DLPFC) and frontal anterior cingulate (ACC) (Blair et al., 2006). Other researchers have connected executive function deficits to related disorders such as ADHD and CD rather than psychopathy alone (Raine et al., 1990; Raine et al., 2005). In order to understand this area further, each of the studies must be compared for a more accurate understanding of the literature and its implication in psychopathy (Blair et al., 2006).
Before the research is discussed, it is important to understand executive functions. The most current and empirically supported definition of executive function is derived from Baddeley’s (2003) model of working memory. Baddeley’s (2003) model of working memory includes four components: the phonological loop, the visuospatial sketchpad, the episodic buffer, and the central executive. The central executive, which several authors use synonymously with executive functions, is broken down further into four subcategories known as: inhibition, shifting/coordination, strategy use, and retrieval from long-term memory (Zoelch et al., 2005). For the purpose of this study, only the attentional components of the central executive are used. Selective attention/inhibition is the ability to focus on relevant stimuli while ignoring irrelevant stimuli (Lezak et al., 2004; Mirsky et al., 1991). Maintaining attention over time is known as sustained attention (Lezak et al., 2004; Mirsky et al., 1991). Shifting attention is defined as the ability to transfer focus easily from one task to another (Lezak et al., 2004; Mirsky et al., 1991).

These two aspects of the central executive are the most empirically supported as areas of deficits in those who score high on psychopathy (Blair et al., 2006; Desimone & Duncon, 1995; Hiatt et al., 2004, Kosson, 1998, Pham et al., 2003; LaPierre et al., 1995; Roussy & Toupin, 2002; Sellbom & Verona 2007; Vitale et al., 2007). Furthermore, attention involves both the frontal and temporal lobes.

In addition, several neurochemical and genetic factors are closely related to deficits in attention. First, dopamine is strongly related to attention in the dorsolateral prefrontal areas. In the area of genetics the D4 receptor gene, Monoamine oxidase a gene, and catecholomethyltransferase are all related to attention problems. Some of these
deficits are similar to those seen in those who are high on psychopathy. Moreover, these deficits should be explored in those who scored high psychopathy as related to attention deficits (Fan & Posner, 2004).

**Attention Literature and Psychopathy**

One of the first studies to examine attention in psychopathy as classified by the PCL-R is Kosson (1998). This study found no differences in overall attention in 129 adult male inmates, but did find some differences in over responding to distracters (selective attention) and lack of attending on tasks for a long period of time (sustained attention). Results suggest that there are selective attention and divided attention (shifting attention) deficits in those classified with psychopathy. Kosson (1998) notes that these results imply that psychopaths’ behavior may only focus on short term goals. However, this study has some limitations in the classification of psychopathy. Psychopaths were classified as with the cut off score of 28.5 and nonpsychopaths were classified with the score of 18.5.

Similarly, Pham et al. (2003) examined selective attention in psychopathic offenders using an extensive neuropsychological test battery including: DII Cancellation, Porteus Maze, Modified Wisconsin Card Sorting, Stroop Color Word Interference, Trail Making, and Tower of London. Using the Stroop CW interference test, Pham et al. (2003) found that psychopaths did not have difficulty with interference and planning. However, on the DII Cancellation Test, psychopaths displayed more errors than controls on maintenance of attention (sustained attention). On the Tower of London task, psychopaths displayed more excessive movements suggesting that they are not able to attend to material when there are distracters and are impaired on planning tasks that require inhibition. In other words, psychopaths displayed deficits on sustained attention.
and some selective attention tasks. These results further support Kosson’s (1998) study in selective attention deficits in psychopathic offenders.

The next study to examine attention was Hiatt et al. (2004) which also supported the results found by Kosson (1998) and Pham et al. (2003) in finding selective attention deficits. These authors measured selective attention was done using three Stroop tasks: standard color word (CW), picture word (PW), and color word Stroop. They found reduced Stroop on separated CW and PW, standard Stroop CW. Those who scored high on psychopathy displayed deficits on separated CW and PW tasks. Moreover, no differences were found on the standard color Stroop comparing psychopathic and nonpsychopathic offenders suggesting that selective attention does no differ in those with and without psychopathy. However, they found differences on the PW task, which lead them to run a third experiment. In this experiment, they used a modified CW task where the color was spatially separated from the color word and found deficits on this task as well. Their results suggest that those with psychopathy as classified using the PCL–R have an attention deficit that inhibits unattended information that is not integrated with deliberately attended information and not compatible with current goal directed behavior, but not supporting the other areas of attention. In other words, those with psychopathic characteristics have deficits in selective attention. Furthermore, they conclude that this deficit is not due to executive function, but are related to nonexecutive attention systems.

The deficits found in selective attention by those who score high on psychopathy, can be applied to behavior and cognitive models. Blair et al. (2006) set out further the research in application to specific frontal lobe processes. In a comparison of nonpsychopathic and psychopathic adult offenders, Blair et al. (2006) conclude that it is
likely that those with psychopathic characteristics have difficulty with inhibition and response set modulation. Furthermore, Blair et al. (2006) found that on an objects alteration (OA) task to measure orbitofrontal cortex (OFC) those with psychopathic characteristics performed worse compared to those without psychopathy. The authors examined participants scores on an objects alteration (OA) task to measure orbitofrontal cortex (OFC), a number-Stroop reading and counting tasks to measure anterior cingulate cortex (ACC) functioning, and a spatial alteration (SA) task to measure dorsolateral prefrontal cortex functioning (DLPFC). Those who scored high on psychopathy showed impairment compared to those without on OFC tasks, but did not show impairment on DLPFC & ACC. The results of this study indicate that those with psychopathic characteristics did not differ from their comparisons on SA tasks and on number-Stroop counting task. They did show differences on the number-Stroop reading task and on the OA tasks, having those with psychopathic characteristics performing worse on both measures indicating that the OFC may be involved in psychopathy. They concluded that the frontal lobe and related executive functioning is related to frontal lobe dysfunction, but they also stated that this alone may not be the best explanation as inhibition and response set modulation also play a major role. Furthermore, the deficits seen in those with psychopathy verses those with ASPD had more selective impairments in their functioning. Moreover, deficits seen are related to presence of reactive aggression rather than goal directed aggression.

The results of Blair et al. (2006), Hiatt et al. (2004), and Kosson (1998) can all be explained using the response set modulation hypothesis. The response met modulation hypothesis has been used to explain the reduced reaction time in those with high
psychopathy on the Stroop task. In other words, they fail to process meaningful information that is peripheral to their deliberate focus of attention. Hiatt et al. (2004) is consistent with Blair’s (2006) work in that they conclude that they only fail to process the information when it is spatially peripheral to their focus of attention.

Mayer et al. (2006) examined disordered attention in 91 male prison inmates. The inmates were divided into low, moderate, and high psychopathy groups and completed an exercise on the computer where they were given, visual linguistic or auditory cues to measure shifts in visuospatial attention. The results do not support that those with high psychopathy have superior selective attention compared to those with low psychopathy. However, those with higher psychopathy scores displayed more difficulty shifting attention when directions were presented aurally suggesting a deficit in language based activities and language based attention. Their results suggest that top down processing of attention sets may be needed to measure the hypothesized superior selective attention and reduced attention to peripheral stimuli with attention within those with high psychopathy. In other words, those with high psychopathy will have better selective attention and reduced peripheral attention when information is presented specific to general. This study also supports the left hemisphere activation hypothesis in that those with high psychopathy have problems integrating multisensory information (Kosson, 1998).

Dvorak-Bertsch et al. (2007) also examined the Stroop task, but found no differences between controls and those with psychopathic characteristics in Stroop measures of attention. Dvorak-Bertsch et al. (2007) used a modified color word Stroop task of twenty trials to examine differences between offenders with high psychopathy and those low on psychopathy in selective attention measure. They found no differences in
their sample in all measures of attention. However, they did find nonsignificant interference in those with psychopathy supporting previous findings of deficits in selective attention that accounts for difficulty regulating their behavior. Perhaps this data indicates that those with high psychopathy have trouble regulating behavior in certain situations and not others due to the fact that the Stroop task demands were different than that of previous research and they measured slightly different functioning corresponding to the ACC pathway and not to the dorsal lateral prefrontal cortex pathway that has shown to have deficits in psychopathy. Furthermore, applying this concept the authors conclude that those with high psychopathy perform better on tasks that differ when spatially separated, but not in spatially integrated tasks indicate that the ACC is not involved in psychopathic dysfunction. These authors apply the BIS system indicating that those with psychopathic characteristics are able to redirect attention and facilitate top down processing in response to bottom up detection of mismatches. This study further integrates past research’s findings.

Vitale et al. (2007) went onto extend these findings in male offenders to female offenders as classified by the PCL-R. This study looked at selective attention in a sample of women offenders using the Stroop PW tasks. Women also had selective attention deficits compared to the studies of men suggesting that there are deficits in cognitive functioning regardless of gender.

In addition to the Stroop task, other measures have also been used to measure executive functions and attention within the orbital frontal lobe in those with psychopathy. These measures include, but are not limited to The Wisconsin Sort Task (WCST), Continuous Performance Test (CPT), Tower of London, Go/no/go task, Porteus
Maze Task. The WCST typically measures shifting of attention. The Porteus Maze, Go/no/go, Tower of London and CPT measure inhibition. Deficits or strengths on these tests help to further understand the cognitive functioning of those with high psychopathy (Gorstein, 1982; LaPierre et al., 1995; Mahmut, Homewood, & Stevenson, 2008; Pham et al, 2003; Roussy & Toupin, 2000; Sellbom & Verona, 2007; Sreenivasan et al., 2008).

One of the first neuropsychological studies of those with psychopathy was Gorenstein (1982). This study examined frontal, hippocampus, septum areas of the brain related to behavior with impulse control. This study suggested that those with psychopathic traits displayed preservative problems on WCST, errors on sequential matching and on Necker Cube reversal all supporting frontal lobe dysfunction and set shifting deficits in attention.

LaPierre et al. (1995) found that those with psychopathic traits were impaired on orbitofrontal-ventromedial tasks and were impulsive in responding. Test that were administered include: Go/no/go, Porteus maze task, Modular smell task, WSCT, and the Psychopathy checklist. The results suggest ventral frontal cortical hypo-activation. There were errors Go/no/go in commission errors and also on Porteus maze pencil lift and wall transversals. Both of these errors support the behavioral inhibition difficulties also supported in the Stroop task literature, which generalizes these deficits to additional tasks in psychopathic criminal offenders.

Roussy & Toupin (2000) wanted to extend LaPierre’s findings to a sample of adolescents ages 14-18. The authors administered the Wisconsin Card Sort Task, Porteus Maze Task, Controlled Word Association task, Modular Smell identification task, and the Go/no-go Task. The results suggest that many qualitative task errors in individuals with
high psychopathy compared to those low psychopathy. Psychopaths made more errors on the “go no go” tasks and the stopping task giving support to OFC dysfunction and also tasks involving inhibition. Results support previous findings of behavioral inhibition in those with psychopathy and suggest that adolescents have similar difficulties and may present similarly to adults in cognitive functioning.

In addition to Stroop measures, Pham et al. (2003) examined additional neuropsychological measures of the Porteus Maze task, Trails, and also WCST. On the Porteus maze task, those who scored high on psychopathy made more qualitative errors and also had more difficult with this task than controls. Those who scored high on psychopathy did not differ on trails task and the WCST when compared to controls. These results suggest more visual spatial problems and difficulty with inhibition and less problems with response sets in those with high psychopathy further supporting behavioral inhibition.

Sreenivasan et al. (2008) also examined cognitive functioning and psychopathy. In a sample of violent inmates Sreenivasan et al. (2008) used 14 different cognitive measures to examine cognitive functioning. These tests included: Wechsler Adult Intelligence Scale Revised (WAIS-R; Wechsler, 1981), Rey Auditory Verbal Test (Lezak 1995), Hooper Visual Organization Test (Hooper, 1983), Wisconsin Card Sort Task (Grant & Berg, 1948), Trails Part A and B (Lezak, 1995), Logical Memory I and Visual Reproduction I from the Wechsler Memory Scales (Wechsler, 1987), and the PCL-R to measure psychopathy. These authors found no differences, except in Trails B between the four factors of psychopathy, except facet two (affective) and Trails Part B. While this finding does not support overall cognitive functioning difficulties in those with

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psychopathy, it does suggest that those with high psychopathy have a deficit in divided attention tasks that is related to the affective facet of psychopathy giving further support the aim of the study.

The next study used the Psychopathy Personality Index (PPI, Lilienfeld & Andrews, 1996) to examine the relationship between executive functioning and psychopathy in a non-incarcerated sample. However, this measure does not have psychometrically supported properties in classify psychopathy. This study found that response inhibition was related to psychopathy, but executive functions may relate to higher overall cognitive scores on the PPI (Sellbom & Verona, 2007). Although not a statistically validated method of measuring psychopathy, the PPI adds some external validity to the inhibition problems seen in those with psychopathic characteristics.

Furthermore, it suggests that both incarcerated and nonincarcerated samples may have the same cognitive deficits.

An additional study, Mahmut et al. (2008), examined psychopathy in a group of college students. The sample was mostly female. The study used the SRP III (SRPIII; Paulhas, Hemphill, & Hare, in press), Iowa Gambling Task, and several neuropsychological measures. The authors found a significant difference between the high and low scorers on the gambling task, but not on measures of affect (Emotional Empathy Questionnaire) and neuropsychological functioning (Trails). Authors report that the data indicates that those with high psychopathy have similar affective and neuropsychological functioning as those with low psychopathy. However, the results are not representative of those with high psychopathy and use a measure to classify psychopathy that is not validated by research.
Overall attention results

Research is mixed on whether attention is abnormal in those with high psychopathic characteristics particularly in adolescents and non-offender populations and should be further examined. The differences seen in the literature may be explained by measurement, sample size, and how they defined attention and the type of attention task demands. Overall, differences have been seen in selective and sustained attention, but much less for shifting attention. These findings also support behavioral inhibition as well as the response set hypothesis of psychopathy.

Selective attention is the most widely supported deficit in those with high psychopathy supporting the RM hypothesis and partially supporting the frontal lobe dysfunction hypothesis. The majority of research on selective attention has been consistent; however, some researchers have not found differences and may be due to differences in measures and defining selective attention. Specifically, Kosson (1998), Hiatt et al. (2004) and Dvorak-Bertsch et al. (2007) all used different adaptations to the Stroop task in their study, which may account for some of the differences seen in their results and the types of deficits seen in attention, but is often broken down into top down and bottom up processing to explain the specific deficits seen. Moreover, they have intact top down processing, but bottom up processing is impaired (Dvorak-Bertsch et al., 2007).

Other studies use other measures than the Stroop task to measure selective attention such as the Porteus Maze Task, Tower of London, CPT, Go/no/go task, and the DII Cancellation test. Also, each study defines attention differently, so task demands of each study have to be analyzed. Overall, it appears that those with high psychopathy display difficulty with response set modulation and selective attention (Blair et al., 2006;
Hiatt et al., 2004; Kosson, 1998; LaPierre et al., 1995; Pham et al., 2003; Roussy & Toupin, 2000; Sellbom & Verona 2007; Vitale et al., 2007).

On the other hand, there is less support for sustained attention than for selective attention. There is mixed evidence with support from some studies (Gorstein, 1982; Kosson, 1998; Pham et al., 2003) and not from others (Blair et al., 2006; Dvorak-Bertsch et al., 2007; Hiatt et al., 2004; LaPierre et al., 1995; Roussy & Toupin, 2002; Sellbom & Verona 2007; Vitale et al., 2007). These results suggest that this aspect of attention is likely to not have differences, but should be examined further for specific differences in task demands that contribute to the differences seen in sustained attention. Differences may be due to the modification of the construct of psychopathy in 1991 and 2003.

Lastly, in the area of shifting attention, there is very little research supporting dysfunction. Specifically, Blair et al. (2006), Pham et al. (2003), Roussy and Toupin (2000) did not find differences in the WCST between those with and without psychopathy. Raine et al. (2005) also found no differences on this task in those with CD. Gorstein (1982) was the only study that did find differences on the WCST between those with and without psychopathic characteristics; however this study was prior to reliable measures of psychopathy. On the other hand, Kosson (1998) and Sreenivasan et al. (2008) found some differences in shifting attention, but not consistent. Overall, literature is not consistent enough to find a reliable difference in this area in those with and without psychopathy.

**Visual Spatial**

In addition to attention, visual spatial deficits have been hypothesized in those with psychopathy. This area has not been researched extensively due to the limited
connection to current cognitive theory, but some support has been seen in those with psychopathy (Pham et al., 2003) and also with CD (Raine et al., 2005). For example Raine et al. (2005) examined 325 adolescent boys examined on neuropsychological measures. Life course persistent CD and childhood limited CD were impaired on spatial and spatial memory tasks. In addition, Pham et al. (2003) found differences with visual spatial memory tasks. However, this area has not been researched and could use additional tasks to examine the difference between those with psychopathic characteristics and without.

Verbal

While deficits also have been demonstrated in language related tasks in those with CD, there is dispute to whether or not they exist in those with psychopathic characteristics. There is also empirical support for selective verbal deficits in those with psychopathy (Mayer et al., 2006; Raine et al., 1990). Specifically, offenders performed more poorly on verbal memory tasks and lower verbal IQs than nonoffenders (Raine et al., 2005). Derived out of the left hemisphere lateralization hypothesis, several researchers have demonstrated difficulty processing verbal information. Raine et al. (1990) found psychopaths limited in verbal processes. Specifically, adolescents who score high on psychopathy show a reduced dichotomy in verbal listening tasks. However, Munoz, Frick, Kimonis, and Aucoin (2008) found a relative verbal strength in adolescents with callous and unemotional traits. Specifically, those with the highest score on callous and unemotional traits and high verbal scores had the highest rate of violent crimes. However, these individuals were still more than one standard deviation below the mean indicating that they display a lower ability compared to typical adolescents.
**Refuting Studies**

Although the majority of studies have found some link to deficits in cognitive functioning, others have found no deficits for those with psychopathy on neuropsychological measures. Hart et al. (1990) examined a battery of tests including the Auditory Verbal Learning Test, Trail Making Test, Visual Organization test, and the Wechsler Adult Intelligence test – Revised on criminals with high, moderate, and low psychopathy as classified by the PCL-R. On each of the measures, no differences were found between the groups. It is likely that these measures are not selective to deficits seen in those with high psychopathy. The major difference between this study and others is the neuropsychological test battery. Previous studies have found differences on behavioral inhibition and response set modulations using various forms of the Stroop task, the Go/no/go task and the Porteus Maze task. This study was the only one that did not find differences, and it is likely due to the type of battery used because the study has good internal validity and its methodology is sound.

**Callus/Unemotional Traits and the Connection to Neuropsychology of Psychopathy**

Current researchers suggest that future research examine the connection between emotion and neuropsychological factors due to their overlap in structures in the brain. One of the most salient characteristics of psychopaths is their inability to have empathy for others. This characteristic that is most often associated with psychopathy is the callous and unemotional trait (Frick et al., 2003). The callous and unemotional personality trait corresponds with Factor 1 on Hare’s two factor model and on the model for youth it is factor 2. For children this trait is measured using the callous-unemotional (CU) factor (Frick et al., 1994). This factor includes characteristics of lack of guilt, lack
of empathy, and superficial charm as demonstrated through factor analysis (Frick et al., 1994).

The callous and unemotional trait has the most predictive validity for violence and reoffending (Frick & Dantagnan, 2007; Frick, Cornell, Bodin, Dane, Barry & Loney, 2003b) even as young as preschool (Kimonis, Frick, Boris, Smyke, Cornell, Farrell et al., 2006). Both adults and youth who have these characteristics have a more severe pattern of aggressive and antisocial behaviors (Frick et al., 2003; Frick et al., 2005) and are stable into adulthood (Barry, Frick, DeShazo, McCoy, Ellis, & Loney, 2000). Moreover, children with both conduct problems and CU traits exhibit significantly more conduct problems and a greater variety of conduct problems than those children with conduct problems alone (Christian et al., 1997). Youth who score high on CU traits have higher rates of CD, self reported criminal behavior, and more police contacts. They also have a higher rate of actual or threatened violence on others compared to those without CU and CD (Frick et al., 2005). They are also likely to display more proactive and instrumental aggression (Howes & Dadds, 2005; Kimonis et al., 2006) than those without this trait.

In addition, children and youth with CD and high CU characteristics have behavior and emotional regulation problems. However, only those with high CU characteristics have behavior inhibition problems (Frick et al., 2003b; Kimonis et al., 2006). These differences are seen in their responses to rewards and punishment (Frick et al., 2003b). Typically those with high CU characteristics fail to respond to punishment and typical reward styles (Howes & Dadds, 2005; Kimonis et al., 2006). These results suggest that both emotional, behavior, and cognitive processing is different in those with CD and those with CD with high CU characteristics.
These processing differences are also seen in their low level of fear inhibition and reaction to emotional stimuli (Loney, Frick, Clements, Ellis, & Kerlin, 2003; Woodwarth & Waschbusch, 2008). Specifically, those with high CU characteristics have difficulty indentifying sad emotions on the faces of others when compared to their peers who do not have this trait, but they were able to identify fear better (Woodwarth & Waschbusch, 2008). This difference is also seen in their inability to process emotional word (Loney et al., 2003). In addition to this inability to process emotions, they are unable to relate and understand the emotions of others in the area of empathy, which leads to the overall conclusion that those with CU traits have lower emotional distress and related processing deficits (Pardini, Lochman, & Frick, 2003). Furthermore, research has connected this inability to identify the emotions and other characteristics through including the amygdala dysfunction, the dysfunctional fear hypothesis, and the violence inhibition mechanism models (Blair, Mitchell, & Blair, 2005).

When examining Frick and colleagues’ (2003b) study more closely, the connection between the neurocognitive and emotional processing deficits in those with high CU traits becomes apparent. Frick et al. (2003b) examined a community sample of children with conduct problems both with and without the presence of CU traits and their relationship with emotional and behavioral dysregulation finding some clear differences between the two groups. Frick et al. (2003b) found that children with conduct problems without CU traits had evidence of emotional and behavioral regulation. On the other hand, the children who demonstrated both conduct problems (CP) and CU traits scored the highest on measures of impulsivity-hyperactivity or behavioral dysregulation (Frick et al., 2003b). Here the processing deficits are seen in behavioral inhibition where the CU
group with CP showed a preference for novel and dangerous activities and a decreased sensitivity to punishment cues when a reward response set was formulated (Frick et al., 2003b). This inability to inhibit behavior is connected to the cognitive theory of psychopathy previously discussed and is also associated with difficulty processing negative emotions. The authors attribute both developmental characteristics, age of onset and the possibility that there is a cognitive deficit where this subset of children has difficulty shifting their goal-oriented response set (Frick et al., 2003b). Moreover, this study indicates a connection between both the cognitive and the emotional processing models to be connected and suggests that both cognitive and emotional deficits are present in those with high psychopathy.

Purpose of the study

Recently, authors have strived to gear literature to focus on the connection of aggression and emotion to neuropsychological functioning as the same systems are implicated in psychopathy (Blair, 2005); however, to date, none of the cognitive models have integrated the specific deficits that have been demonstrated in both cognitive and emotional (Blair, 2005). However, there have been two recent studies that have helped to bridge the gap in research supporting the connection between the cognitive and emotional systems involve in the development of psychopathy.

First, Malterer, Glass, and Neumann (2008) in the literature by looking at emotional trait intelligence (EI) in relation to the RM hypothesis of psychopathy. The sample consisted of male prison inmates who scores high and low on the PCL-R and tested their ability to focus their attention on emotional information and repair one’s mood or emotional state. The authors found that individuals with low anxiety scores hard
more difficulty focusing their attention and repairing their emotions than those with high anxiety. In addition, those who score high on the interpersonal and affective components of psychopathy paid less attention to their emotions than those who score low on the factor and those who were higher on factor 2 indicating impulsivity, had more difficulty repairing their emotions.

Howard and McCallagh (2007) also found that under conditions of focused attention, those with psychopathy showed a neuroaffective processing deficits. Those with psychopathy missed more targets and had lower ERPs than those without psychopathy when viewing arousal pictures suggesting their attention focus was disrupted by the affective background. This study also provides a critical piece of evidence to the literature base that supports the link between noncognitive factors such as emotions and neuropsychological factors such as attention.

While these two studies have provided some initial evidence, additional literature is needed to further develop this link between attention cognitive and emotional systems of psychopathy. As a result of this need, the relationship between neuropsychological functioning and emotions in adolescents with psychopathic characteristics was explored. Moreover, several researchers have linked specific executive function deficits to those with psychopathy and also support a genetic etiology (Blair, 2006b; Carlson et al., 2003; Larsson et al., 2006; Lilienfield & Andrews, 1996; Rhee & Waldman, 2002) with orbital frontal and amygdala dysfunction (Blair et al., 2006; Pham et al., 2003). Specifically, selective attention/inhibition and possible sustained deficits have been seen in the neuropsychological literature (Blair et al., 2006; Hiatt et al., 2004, Kosson, 1998, Pham et al., 2003; LaPierre et al., 1995; Roussy & Toupin, 2002; Sellbom & Verona 2007; Vitale
et al., 2007). Also deficits have been seen in the emotional literature with regards to attention (Desimone & Duncon, 1995). Overall, dysfunction in common neurological systems between cognition and emotion are likely to account for these deficits.

Research in this area is limited and much of the results have been on adults and Stroop task measures of selective attention/inhibition. This study will examine the cognitive profile of these adolescents, looking at executive functions and how they differ in individuals who score high on callous/unemotional factors. Lack of empathy is often referred to as a key developmental component of the callous/unemotional trait (Cleckley, 1941; Frick et al., 1994; Hare, 1991, 1993). Thus, examining these characteristics may help understand how adolescents process information in relation to emotion and may give light to future interventions. Neuropsychological functioning comparing individuals who score high verses low on callous and unemotional traits were compared. Currently, no literature has attempted to examine the construct of psychopathy in this manner.

Research Questions and Hypotheses

Several research questions will be examined. Based on the abnormalities seen neuroanatomically and neurochemically in the control of executive function, emotions, and the ventral system, several hypotheses were formed. To date literature supports certain executive function deficits in those with psychopathic characteristics, but does not differentiate between specific characteristics that might contribute to this impairment. The four factor model of psychopathy has the strongest empirical support. One particular factor, of affect- or callous and unemotional, of the factors will be examined in their relationship to neuropsychological correlates. Due to conflicting and lack of research, it is unclear how IQ, verbal, and visuospatial tasks are affected.
First, it was hypothesized based on previous research (Blair et al., 2006; Hiatt et al., 2004, Kosson, 1998, Pham et al., 2003; LaPierre et al., 1995; Roussy & Toupin, 2002; Sellbom & Verona 2007; Vitale et al., 2007) that those who score high on psychopathy measures will differ from those with high or moderate scores on psychopathy measures in terms of some attention measures. Specifically, it was expected that those who score high on psychopathy, would score worse on measures of selective attention and they would not display deficits in sustained and in shifting attention when compared to those with low psychopathy scores.

Based on the shared neurological systems relating to the amygdala, research suggests that both impairments in cognition related to executive functioning and the frontal lobe and impairments in emotional characteristics are related. Furthermore, it was hypothesized that those who scored higher on callous/unemotional (affective) traits would have different pattern of impaired neuropsychological factors compared to those who do not have high callous/unemotional traits. Moreover, those who score high on callous and unemotional traits would show a different pattern of impairment than those without these traits on tasks that measure orbital frontal functioning such as selective attention tasks. The next hypothesis was that those who score high on the callous/unemotional (affective) factor of psychopathy would also have more impairment on tasks of emotional responding than those without these characteristics based on previously demonstrated impairments.

Due to the lack of research in this area, how each of the four factors related to executive functions cannot be hypothesized. However, it is possible that the four factors of interpersonal, affective, lifestyle, and antisocial may contribute differently to the
neuropsychological and may be explored in a future exploratory analysis. Overall, this study aimed to add to the literature base to develop a better understanding of cognitive and emotional functioning in adolescents with psychopathy.
CHAPTER III

METHOD

Psychopathy is a disorder that is present in extreme and violent offenders and is associated with predatory violent and aggressive behaviors that are typically unresponsive to treatment (O’Neill, Lidz, & Heilbrun, 2003; Porter et al., 2001). Such individuals commit a large percentage of the violent crimes, and are more likely to reoffend violently than individuals classified as nonpsychopaths (Corrado et al., 2004; Gacono & Hughes, 2004; Serin, 1996).

Research supports a genetic etiology for those with psychopathic characteristics as seen in neuroanatomical and neurophysiological abnormalities. Furthermore, research is limited, except in the area of selective attention, describing the neuropsychology of psychopathy in youth. When the research is available, the findings in the existing literature often conflict. One consistent finding is dysfunction in selective attention in adults with psychopathy (Blair et al., 2006; Hiatt et al., 2004; Kosson, 1998; LaPierre et al., 1995; Pham et al., 2003; Roussy & Toupin, 2002; Sellbom & Verona 2007; Vitale et al., 2007). Several other deficits in sustained attention (Gorstein, 1982; Kosson, 1998; Pham et al., 2003), shifting attention (Gorstein, 1982; Kosson, 1998), verbal deficits (Mayer et al., 2006; Raine et al., 1990), and visual spatial deficits (Pham et al., 2003; Raine et al., 2005) have also been explored, but research is inconclusive.

Neuropsychological functioning in delinquent adolescents with high and low levels of callous and unemotional traits was examined. Their performance on selective, sustained, and shifting attention was explored. Based on the shared neurological systems relating to the amygdala and the neuroanatomical and neurochemical abnormalities
(Blair, 2005; Blair et al., 2006; Soderstrom et al., 2002), it is likely that both impairments in cognition related to executive functioning and attention and callous and also unemotional traits. Furthermore, adolescents who score high on callous and unemotional traits will have more difficulty compared to adolescents without these traits on tasks that measure orbital frontal functioning such as selective attention tasks and emotional responding.

Participants and Setting

The database was obtained from an alternative education charter school and an alternative residential placement in Western, PA. The data set was collected as part of comprehensive special education evaluations. The school conducted evaluations that examine academic, behavioral, and personality variables as part of student’s reevaluation and initial evaluations for special education. A portion of the data set collected during the evaluation was used in the analysis. The database included information on approximately 100 students. The database included participants’ identification numbers, age, gender, race, violent/nonviolent classification, diagnoses as well as several cognitive, behavioral, personality, and neuropsychological measures.

The charter school services several school districts in the surrounding metropolitan area. Students at the school have been removed from their home school districts because they are on probation. Currently 175 students are enrolled in the school. Enrollment will rise every year until 200 students are enrolled. Many, but not all of the students, also demonstrate poor academic progress in various areas. Approximately 65% of the students receive special education services. Length of stay at this alternative school is determined by the needs of the individual students and is determined by the school
administration and probation officers. Some students may remain in this setting until they graduate even if they are no longer on probation.

The majority of the classrooms have a student to teacher ratio of approximately 10:1. The students follow a typical school day schedule. The school provides curriculum for grades 8 through 12; however, each grade is not necessarily represented by its own classroom. The students are placed in a specific classroom based on academic, behavioral, and emotional concerns. The majority of students rotate through five different classes during the day. Students are placed into English, math, science, social studies, physical education, and health classes based on the student’s current grade standing.

Within the school, there are two semi-self contained classrooms. One for students in emotional support and one for regular education students who have failed to succeed in the general education classrooms. The special education students who are in full time emotional support rotate with the other students between the two emotional support teachers. Students in the alternative education classroom for disciplinary purpose remain in the same classroom each day until they are released for good behavior.

The second school where the data set was collected is a residential placement for delinquent males ages 14-18 and serves grades 9-12. The males were placed into this school through the court systems from Maryland, Pennsylvania, West Virginia, Delaware, and Washington D.C. Currently. Approximately 300 male students were enrolled in the school during data collection. As reported by the school, students attended school year round and the length of their stay is determined by the court system and behavior while attending the school. A typical stay is 6-9 months.
Students at the residential placement are placed into classes based on their academic, behavioral, and emotional needs. Students are grouped based on age and disability category as determined by their individualized education program (IEP). Students have classes throughout the day, and they rotate from classroom to classroom depending on their schedule. Two special education teachers split the students based on their current grade level and needs. The typical classroom consists of small classrooms of 15:1 student to teacher ratio.

The information collected in this study was gathered as part of comprehensive special education evaluations. The examiner participated in data collection as part of the school team. This author served as a school psychology practicum student for the school. As an employee and practicum student, this author and supervisor put together a psychoeducational battery to examine behavior, personality, and cognitive functioning of students. The PCL-R and PCL-YV included inter-rater reliability, completed by the site supervisor. A separate data analysis that was conducted with the permission of the school, and used specific elements of the existing school-wide data set was carried out.

Participants were adolescents ages 13-20 taken from the database. The sample was a convenience sample of children given all of the measures included in the study as part of their special education assessment. Exclusionary criteria included diagnoses of mental retardation, thought disorders, and/or autism spectrum disorders.

Measures

Each of the measures used has sound psychometric properties. It was reported in a summary provided to the lead author of this study that each measure was administered by trained professionals according to best practices and the test manuals. These measures
included the Psychopathy Checklist Revised (Hare, 2003), the Psychopathy Checklist Youth Version (Forth, Kosson, & Hare, 2003), The Woodcock Johnson Cognitive Battery III Normative Update (Woodcock, McGrew, Schrank & Mather, 2007), and the Inventory of Callous and Unemotional Traits (Frick, 2003).

**Psychopathy Checklist: Revised (PCL-R, Hare, 2003)**

Prior to the development of the first psychopathy rating scale by Hare in 1980, no reliable and valid way to measure psychopathy existed. The PCL-R was first modified in 1985, then in 1991, and the last modification came in 2003. The PCL-R is a 20 item rating scale used for measuring psychopathy in clinical, forensic, and research settings. This measure uses a semi-structured interview and file review to identify and score specific traits that are associated with psychopathy. The PCL-R is used with adults ages 18 and up. These items are grouped into several clusters based on factor structure. Several factor structures including a two and three, and four factor model have been suggested. Each item is scored on a three point rating scale of 0, 1, and 2. A score of 0 means lack of psychopathic symptoms, 1 means presence of some psychopathic symptoms, and 2 represents strong psychopathic symptoms for each item. The total scores can range from 0 to 40. In North America, a score of 30 is used as a cut off score for research on psychopathy. The PCL-R provides a reliable and valid assessment of psychopathy. The test manual reports that the internal consistency is high. The interrater reliability for one rating is .87 and for two it is .93 (Hare, 2003).

For the 2003 edition, psychometric properties within several subsets of the sample were analyzed. Male offenders, female offenders, and forensic populations were examined. The four factors of the measure are interpersonal, affective, lifestyle, and
antisocial were examined in terms of incremental validity. The authors found that the facets of interpersonal, lifestyle, and affective has weak incremental validity in their sample, but antisocial had strong in predicting recidivism rates (Walters, Grann, Knight, & Dahle, 2008). Flores-Mendoza et al. (2008) also found incremental validity relating to the number of offenses that they committed and type of crime committed.

These constructs and psychometric properties have been demonstrated across different ethnic, regional, and gender populations (Cooke, Kosson, & Michie, 2001; Skeem, Edens, Camp, and Colwell, 2004; Sullivan, Lopez, Abramowitz, and Kosson, 2006; Windle and Dumunchi, 1999). Consistent over time is the support for the use of this measure with African American and Caucasian subjects. Studies using CFA and item response theory have found no differences in factor structure between African Americans and European Americans (Cooke, Kosson, & Michie, 2001; Windle and Dumunchi, 1999). Skeem et al. (2004) did a meta-analysis between European and African Americans on the PCL-R. While there were some differences, effect sizes were similar for all facets.

Sullivan et al. (2006) extended the research to Latino populations as well as African American and Caucasian populations. In a match comparison, Sullivan et al. (2006) examined the construct and reliability to their sample of 83 Latino inmates. The authors found that the PCL-R is a reliable and valid measure for their sample where generally the same pattern of construct appearing across populations. They found that α coefficients were .83 for Latino Americans, .80 for European Americans, and .79 for African Americans. The internal consistency for each group is as follows: Latino American .61-.71, European Americans .68-.82, and .64-.75 for African Americans. Interrater reliability of 28% of the sample was at 90% and did not differ by ethnicity.
Psychopathy Checklist Youth Version, (PCL-YV; Forth, Kosson, & Hare, 2003)

The PCL: YV is a 20-item version of the PCL-R modified for use with adolescents. The PCL-YV uses the same scoring system and methods of assessment as the PCL-R. This measure is made based off of the adult measure PCL-R. It can be used with youth ages 13-18 (Salekin et al., 2004). The only difference is that some items are modified for appropriate use with adolescents. Like the adult version, this measure has very good psychometric and predictive properties.

Several models of the PCL-YV have been developed. The most empirically supported model of the PCL: YV is the four factor model. This model has great properties and is very robust (Neuman et al., 2006). For the four facets of psychopathy, the Cronbach \( \alpha \) coefficients were high: interpersonal, .75; affective, .71; lifestyle, .70; and antisocial, .78. Jones et al. (2006) also examined the construct of psychopathy in adolescents. The adult model does not fit in adolescent populations. These authors support that the three to four factor models have a moderate fit, but because the four factor model includes more items from the PCL-YV, it is the best fit. The CFI of this model was .80. The PCL YV manual (Forth et al., 2003) reports interrater agreement of ICC of .9-.92 and across samples cronbachs \( \alpha \) ranged from .85-.94.

In addition, interrater reliability and internal validity data of the PCL-YV appear adequate and has been supported by several authors. The PCL-YV demonstrates concurrent validity with Antisocial Behaviors, ODD, and ADHD (Jones, Caufamann, Miller & Mulvey, 2006). Moreover, Welsh, Schmidt, McKinnon, Chattha, and Meyers (2008) examined predictive and incremental validity of the PCL-YV in adolescents. Using hierarchical logistical regression analyses, found that the PCL-YV explained 17%
of the variance in recidivism. While a weak predictor, it does support some relationship between the two variables. Schmidt, Mckinnon, Chattha, and Brownlee (2006) found that the PCL-YV predicts recidivism in adolescent Caucasian males. In addition the PCL-YV demonstrates concurrent validity with the Child Behavior Checklist (CBCL; Achenbach, 1991, 2001) (Schmidt et al., 2006).

Kosson, Cyterski, Neumann, Steuerwald, and Walker-Matthews, (2006) examined the reliability and validity of psychopathy using the PCL – YV in 115 nonincarcerated adolescents. Reliability of the PCL-YV was high. In addition, the PCL-YV predicted antisocial behavior, child psychopathy, adult characteristics of psychopathy, and lack of attachment to parents. Specifically, each construct had \( \alpha \) coefficients of .80-.88. The test also had interrater agreement of .89 and intra class correlation of .80. There also were no differences in the constructs between races.


The Woodcock Johnson Cognitive Battery III Normative Update for measures of attention and executive function was used. The WJ III COG NU has demonstrated to be a reliable and valid measure. The cognitive battery includes 20 subtests for measuring general intellectual ability, broad and narrow cognitive abilities, and aspects of executive functioning. The cognitive tests break down to measure three cognitive performances: verbal ability, thinking ability, and cognitive efficiency. The test is further broken down into seven broad Cattell Horn Carroll (CHC) factors.

The normative update was standardized using the U.S. census data from the 8,782 of the original subjects. Each subject was weighted and applied to represent the correct
proportions for the updated census. Subjects ranged in age from age 2 to over 80 years. Subjects were randomly selected within a stratified sampling design that was controlled for: census region, community size, sex, race, type of school, type of college/university, education of adults, occupation status of adults, occupation of adults in the labor force, and foreign born. Subject scores were revised to create new W scores for subjects’ ages. Age based norms are available for 12+ months to 90+ years.

The WJ III COG NU has strong psychometric properties as a whole as well as at the cluster, and subtest levels. The reliability for the WJ III COG NU cognitive is .98 and .95 for the verbal extended, .96 thinking ability, and .92 for cognitive efficiency. Six subtests were used in analysis. Reliabilities for the subtests of interest are concept formation (.94), numbers reversed (.87), auditory working memory (.87), auditory attention (.88), planning (.74), and pair cancellation (.96). The reliability for the clusters of broad attention is .94 and for executive processes is .96 (Woodcock, McGrew, Schrank & Mather, 2007).

Floyd, McCormack and Ingram (2006) demonstrated that the WJ III COG NU clusters of working memory, cognitive fluency, broad attention, and executive processes and each of their subtests were all related to executive functioning. For the purposes of this study, only broad attention and executive functions were examined. Broad attention measures include attention capacity, divided attention, sustained attention, and selective attention and are measured on auditory working memory, auditory attention, pair cancellation, and numbers reversed. Executive processes are related to planning and forethought and it measured by the subtests of planning, pair cancellation, and concept formation.
An additional measure that was used in this study is the ICU. The ICU was used to measure Callous/Unemotional traits. This measure was developed using the six-item Callous/Unemotional scale found on the Antisocial Process Screening Device (APSD; Frick & Hare, 2001). The following items were adapted from the ASPD, (i.e., “Is concerned about how well he/she does school or work”, “Feels bad or guilty when he/she does something wrong”, “Is concerned about the feelings of others”, “Does not show feeling or emotions”, to form the 24 Likert items of the ICU (Frick, Bodin, & Barry, 2000; Essau, Sasagawa, & Frick, 2006). The scale ranges from “0” (“Not at all true”) to “3” (Definitely true”). Before calculating the total scores, the twelve positively worded items (items 1, 3, 5, 8, 13, 14, 15, 16, 17, 19, 23, 24) required reverse scoring (Essau et al., 2006). Although parent, teacher, and self-report versions of the ICU are available, only the self-report version was used.

Using exploratory factor analysis, the ICU breaks into three factors of callousness, uncaring, and unemotional (Essau et al., 2006). The callousness factor depicted an aspect of behavior that included lack of empathy, guilt, and remorse. The uncaring factor relates to behavior that relates to a lack of caring of performance on tasks and the lack of concern for the feelings of others. The unemotional factor, measures the lack of emotional expression in their behavior (Essau et al., 2006).

The ICU is both a reliable and valid measure. The internal consistency of the ICU as demonstrated by α coefficient is .77 and the Guttman Split half reliability of .70 (Essau et al., 2006). Internal consistency of the three subscales was also determined to be good for two out of the three factors with a coefficient α of .70 for the callousness factor, .73
for the uncaring factor, and a coefficient $\alpha$ of .64 for the unemotional factor. The lower coefficient for the unemotional factor is likely due to the small amount of items that load onto it. Item-total correlation and coefficient $\alpha$ did not propose the deletion of any item would significantly increase the internal consistency of the scale. The three scales demonstrated moderate inter-correlation after correction for unreliability were with the callousness scale correlating with the unemotional scale at .24 ($p < .001$) and uncaring scale at .27 ($p < .001$) and the uncaring scale correlating with the unemotional scale at .08 ($p < .001$). Additionally, construct validity was supported by the association of the ICU and the Big Five personality dimensions (Essau et al., 2006).

Gender and age affects have been evidenced with this measure with significant main effects found for the total ICU scores ($F(1, 1282) = 218.36$, $p < .001$). Moreover, girls had lower callous-unemotional traits than boys as well as the callousness ($F(1, 1340) = 152.23$, $p < .001$), uncaring ($F(1, 1413) = 84.48$, $p < .001$), and unemotional ($F(1, 1384) = 139.81$, $p < .001$) subscales. The age group of 15-16 year olds also had higher callous and unemotional traits than the 13-14 age group and the 17-18 age group (Essau et al., 2006).

Research Design

An apriori statistical analysis was conducted to determine the number of participants needed to achieve adequate power to high power with medium and high effect sizes. Past research has found effect sizes that range from .13 to .7 between groups on tasks of divided and selective attention in adults with psychopathy with a median effect size of .55. G*Power 3.01.0 was used to calculate the number of participants needed based on these past studies’ effect sizes. The results from the apriori analysis for a multiple
regression of two groups and four predictors, a sample size of 39 participants were needed to achieve an effect size of .55. In addition, for a MANOVA with two groups and four response variables, 40 participants are needed. For the analysis, at least 40 participants are needed.

Using this research design has several threats to both internal and external validity. Possible threats to internal validity include that the sample was a convenience sample, or in other words, participants were not selected at random. The database was also preexisting, which leads to threats of validity through instrumentation. Whether the data were collected as the manual intends was unknown. A threat to the external validity is the restricted range of the sample, which makes the results less generalizable.

**Definition of Variables**

Variables used were defined based on research and the manuals in which they were obtained. The definitions are broken into descriptive statistics and the independent and dependent variables for each analysis. The variables and their operational definitions are presented below.

The descriptive statistics (e.g. age, race, type of crime) that were used were determined and defined by the school. Each of these variables was provided in a preexisting database. The database classified participants into groups of violent verses nonviolent offenders based on the type of offenses and charges that they committed. The school defined violent offenders according to the Department of Justice and the Federal Bureau of Investigations. Violent crimes are made up of: murder and non-negligent manslaughter, forcible rape, robbery, and aggravated assault. These offenses also have to
involve force or threat of force (Department of Justice and the Federal Bureau of Investigations, 2009).

Variables were defined and classified for the main analyses based on research. Psychopathy was operationally defined using the PCL R and PCL YV manuals for the definitions and current research. Hare (1991) classified psychopathy into two factors: personality and antisocial traits to develop an empirically supported model. The first factor, personality factor, includes the characteristics of self centered, callous, and manipulative personality. It includes the traits of lying, manipulation, callousness, lack of affect, guilt, remorse and empathy. The second factor, antisocial traits, is composed mainly of behavioral components and includes a need for stimulation, poor behavioral controls, lack of long term goals that are realistic, and juvenile delinquency. Several researchers have further broken down the two constructs into the four factor model (Hare & Neumann, 2005) and also into a three factor model; however, the overall construct remains the same (Cooke & Michie, 2001).

Due to the theoretical similarities in the construct of psychopathy between the PCL R and the PCL YV (Forth et al., 2003; Hare, 2003), the measures were used interchangeably in the analyses. This decision was also based upon the type of sample that was used. While some of the students were above 18 years of age, all of the participants were still enrolled in school, making the PCL YV a more appropriate measure for the participants due to the wording of many of the items. Furthermore, the PCL-YV and PCL overall scores were used to measure the independent variable for the first two analyzes. High/moderate psychopathy was defined as having a score of 25 and above on the PCL YV and PCL R. Low psychopathy was defined by a PCL score of
below 25. The authors of the PCL-YV do not provide cut off scores to classify psychopathy. These cut off scores were chosen based upon previous research (Brandt, Wallace, Patrick & Curton, 1997; Kosson, 1998) and were needed due to sample size. While several of the adolescent researchers have used the adult criteria established for psychopathy, a score on the PCL R > 30 (Gretton et al. 2004; Saliken et al., 2004), but this criteria was not able to be met due to a small number of participants meeting this criteria. Even the creators of the PCL YV do not recommend using cut off scores with adolescents (Forth et al., 2003).

The analyses also examined the constructs of executive functions and attention. The definition of these constructs was based upon Baddeley’s (2003) model of working memory. To review, Baddeley’s (2003) model of working memory includes four components: the phonological loop, the visuospatial sketchpad, the episodic buffer, and the central executive. The central executive, which several authors use synonymously with executive functions, is broken down further into four subcategories known as: inhibition, shifting/coordination, strategy use, and retrieval from long-term memory. Furthermore, selective attention, sustained attention, and shifting attention were defined using Lezak et al. (2004) and Mirsky et al. (1991). Selective attention/inhibition is the ability to focus on relevant stimuli while ignoring irrelevant stimuli (Lezak et al., 2004; Mirsky et al., 1991). Maintaining attention over time is known as sustained attention (Lezak et al., 2004; Mirsky et al., 1991). Shifting attention is defined as the ability to transfer focus easily from one task to another (Lezak et al., 2004; Mirsky et al., 1991).

The dependent variables for the first two analyses were defined using the above definitions and when appropriate definitions from the WJ III COG NU manual. The
dependent variables for the first analysis were selective attention as measured by auditory attention, divided attention as measured by auditory working memory, sustained attention as measured by pair cancellation, and attention capacity as measured by numbers reversed. As previously stated, the definitions of Lezak et al. (2004) and Mirsky et al. (1991) were used to define the dependent variables of sustained attention, selective attention, and shifting attention. Attention capacity was defined using the WJ III COG NU and is a measure that is used to measure working memory, which is known as the “ability to hold information in immediate awareness while performing a mental operation on the information” (Woodcock et al., 2007, pg. 21).

The second analysis used psychopathy as an independent variable and concept formation (shifting sets) and planning (ability to plan) as dependent variables as defined by Baddeley (2003) and the WJ III COG NU manual (Woodcock et al., 2007). Concept formation is a test that measures fluid reasoning using the ability to shift cognitive sets often (Woodcock et al., 2007). Planning is another measure of fluid reasoning that relies on the ability to solve problems using forethought (Woodcock et al., 2007). Moreover, concept formation closely relates to shifting/coordination on Baddeley’s model while planning relates to strategy use.

How the dependent variables for questions one and two load on broad attention and executive processes is presented in Figure 1. In order to better understand how broad attention and executive processes related to Baddeley’s model of executive functions, a diagram is presented in Figure 2.
Figure 1. Neuropsychological Constructs and their Corresponding Tests on the WJ COG
Figure 2. Baddeley’s Model of Working Memory

In the third analysis, the ICU was used as the dependent variable to measure callous and unemotional traits and auditory working memory, auditory attention, numbers reversed, and pair cancellation that all make up the broad attention construct on the WJ III COG NU were used as the independent variables. Callous and unemotional traits are operationally defined as including personality or interpersonal traits which refers to a lack of empathy towards others and manipulation of others and the unemotional portion that is defined as the absence of guilt and shallow emotions (Christian et al. 1997; Frick et al. 2000a; Frick, et al., 1994). This analysis uses the same definition as the first analysis to operationalize the four broad attention measures.

The last analysis also used the ICU as a dependent variable with the concept formation and planning as independent variables. The same operation definitions used above were used for this analysis. A complete list of all the research questions, hypotheses, analyses and corresponding variables are available in the appendix Table 1.

Procedures

Because the data were from pre-existing database, participants were not recruited. The database was maintained by a local educational agency. Information was collected
during the 2006-2007, 2007-2008, and 2008-2009 school years, and was part of battery of assessments used by the district to determine educational placement. The school provided the researcher with SPSS and excel files with identifying information removed. Descriptive data (e.g., age, race, type of crime) were reported in terms of aggregated means and standard deviations. Pearson’s correlations were run for each of the measures to examine the relationship between them. Reliability was also calculated for the ICU and cross-rater reliability was calculated for the PCL-YV and the PCL-R.

The assessment data were collected in standardized format by the school psychologists and graduate school psychology students participating in a teaching grant. In a summary provided to the examiner the data were collected by a variety of trained (school psychologists, graduate students) staff over several years; total testing time is approximately three hours (total) distributed over several (two or three) meetings in one-to-one quiet setting consistent with best practices. It is important to note that the first author of this study was employed through an educational training grant at the local education agency during portions of this data collection. Specifically, the first author has collected data for the educational agency under the supervision of a certified school psychologist.

The database was obtained from pre-existing data set from two alternative education settings. It was the practice of the local education agency to administer informed consent procedures as mandated by federal special education law. The educational agency maintains consent from all of their parents.
Data Analysis

The study examined neuropsychological differences in adolescents with psychopathic characteristics. Specific traits of psychopathy such as callous and unemotional traits were of focus due to the overlapping brain systems and attention and executive functions. All analyses were run using SPSS version 14.0. Each research question and its appropriate analysis are discussed below.

Descriptive Statistics and Pre-analyses

Prior to the main analyses, several pre-analyses were run including descriptive statistics, reliability statistics, and correlations. Descriptive statistics including means and standard deviations were calculated for each of the measures (PCL, ICU, and the WJ III COG NU) and also for age. Percentages were calculated for nominal data of race and type of offense.

Reliability estimates were examined for the measures and interrater reliability was obtained for the two raters. Internal consistencies were calculated for the ICU and the PCL using Cronbach’s $\alpha$. Raw data were not available for the WJ III COG NU, and thus Cronbach’s $\alpha$ could not be calculated. The WJ III COG NU has demonstrated sound psychometric properties over time and has established reliability and validity as a measure (Floyd et al., 2006; Woodcock et al., 2007). Pearson’s bivariate correlations were run to measure interrater reliability for the PCL between the two raters scores provided in the database.

In addition, Pearson’s bivariate correlations were also run for each of the dependent and independent variables and also for other variables of interest to assess for possible significant relationships in main analyses and detect for possible
Variables that were correlated include: each of the items on the PCL, four PCL factors, PCL total score, GIA, auditory working memory, auditory attention, numbers reversed, planning, concept formation, pair cancellation, broad attention, executive processes, and the ICU total score.

Before the main analysis was run, the data were checked for normality. Normality was assessed using SPSS programming. Data were analyzed for normal distribution through looking at kurtosis, outliers and skewness of the data. Normally distributed refers to the residuals fitting the normal curve. Data that is normally distributed has kurtosis and skew values of zero. Data is considered to be normally distributed if the values are less than the absolute value of 1.5 (Tabachnick & Fidell, 2007). The data were also assessed for outliers. Outliers were examined through Cook’s distance and DFBETAS. Influential points were defined as a Cook’s distance and DFBETAS greater than one (Stevens, 1999).

In addition to normality several other assumptions were assessed as part of each analysis. First, independence of observations was assessed. Independence assumption requires that responses of participants are not related. As each participant in the database was tested alone or when tested in groups they did not have contact with any other participants while testing, this assumption was satisfied (Stevens, 1999).

Next, multicollinearity was examined for the two regression analyses. Multicollinearity occurs when there are moderate or high intercorrelations among predictor variables (Stevens, 1999). Multicollinearity is problematic because it limits the ability for the researcher to identify the variance contributed by a single variable, it limits the size of R because it takes up much of the variance on the independent variable, and it
increases the variance in regression coefficients (Stevens, 1999). Multicollinearity was primarily assessed by using the correlation matrix to determine if the subtest of broad attention (auditory working memory, auditory attention, numbers reversed, and pair cancellation) and executive processes (planning and concept formation) were highly correlated within their construct. The simple linear correlations between independence variables are examined and also the variance inflation factor (Stevens, 1999).

Homogeneity of variance/covariance was also checked. Homogeneity of variance/covariance refers to having the variances in the population variances be the same for the groups. The only time this does not occur is when the group sizes are not equal. Homogeneity of variance/covariance is measured by Levene’s or Box’s M (Stevens, 1999).

In addition, linearity was assessed. Linearity refers to whether or not the relationship between two variables of interest fit a straight line. This assumption is assessed using a scatter plot of the residuals. If the assumption is met, data will scatter evenly along a horizontal line (Stevens, 1999).

Analysis and Assumptions for Research Question 1

The first comparison examined whether those with high/moderate psychopathy scores performed differently than those with low psychopathy scores on measures of attention. It was hypothesized that deficits will be seen in selective and divided attention, but not for sustained and attention capacity in those with high/moderate psychopathy scores compared to those with low psychopathy scores. To answer this question, a MANOVA between low and moderate/high psychopathy groups’ effects on measures of attention was run. A significant difference was defined using an $\alpha$ of .05.
In the first comparison, psychopathy was the independent variable. Levels of psychopathy were classified based on the PCL-R manual and research (Hare, 2003; Kosson, 1998; Brandt et al., 1997). Low psychopaths were classified with a PCL R or PCLYV score less than 25. Moderate to high psychopaths were have scores above 25. The Woodcock Johnson subtests that make up broad attention were used as dependent variables. Broad attention is composed of selective attention, working memory/attention, sustained attention and divided attention. Selective attention/inhibition was measured using subtest 14, auditory attention, of the WJ III COG NU. Sustained attention was measured using subtest 20, pair cancellation. Working memory/Attention capacity was measured using numbers reversed. Divided attention was measured by subtest 9, auditory working memory. Standard scores of each subtest were used based on age norms. The assumptions for question 1 were:

1. The data set was normally distributed for each of the dependent variables of selective attention/inhibition, sustained attention, divided attention, and attention capacity.
2. Observations were independent for all subjects and are not related to one another
3. Equality of variance-covariance matrices/ Homogeneity of Covariance

Each of the assumptions was tested using SPSS 14.0. Normality was assessed by examining kurtosis, outliers, and skewness of the data as part of the pre-analysis as previously discussed. Homogeneity of covariance for all subjects and were examined using Box’s M.
Assumptions and analysis for research question 2

In the second comparison, an additional MANOVA was run to examine the differences between low and moderate/high groups on overall executive functions groups were classified as they were for question 1. The research question was: Are there any differences between low and moderate/high psychopathy groups on measures of executive functions including the tests of concept formation and planning on the WJIII? For this analysis the independent variables were low vs. high to moderate and the dependent variables were subtests that make up the executive processes cluster of the Woodcock Johnson III Cognitive battery. These subtests include planning, pair cancellation, and concept formation. Furthermore, it was hypothesized those with moderate/high psychopathy were not display deficits in executive functions when compared to those with low psychopathy as seen on the subtests of planning and concept formation. The assumptions for question 2 are:

1. The data set was normally distributed on the dependent variables of planning and shifting sets for high/moderate psychopathy and low psychopathy groups.

2. Observations were independent for each subject.

3. Equality of variance-covariance matrices/Homogenetiy of Covariance

These assumptions were tested using the same methods as question1 with SPSS programming. Data were analyzed for normal distribution, and kurtosis, outliers and skewness of the data were corrected. Homogeneity of covariance was tested using Box’s M test. Appropriate post hoc tests were also done for results significant $p = 0.05$. 

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Assumptions and analysis for research question 3

The third analysis was a stepwise multiple regression with the ICU as the criterion variable and measures of broad attention as the dependent variables. The analysis examined if broad attention subtests accounts for any of the variance in callous and unemotional traits? The same subtests that were dependent variables in question one were used for this question. These subtests are auditory working memory, auditory attention, pair cancellation, and numbers reversed. This question hypothesized that broad attention accounts for much of the variance in callous and emotional traits. In addition, selective attention as measured by auditory attention were account for the most variance in the callous and unemotional trait compared to the other three measures. The assumptions for question 3 were:

1. Errors were independent
2. Variance was Constant
3. The data set was normally distributed with a mean of zero
4. Data is linear

As part of the analysis to check to see if the assumptions were met, residuals for the dependent variables of ICU were also assessed to check for normality. If the normality was met, the distribution of the residuals forms a normal curve. The normal distribution of data were also examined in the pre-analysis by looking at kurtosis, outliers, and the skew of the data. Cook’s distance and DFBETAS measured outliers (Stevens, 1999). Residuals were also examined to test for homogeneity of covariance and linearity. Equality of variance was checked using Levene’s error variance at $p = 0.05$. 

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Multicollinarity was also tested for using tolerance and the VIF factor. Independence is assumed as part of the methodology.

Assumptions and analysis for research question 4

The fourth analysis that was run was an additional multiple regression. This comparison examined the ICU regressed onto executive processes. The dependent variables were pair cancellation, planning, and concept formation. Research Question 4 states: Does executive functions account for any of the variance in callous and unemotional traits? It also hypothesized that executive functions did not account for the variance in callous and unemotional traits. The assumptions for question 4 were:

1. Errors were independent
2. Variance was Constant
3. The data set was normally distributed with a mean of zero
4. Data is linear

The same tests done for the third analysis were used for the fourth analysis. Scatterplots for the residuals for the dependent variable of ICU were also assessed to check for normality, linearity, and homogeneity of variance. Normality was also assessed using Cook’s distance and DFBETAS (Stevens, 1999). Multicollinarity was tested for using tolerance and the VIF factor. Levene’s was used for homogeneity of variance.

Independence is assumed as part of the methodology.

Follow up Analyses

In addition to the main analyses, several follow up analyses were also run. First, ANOVAs were run on all dependent variables with the PCL as the dependent variable between high/moderate and low groups. These were run to answer the question of
whether differences occurred between those who scored high/moderate psychopathy scores and those with low psychopathy scores on neuropsychological measures of attention and executive functions as well as IQ. Moreover, ANOVAs were run in addition to the MANOVAs because some of the independence assumptions were not met in the MANOVAs due to high correlations between the variables. ANOVAs were run with auditory working memory, auditory attention, pair cancellation, numbers reversed, broad attention, executive functions, and GIA as dependent variables to examine each of the variables separately to reduce the high correlations. The assumptions for each of the ANOVAs were:

1. Observations are independent of each other
2. The data were normally distributed with a mean of zero
3. There was homogeneity of variances

The first assumption was met through the design of the study. Normality was checked through kurtosis, outliers, and the skew of the data. Homogeneity of variance was examined using Levene’s error variance. All observations should be independent due to how the data were collected.

Due to the lack of significance in the main analyses that were run between high/moderate and low psychopathic groups on neuropsychological measures, the question arose to whether the extreme high and extreme low scorers within the sample would differ from each other on neuropsychological measures. To answer the question, the sample was split into extreme groups of those with high psychopathic characteristics and those with low psychopathic characteristics. Furthermore, the group was split into quartiles, leaving the top quartile and the bottom quartile for analyses. This sample then
had the four main analyses run on them, which included MANOVAs and regressions. However, when the sample was broken into quartiles, there were not enough participants to run the MANOVA and regression analyses to obtain adequate power. In addition, ANOVAs were run for each of the dependent variables due to the lack of power. The assumptions for each analyses were:

1. The data set was normally distributed
2. Observations were independent for each subject.
3. Equality of variance-covariance matrices/Homogeneity of Covariance

These assumptions were testing using the same methods as question 1 and question 2 with SPSS programming. Data were analyzed for normal distribution, and kurtosis, outliers and skewness of the data were corrected. Homogeneity of covariance was tested using Box’s M test. Appropriate post hoc tests were also done for values significant at $p = 0.05$.

The last analysis that was done was an exploratory factor analysis on the PCL YV. While not in a part of the original analysis, it was important to determine the factor structure to help further understand psychopathy in this sample, specifically the affective factor and apply it to research on adolescents with psychopathic characteristics since it was a focus of the study. Research supports a three and four factor model of psychopathy in adolescents. If the factor analysis resulted in four factors that had a strong affective factor, additional analyses would be run to compare; however, this was not the case. As a result, no additional analyses were run. The assumptions for factor analysis were:

1. The data set was normally distributed
2. Observations were independent for each subject.
3. Equality of variance-covariance matrices/Homogenetiy of Covariance

4. Data is linear

5. There is not multicollinearity

Data were analyzed for normal distribution, and kurtosis, outliers and skewness, and when appropriate was corrected. Scatterplots for the residuals for the dependent variable and assessed for normality, independence, linearity, homogeneity of variance, and to determine in the data is orthanoginal. Normality was also assessed using Cook’s distance and DFBETAS (Stevens, 1999). Multicolliniarity was tested for using tolerance and the VIF factor. Levene’s was used for homogeneity of variance.
CHAPTER IV

RESULTS

This chapter describes the results from the analyses described in chapter three. Moreover, descriptive statistics, four main analyses, and follow up analyses are all presented in the paragraphs below. Each of the analyses was based upon the four research questions. First, a MANOVA was run to examine the question of whether adolescents with low psychopathy scores verses those with high scores performed differently on measures of attention. Next, a second MANOVA was run to examine a similar question comparing the two groups on measures of executive functions. Lastly, two regressions were run to determine how much attention and executive functions separately account of the variance in the ICU. Using the the results from the main analyses, several follow up analyses were completed to answer additional questions that arose.

Descriptive Statistics

Participants obtained from a preexisting database resulted in a sample that consisted of 62 adolescent males. Due to incomplete data and exclusionary criteria, there were 62 participants from the original sample of 118 left for analyses. Participants with mental retardation and psychotic disorders were excluded from the study. In addition, several participants were not administered the PCL, ICU, and the WJ COG III extended battery. The final sample ranged in age from fourteen to nineteen years of age with a mean age of 16.61 years. The ethnic breakdown of the sample was 50 (80.6%) African American, 6 (9.7%) Caucasian, 3 (4.8%) Hispanic, and 3 (4.8%) Biracial students. As previously defined in chapter three, the sample had (n = 40) high/moderate with scores on the PCL 25 and over and (n = 22) low group as defined by a PCL score of below 25. As
classified in the database, \( n = 40 \) (64.5%) of the sample was classified as violent offenders and \( n = 22 \) (35.5%) were nonviolent offenders.

Pre-analyses

Pre-analyses were run prior to the four main analyses. First, the internal consistency was examined for the ICU and PCL using Cronbach’s \( \alpha \). The interrater reliability was also calculated for the PCL using Pearson’s bivariate correlations. In addition, Pearson’s correlations were run for all measures to examine possible relationships and multicollinearity. Last, the data for the WJ III COG NU, ICU, and PCL were examined and corrected for normality using skew, kurtosis, and by graphing the residuals.

Independent variable composites of the ICU and the PCL were examined for their consistency as part of the pre-analyses. Reliability estimates were calculated for these measures because they are not commonly used measures and reliability, while reported high, has not fully been established in the literature. Furthermore, the PCL had an \( \alpha \) coefficient of .70 and the ICU had an \( \alpha \) coefficient of .75. Both coefficients were in the acceptable range. WJ III COG reliability has been established and was discussed in chapter three. Pearson’s bivariate correlation was run to measure interrater reliability for the PCL. Using 50 (80%) of the 62 participants, a Pearson’s correlation coefficient of .94 obtained, which is one of the highest reported and is comparable to the inter rater reliability of the PCL YV manual value of .9-.92 (Forth et al., 2003).

Also, as part of the preliminary data analysis, significant relationships were examined to understand possible relationships that will occur during the main analyses which included means, standard deviations, range and correlations for all variables. If
factors are moderately correlated, it justifies putting them into a MANOVA. Pearson's bivariate correlations were run. Moderate correlations were found for Planning and the ICU ($r = .264$), Numbers reversed and planning ($r = -.153$), planning and the PCL total score ($r = -.233$), Numbers reversed and the affective ($r = -.206$) and lifestyle factors ($r = -.238$), Planning and PCL total score ($r = -.272$), numbers reversed and PCL total score ($r = -.238$), broad attention and lifestyle factor ($r = -.208$), auditory working memory ($r = -.238$) and lifestyle factor. A complete table of the correlation coefficients is presented in the Appendix Table 12.

Each of the measures means, standard deviations, and normality statistics are reported in Table 5. Scores on the ICU, PCL and for the Woodcock Johnson III COG NU were all normally distributed. Normality was assessed by examining the plot of the residuals for each regression, and using kurtosis and skew of the data for the MANOVAS and the ANOVAS. Outliers were assessed by using Cooke's distance and Manhalobus distance, each were less than one. Outliers, Skew, Cooke's distance, and Manhalobus distance were in the acceptable range indicating normal distribution of the data.

Table 5

*Means, Standard Deviations, Ranges, Skew, and Kurtosis of the PCL, ICU and WJ III*

<table>
<thead>
<tr>
<th>Measure</th>
<th>M</th>
<th>SD</th>
<th>Range</th>
<th>Skew</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCL</td>
<td>22.06</td>
<td>5.30</td>
<td>11-34</td>
<td>-.343</td>
<td>-.507</td>
</tr>
<tr>
<td>ICU</td>
<td>28.11</td>
<td>8.43</td>
<td>14-51</td>
<td>.263</td>
<td>-.257</td>
</tr>
<tr>
<td>WJ III COG</td>
<td>76.34</td>
<td>10.96</td>
<td>61-104</td>
<td>.593</td>
<td>-.162</td>
</tr>
</tbody>
</table>

Note: The WJ III COG uses standard scores with a mean of 100 and a SD of 15. The PCL and ICU are raw scores.
Main Analyses

Research question one results

The first main analysis that was run was a MANOVA to examine the differences between low and high psychopathy on measures of attention. First, three assumptions of independence, homogeneity of variance, and normality were checked. Box’s M was met with a value of 9.51. Levene’s error variance was not significant, supporting the independence assumption. Normality was assessed and met as part of the pre-analysis as demonstrated with the skew and kurtosis with values less than one.

While all of the assumptions were met, the results from this analysis indicate that there were no differences between the high and low psychopathy groups on measures of attention as measured by Wilk’s lambda. Moreover, auditory attention, $F(1, 60) = .000, p > 0.05$, numbers reversed, $F(1, 60) = 1.652, p > 0.05$, auditory working memory, $F(1, 60) = .381, p > 0.05$, and pair cancellation $F(1, 60) = .583, p > 0.05$ were not statistically significant.

Due to the high correlation between many of the measures of attention displayed in the pre-analysis, several follow up ANOVAs were run. An ANOVA was run with broad attention alone. Results indicate that there were no differences between high and low psychopathy scorers on measures of broad attention $F(1, 60) = 1.82, p > 0.05$. The assumptions of normality, independence, and homogeneity of variance were also met for this analysis. Normality and the independence assumptions were met as part of the pre-analysis and homogeneity of variance was met using Levene’s error variance for each of the ANOVAs.
Research question two results

A MANOVA was run to examine the differences between low and moderate/high groups on overall executive functions. First, four assumptions of independence, homogeneity of variance, linearity and normality were checked. Normality, independence and linearity were all met. Normality was met as part of the pre-analysis. Independence was met as part of the methodology. Box’s M was not met, which indicates that covariances for each of the measures were not equal. Because MANOVA was violated, Pillai’s Trace was used based on Mertler and Vannatta (2005). In addition, Levene’s equality of variance was not met for concept formation, but was met for planning. The analysis should be preceded with caution and examined with a more conservative $\alpha$ because the independence assumption was violated. The measures are not independent of one another on concept formation, but they were for planning. There were no differences between the high and low psychopathy groups on measures of executive functions of concept formation, $F(1, 58) = 2.001, p > 0.05$ and planning, $F(1, 58) = 3.620, p > 0.05$.

When examining executive functions in the MANOVA, the independence assumption was violated as measured by Box’s M. It is likely that the assumptions were not met due to the high correlation between concept formation and planning. Because this assumption was not met, an ANOVA was run for the executive construct. For this analysis, all of the assumptions of homogeneity of variance, normality, and independence were all met. There were no differences between the moderate/high psychopathy group and the low psychopathy group on executive functions $F(1, 58) = 1.716, p > 0.05$. 

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Research question three results

The next analysis that was run was a stepwise multiple regression with the ICU as the dependent variable and measures of broad attention subtests of auditory attention, numbers reversed, auditory working memory, and pair cancellation as the independent variables. First, the three assumptions of independence, homogeneity of variance, and normality were checked. For this analysis, all of the assumptions were met. Normality assumption can be seen in Figure 3 as the distribution of the residuals forms a normal curve. The linearity assumption can be seen in Figure 4 as the data points are scattered evenly along a straight line. The homoscedacity can be seen in Figure 5 as the datapoints scatter randomly around a horizontal line at zero. In this assumption, it appears that more of the data points fell below zero. This indicates that there may be some difficulty with homoscedacity and a more conservative alpha was used. Tolerance was all less than one indicating that there was no multicollinerarity and Box’s M was also met indicating independence of errors. The results indicated that four measures of attention did not account for the variance in callous and unemotional traits $F(1, 59) = .037, p > 0.05$. The regression results are presented in Table 6.
Table 6

*Regression analysis with numbers reversed, auditory attention, pair cancellation and auditory working memory regressed on the ICU*

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>SE B</th>
<th>Beta</th>
<th>t</th>
<th>p SIG</th>
<th>Tolerance</th>
<th>VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numbers Reversed</td>
<td>.038</td>
<td>.080</td>
<td>.079</td>
<td>.427</td>
<td>.639</td>
<td>.644</td>
<td>1.552</td>
</tr>
<tr>
<td>Auditory Attention</td>
<td>.022</td>
<td>.068</td>
<td>.046</td>
<td>.331</td>
<td>.742</td>
<td>.931</td>
<td>1.074</td>
</tr>
<tr>
<td>Pair Cancellation</td>
<td>-.027</td>
<td>.107</td>
<td>-.037</td>
<td>-.255</td>
<td>.800</td>
<td>.860</td>
<td>1.163</td>
</tr>
<tr>
<td>Auditory WM</td>
<td>-.040</td>
<td>.086</td>
<td>-.078</td>
<td>-.468</td>
<td>.642</td>
<td>.644</td>
<td>1.552</td>
</tr>
</tbody>
</table>

*Note: WM = working memory*

*Figure 3. Normal Distribution of residuals for dependent variable of ICU with auditory attention, pair cancellation, numbers reversed and auditory working memory as predictors*
Figure 4. Scatterplot of standardized residuals showing satisfaction of linearity assumption for the dependent variable of ICU

Figure 5. Scatterplot of residuals around regression line for dependent variable of ICU satisfying homoscedasticity assumption for auditory attention
Research question four results

The last analysis that was run was a stepwise multiple regression with the ICU as the dependent variable and measures of executive functions including concept formation and planning as the independent variables. First, three assumptions of independence, homogeneity of variance, and normality were checked. The normality assumption being met can be seen in Figure 9. Moreover, the data residuals fit a normal curve. Linearity is demonstrated in Figure 10 as the residuals fall closely to the regression line. Homoscedacity is displayed in Figure 11 as the data is evenly distributed across a horizontal line at zero. Tolerance was all less than one indicating that there was no multicollinearity. Box’s M was not met indicating that errors are not independent from each other. Again, because sample sizes are similar, results are robust. The results indicated that planning significantly accounted for the variance in ICU scores $F(1, 58) = 4.754, p < 0.05$, while concept formation did not. The $\eta^2$ was .059 indicating that planning accounted for 6% of the variance in the ICU. For planning the adjusted R square was 0.061. The beta weight was .277. This indicates that those with higher self rated callous traits had higher planning ability. Moreover, those who scored higher the planning also scored higher on callous and unemotional traits.

Table 7

Regression Analysis with planning and concept formation regressed on ICU

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>SE B</th>
<th>Beta</th>
<th>t</th>
<th>p</th>
<th>Tolerance</th>
<th>VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning</td>
<td>.262</td>
<td>.120</td>
<td>.277</td>
<td>2.18</td>
<td>.033</td>
<td>1.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>
Figure 7. Normal Distribution of residuals for dependent variable of ICU with planning and concept formation as predictors

Figure 8. Scatterplot of residuals around regression line for dependent variable of ICU satisfying linearity assumption
Figure 9. Scatterplot of standardized residuals showing satisfaction of homoscedasticity assumption for the dependent variable of ICU

Follow-up Analyses Results

Follow up analyses were run based on data from the MANOVA, regressions, and from the descriptive data. Each of these analyses was done to answer remaining questions left by the main analyses. It was planned to run MANOVAs and regressions; however there was not enough participants to run these analyses. When broken down into quartiles, the total participants was only 31. These additional analyses include ANOVAs of the quartiles for each of the variables used in the first set of analyses between high and low groups and factor analysis of the PCL. In addition, just as an exploratory analysis, a multiple regression was run with planning and the ICU to see if larger differences existed between the high and low groups.

Follow up ANOVAS

Due to the lack of significance by dividing the total sample into high and low groups based upon their scores, the sample was broken into quarters. The top group was
classified with a score of 26 and above and the bottom quarter was 18 and below. The high PCL score had an \( n = 17 \) and the low psychopathy group had an \( n = 16 \). ANOVAS were run for each of the dependent variables examined in the four main analyses to determine if differences exists between high and low psychopathy.

Several of the ANOVAs were not significant. There were no differences in broad attention \( F(1, 32) = 1.820, p > 0.05, \) in auditory attention \( F(1, 32) = .020, p > 0.05, \) concept formation \( F(1, 32) = .547, p > 0.05, \) pair cancellation \( F(1, 32) = .201, p > 0.05, \) and auditory working memory \( F(1, 32) = 1.117, p > 0.05, \) and on the ICU \( F(1, 32) = .374, p > 0.05. \) Moreover, there were no differences between the high psychopathy group and the low psychopathy group on these measures. For these analyses, all of the assumptions were met.

While not a significant difference, three of the analyses approached significance. The first dependent variable that was examined in the follow up analysis was GIA. All of the three assumptions including normality, independence, and homogeneity of variance were met. There was not a significant difference between GIA for low and high psychopathy; however, it approached significance. Moreover, there was a trend that suggested that those with lower GIA had higher psychopathy scores \( F(1, 32) = 3.395, p = 0.075. \) Numbers reversed was close to having a difference between high and low psychopathic offenders \( F(1, 32) = 3.8, p = 0.06. \) Moreover, there was a nonsignificant trend where the low psychopathy group performed better than high psychopathy group. In planning there was a nonsignificant trend where the low psychopathy group also performed better on planning than the high psychopathy group \( F(1, 32) = 2.188, p = .06. \)
As with the preliminary analyses, a regression was on the ICU and planning. The results indicate that planning explains a significant amount of variance in the ICU $F(1, 32) = 6.203, p < 0.05$. Furthermore, 14% of the variance in the ICU was accounted for by planning. The β weight was .375, which is a moderate effect size. All of the assumptions were met, as measured by Tolerance and VIF, normality and errors were independent of each other. Normality was displayed in Figure 10, and homoscedasticity was demonstrated in Figure 11. Linearity was represented in Figure 12.

Figure 10. Normal Distribution of residuals for dependent variable of ICU with planning and concept formation as predictors
Figure 11. Scatterplot of standardized residuals showing satisfaction of Homoscedasticity assumption for the dependent variable of ICU

Figure 12. Scatterplot of standardized residuals showing satisfaction of linearity assumption for the dependent variable of ICU
Factor analysis of the PCL

An additional analysis that was completed in this study was factor analysis on the PCL to help further understand the factor structure of callous and unemotional traits related to the PCL in the sample. For the factor analysis each of the following assumptions were examined and met: normality, independence, homogeneity of covariance, linearity, and multicollinearity. Theoretically there are two competing models of psychopathy in adolescents, the three factor and the four factor model. The Scree plot identified six factors before leveling out. These six factors accounted for 60% of the variance. The Scree plot is presented in Figure 15 and the variance accounted for by each of the factors is presented in Table 8.

Due to theoretical models, the three and four factor models were examined. The three and four factor models were good fits for the data, but not with the same corresponding items as those previously proposed. The three factor model accounted for 40.42% of the variance while the four factor accounted for 48.53% of the variance in the PCL. While the six factor accounted for more of the variance, it did not match with past research and the construct presented in the PCL YV and PCL R manuals of psychopathy (Forth et al., 2003; Hare, 2003).
Figure 13. Scree Plot of Factor Analysis of the PCL

Table 8

Total Variance Accounted for by Each Factor by the PCL

<table>
<thead>
<tr>
<th>Component</th>
<th>Total</th>
<th>% of Variance</th>
<th>% Cumulative Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.93</td>
<td>19.64</td>
<td>19.64</td>
</tr>
<tr>
<td>2</td>
<td>2.41</td>
<td>12.08</td>
<td>31.71</td>
</tr>
<tr>
<td>3</td>
<td>1.74</td>
<td>8.71</td>
<td>40.42</td>
</tr>
<tr>
<td>4</td>
<td>1.62</td>
<td>6.01</td>
<td>48.53</td>
</tr>
</tbody>
</table>

Note: % = Percentage, The % of variance and % of cumulative extracted are the same for the three and four factor models

The first model is the three factor model (Table 9). This model loaded seventeen out of the twenty items. Each item loaded with a cut off of .428 and higher onto the three factors. The three factor solution accounted for 40.42% of variance in the original matrix. Item three (proneness to boredom), item four (lying), and item sixteen (failure to
accept responsibility) did not load onto any of the factors. The factors were labeled: interpersonal style (factor 1), behavioral style (factor 2) and deficient affective experience (factor 3). These labels were chosen based on the labels used in the three factor Cooke and Michie (2001) psychopathy model and the four factor Neumann and Hare (2005) model of psychopathy. These classifications also were based upon the original definition of psychopathy in the PCL R and PCL YV manuals (Forth et al. 2003, Hare, 2003). Moreover the items that loaded on the interpersonal style had characteristics of personality traits. The second factor loaded items that were behavioral, and the third led with lack of appropriate emotional experience.

The second model also loaded a total of seventeen out of twenty items (Table 10). Item three (proneness to boredom), item fifteen (irresponsibility), and item seventeen (lack of close interpersonal relationships) did not load onto any of the factors or loaded onto multiple factors. Loading was cut off at .439 or above for each factor. The four factor solution accounted for 48.53% of variance in the original matrix. The factors were labeled affective/antisocial (factor 1), interpersonal (factor 2), behavioral (factor 3), and Lack of responsibility (factor 4). The interpersonal factor matched the items on Neumann and Hare’s (2005) model and thus there label was used. The affective factor matched three of the items in Neumann and Hare’s model and also loaded three items from their antisocial factor. The last two that were labels that were chosen for factor 3 and factor 4 were based off of the wording for each item taken from the PCL YV manual (Forth et al, 2003).
### Table 9

*Three Factor Model of the PCL*

<table>
<thead>
<tr>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>impersonal sexual behavior</td>
<td>conning/manipulation</td>
<td>lack of remorse</td>
</tr>
<tr>
<td>glibness</td>
<td>early behavioral problems</td>
<td>lack of emotion</td>
</tr>
<tr>
<td>callousness</td>
<td>poor behavioral control</td>
<td>poor relationships</td>
</tr>
<tr>
<td>criminal versatility</td>
<td>impulsivity</td>
<td>lack of goals</td>
</tr>
<tr>
<td>grandiosity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>parasitic lifestyle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>serious criminal behavior</td>
<td></td>
<td></td>
</tr>
<tr>
<td>revocation of con. release</td>
<td></td>
<td></td>
</tr>
<tr>
<td>irresponsibility</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 10

*Four Factor Model of the PCL*

<table>
<thead>
<tr>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
<th>Factor 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>callousness</td>
<td>glibness</td>
<td>poor behavioral controls</td>
<td>lack of goals</td>
</tr>
<tr>
<td>shallow affect</td>
<td>grandiosity</td>
<td>early behavioral problems</td>
<td>failure to accept resp.</td>
</tr>
<tr>
<td>lack of remorse</td>
<td>lying</td>
<td>impulsivity</td>
<td></td>
</tr>
<tr>
<td>criminal versatility</td>
<td>conning/manipulative</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serious criminal beh.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>revocation of cond.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>parasitic lifestyle</td>
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</tbody>
</table>

*Note:* beh = behavior, cond = conditional release

### Summary of Results

Overall all there were no differences between high/moderate and low psychopathy groups on measures of attention and executive function. More specifically there were no differences in the areas of auditory attention, numbers reversed, auditory working memory, pair cancellation, broad attention, concept formation, planning and executive functions.
When examining callous and unemotional traits, attention and executive functions were examined separated. In the area of attention, the four measures of attention did not account for the variance in callous and unemotional traits. For the executive functions, planning significantly accounted for 6% of the variance in the ICU. Concept formation did not and was not included statistically in the model. These results indicate that those with higher self rated callous and unemotional traits had higher planning ability than those who did not.

In the follow up analyses, there were no differences between the quartile groups on broad attention, auditory attention, concept formation, pair cancellation, auditory working memory, and in the ICU tasks. There were several nonsignificant trends. These trends included that the lower GIA had higher psychopathy scores, the low psychopathy group performed better than high psychopathy group on the attention capacity task, and the low psychopathy group performed better on planning than the high psychopathy group. Also a part of the follow up analyses, there was also support for both the three and four factor models of psychopathy as done through factor analysis.
Chapter V

DISCUSSION

This next chapter integrates the results from chapter four and previous research discussed in chapter two to come up with a conclusions and give suggestions for future research. It also examines the significance of the results and makes application of them. Each of the research questions are discussed with application to the literature base. The limitations, implications for future researchers, and then the overall conclusions follow in the sections below.

It is important to review the purpose as well as the significance of the study. Due to recidivism rates, prognosis, and stability into adulthood, understanding the construct of psychopathy with application to specific traits and characteristics in adolescents is essential (Corrado et al., 2004; Salekin et al., 2004; Serin, 1996; Serin & Amos, 1995; Serin et al., 1990). Being able to link specific personality characteristics to a cognitive and emotional profile to differentiate between those with conduct disorder only and those with psychopathic traits is important as their treatment and prognosis vary between the two groups (Gacono & Hughes, 2004). However, research in this area is limited and needs to be expanded upon.

The purpose of this study was to examine the cognitive profile of these adolescents, looking at executive functions and how they differ in individuals who score high on callous/unemotional traits (Cleckley, 1941; Frick et al., 1994; Hare, 1991, 1993). Through examination of these characteristics, the goal was to help practitioners and researchers understand how adolescents process information in relation to emotion,
giving light to future interventions. The results and questions of this study are discussed below.

Attention and Psychopathy

It was hypothesized in chapter one that adolescents who score high on psychopathy measures would perform differently than those with high or moderate scores on psychopathy measures in terms of some attention measures. Specifically, it was expected that those who score high on psychopathy, would score worse on measures of selective attention and that there would be difference in divided attention (shifting attention) between the two groups. It was also hypothesized that there would not be any deficits in sustained attention and attention capacity between those with high/moderate psychopathy scores and those with low psychopathy scores. The results supported two out of the four hypothesizes. Research in the area of attention has mixed results and is based upon the type of task demand that is being measured. The research is broken down into four areas, selective attention, shifting, and sustained attention and attention capacity. Each of these areas varies within the literature based on the measures used and the type of population.

Selective Attention

The first area that was examined in attention was selective attention. It was chosen first because it is the most widely supported deficit in those who score high on psychopathy (Blair et al., 2006; Hiatt et al., 2004; Kosson, 1998; LaPierre et al., 1995; Pham et al., 2003; Roussy & Toupin, 2000; Sellbom & Verona 2007; Vitale et al., 2007). While most of the research suggests a deficit, some researchers have not found differences in overall selective attention (Dvorak-Bertsch et al., 2007; Mayer et al.,
These differences in our results compared with the literature base may be due to the type of population, definition of selective attention, and the type of measure used to assess selective attention.

First, the differences between our results and the literature may be due to differences in sample. The majority of research in adults has found differences between groups in selective attention (Blair et al., 2006; Hiatt et al., 2004; Kosson, 1998; LaPierre et al., 1995; Pham et al., 2003; Roussy & Toupin, 2000; Sellbom & Verona 2007; Vitale et al., 2007). This study used a sample of adolescents and predicted that the results would be similar between the two groups because selective attention typically matures by the age of twelve (Betts et al., 2006). However, very little research has been done on adolescents with psychopathy in the area of selective attention. Roussy and Toupin (2000) found differences on measures of selective attention, suggesting that adolescents have similar difficulties to the adults and may present similarly to adults in cognitive functioning. Our results do not support this deficit in adolescents indicating that more research is needed to further understand this construct and its relation to psychopathy in adolescents.

In addition, the definition of selective attention or the part of selection attention that each study measures varies from study to study. Thus, it is important to look at the task demands of what they are calling selective attention to determine if a true deficit lies there. Furthermore, there are three systems involved in selective attention: alert, orienting and executive control. As previously stated in the literature review, alerting involves wakefulness, orienting involves selection of information from sensory input and executive control responses to thoughts feelings and how and individual should respond
(Rueda et al., 2005). Researchers have found that those with high psychopathy scores, have intact top down processing, but bottom up processing is often impaired (Dvorak-Bertsch et al., 2007). This also is consistent with Hiatt et al. (2004) and Blair’s (2006) work in that they conclude that they only fail to process the information when it is spatially peripheral to their focus of attention. These results suggest that those with psychopathy are able to orient to a task, but have more with the executive portion and making good decisions. They will see situations for what they are and people for who they are in the moment to them rather than a part of a larger piece of society. Moreover, they are not able to see a person as a part of a family or functional member of society, but can only see how that person functions to them.

Depending on the type of task, different parts of selective attention may be measured, supporting why the WJ III COG NU results did not have the same results as other neuropsychological measures. Moreover, it could be that auditory attention does not measure the specific deficit seen in those with psychopathic characteristics. The majority of supporting research for selective attention has been done using the Stroop task (Dvorak-Bertsch et al., 2007; Hiatt et al., 2004; Kosson, 1998). The Stroop tasks often measure both top down and bottom up processing to explain the specific deficits seen (Dvorak-Bertsch et al., 2007) in psychopathy. In addition to the Stroop task to measure selective attention, the Porteus Maze Task, Tower of London, Continuous Performance Task (CPT), Go/no/go task, and the DII have also been used. These measures have not shown as much success in deficits as the Stroop measures (Blair et al., 2006; Hiatt et al., 2004; Kosson, 1998; LaPierre et al., 1995; Pham et al., 2003; Roussy & Toupin, 2000; Sellbom & Verona 2007; Vitale et al., 2007). Research, as well as the results, suggest
that the specific task demands on the Stroop measure may account for the deficits seen in psychopathy that the WJ III COG NU’s auditory attention does not measure such as bottom up processing. Our study did not find this because the task demand relied more heavily upon orienting attention than the executive process aspect of selective attention. Moreover, additional research is needed to compare different selective attention measures. This additional piece will help to determine whether there are two different types of psychopathy, which may warrant different cognitive theories to explain each. Furthermore, secondary psychopathy would be explained by the idea that the BAS over focuses attention limiting response modulation (Putnam et al., 2004) and another cognitive theory would be used to explain primary psychopathy. The research suggests that those with psychopathy have difficulty paying attention to information when they are required to piece many things together to solve a problem or form a concept when compared to focusing on one thing and breaking it into smaller parts, the proverbial “not being able to see the forest through the trees”. Moreover, their crime is what it is and they cannot see application to society and how it will affect others.

Shifting Attention

Shifting attention or divided attention was also examined. However, unlike selective attention, there is very little research on shifting attention and psychopathy. Consistent with Blair et al. (2006), Pham et al. (2003), Roussy & Toupin (2000), there were no differences in shifting attention in those with who scored high on psychopathic characteristics and those who scored low on psychopathic characteristics. Raine et al. (2005) also found no differences on this task in those with CD. Moreover, the research suggests that differences are not present between adolescents with psychopathic
characteristics and those without on measures of shifting attention, such as pair
cancellation. That is, they do not have difficulty moving their focus from one task to
another and orienting to a new task.

**Attention Capacity**

The area of attention capacity has not been examined in the literature. Because of
similar measures of attention were not affected in the literature, it was hypothesized that
there would be no differences between the groups in attention capacity (Pham et al.
2003). This hypothesis was supported. However, in the follow up analysis there was a
trend between the low and high psychopathy group in that those with high psychopathy
did not perform as well as those with low psychopathy suggesting that those with less
psychopathic traits can attend to more information at once compared to those without
psychopathy. This result is similar to research’s finding in selective attention and may
show a new perspective on why those with psychopathy have difficulty with bottom up
processing.

**Sustained Attention**

In the area of sustained attention, there is mixed evidence provided by the
literature. Few studies have found differences between high and low psychopathy in
sustained attention (Gorstein, 1982; Kosson, 1998; Pham et al., 2003) and many who
have not (Blair et al., 2006; Dvaorak-Bertsch et al., 2007; Hiatt et al., 2004; LaPierre et
al., 1995; Roussy & Toupin, 2002; Sellbom & Verona 2007; Vitale et al., 2007). The
hypothesis was supported when there were no differences in sustained attention between
the high/moderate and low groups. Moreover, there were no differences between groups
on the amount of time they sit down and sustain focus and effort on a task. Those with
psychopathy and without can sit down and focus on a task at a similar level when compared to each other.

Executive Processes and Psychopathy

The second research question examined whether there were any differences between low and moderate/high psychopathy groups on measures of executive functions including the tests of concept formation and planning on the WJ III COG NU. The hypothesis of was supported that there were no differences between those with moderate/high psychopathy on these measures. Moreover, there is little neuropsychological literature on executive functions of planning and shifting cognitive sets. The literature suggests that there are little to no differences between the two groups overall in cognitive shifting and in planning (Mahmut et al., 2008; Pham et al., 2003; Roussey & Toupin, 2000; Sreenivasan et al., 2008).

In the area of cognitive shifting, there have been mixed results in the literature. Pham et al. (2003) examined cognitive shifting using the WCST and the Trails. They found no differences on these tasks when comparing low and high psychopathy groups. Similarly, Mahmut et al. (2008) and Sreenivasan et al. (2008) both found no differences on cognitive shifting between those who score high on psychopathy and low on psychopathy in measures of cognitive shifting. Our results also support the literature, suggesting that adolescents who score high on psychopathy, like adults, do not have deficits in cognitive shifting.

Planning has also shown mixed results between the two groups. Pham et al. (2003) found that on the Porteus maze task, those who scored high on psychopathy made more qualitative errors and also had more difficult with this task than controls. Roussey
and Toupin (2000) found similar results to Pham et al. (2003) in adolescents. They discovered that many qualitative task errors in individuals with high psychopathy compared to those low psychopathy, suggesting that differences may arise in this area between the two groups.

The results support the hypothesis that there would not be differences between the two groups in planning. However, it does conflict with previous research’s results (Pham et al., 2003; Roussey & Toupin 2000). The reason that this study did not follow past research was that there were very few studies that examined planning between those who score high on psychopathy and those who score low on psychopathy. Although the results were not significant, there was a trend that is consistent with past research. Moreover, those with high psychopathy tend to have more errors on planning tasks compared to those who score low on psychopathy. Overall, they are able to plan to solve a problem, but they make judgment errors than those with low psychopathy along the way.

Callous and Unemotional Traits and Attention

The next research question explored whether specific types of attention accounted for any of the variance in callous and unemotional traits. Recent literature was found an inability to process emotions and related inhibition (Loney et al., 2003; Woodwarth & Waschbusch, 2008) and the connection between both the cognitive and the emotional processing models to be connected and suggests Sreenivasan et al. (2008) supports an overall cognitive functioning difficulties in those with psychopathy, but it does suggest that those with high psychopathy have a deficit in divided attention or shifting attention tasks that is related to the affective facet.
Based on these findings and previous research results of selective attention (Dvorak-Bertsch et al., 2007; Hiatt et al., 2004; Kosson, 1998), it was hypothesized that selective attention as measured by auditory attention would account for the most variance in the callous and unemotional trait compared to divided attention as measured by auditory working memory, attention capacity as measured by numbers reversed, and sustained attention as measured by pair cancellation. This hypothesis was not supported by this study, which implies that attention does not account for the variance in the ICU and its related callus and unemotional traits. In other words, each of the four areas of attention are not related to callous and unemotional traits, which implies that attention does not affect how those with psychopathy process emotions and make related decisions.

Callous and Unemotional Traits and Executive Processes

Similar to research question three, research question four looked at executive functions and if they accounted for any of the variance in callous and unemotional traits. This analysis was also based upon the overlap between cognitive and emotional systems. Only preliminary research in this area has been done. Sreenivasan’s et al. (2008) results can be applied to concept formation as Trails B measures cognitive shifting and planning. Based on the lack of research in this area, it was hypothesized that neither test would account for any of the variance. Our results in using concept formation to test cognitive shifting did not find the same results as Sreenivasan et al. (2008) who found differences in cognitive shifting, but they do support our current hypothesis for concept formation. On the other hand, our hypothesis was rejected for planning. Planning significantly accounted for the variance in the ICU between high and low psychopathy. Moreover,
there were larger differences in the extreme groups than the entire group divided. These results suggest that those with higher self rated callous traits have a better ability to plan. The results also imply that research should examine this area more carefully in the literature. However, there is no difference on forming concepts and solving problems.

The significance of this finding suggests that those with callous and unemotional traits compared to those without are able to plan their crimes skillfully and they are well thought out.

Application of Findings to Cognitive Models of Psychopathy

As previously discussed in the literature review, several models have been used to explain the neuropsychological patterns seen in those with psychopathy. These models include the response set modulation hypothesis (RM), fear dysfunction, frontal lobe, violence inhibition mechanism model (VIM), left hemisphere activation hypothesis (LHA), and the integrated emotion system (IES) models. It was hypothesized that the RM model would be the best explanation based on the previous literature; however, it was not. The RM hypothesis was not supported because there was not a difference in shifting and selective attention between the two groups (Blair 1995, 2001; Blair et al., 2005). The non significant results in selective and shifting attention indicates that this theory does not apply to our sample. There was also no evidence supporting the fear dysfunction hypothesis. There was some LHA hypothesis (Hare & Jutai, 1988; Kosson, 1998) because the sample had significantly lower verbal scores than cognitive efficiency and thinking ability scores. The VIM model and the Frontal lobe dysfunction model were moderately supported as there was indication that the frontal lobe and associated systems involve in the VIM model may be impaired (Blair, 2005).
The model that best fits with the findings is the IES model; the IES model suggests amygdala dysfunction in those with psychopathy, describing this dysfunction as the inability to form connections to aversive stimuli in those with psychopathic characteristics. As a result, they are not able to make conditioned stimulus connections and in turn are not able to make moral social references. This model also suggests orbital frontal and ventrolateral associations related to amygdala dysfunction (Blair, 2005).

However, this model does not completely describe all the findings. Furthermore, it does not describe the cognitive processes that contribute to the ability to make these social references including the inability to use bottom up processing in social situations to understand other’s emotions and also fails to integrate their ability of those with callous and unemotional traits to plan, which both result in predatory criminal behavior (Dvorak-Bertsch et al., 2007). Both of these areas suggest involvement of the orbital frontal and ventrolateral associations related to the amygdala, which is consistent with the IES model (Blair, 2005). The IES model just needs to add more detail on how the conditioned responses are formed in connection to specific neuropsychological patterns of those with psychopathy and specific traits of psychopathy, such as callous and unemotional traits.

Follow Up Analyses and Factor Analysis

Several follow up analyses were done that were not part of the original analyses. In addition to these questions, the overall cognitive functioning otherwise known as GIA on the WJ III COG NU was compared between the groups and factor analysis was done on the PCL. Many were discussed in the previous sections as they were just extensions on the questions that were proposed. ANOVAS were run due to the high correlation between the dependent variables in the MANOVAs. Also due to the lack of difference
between the high and low groups, comparisons were run between the top and bottom quartiles in those with psychopathy. Factor analysis was run on the PCL to examine the callous and unemotional factor to determine if additional analyses were needed.

First, an ANOVA was run on GIA to determine if there were differences between the high and low quartile psychopathy groups. While intelligence has been an area that is commonly explored in those with psychopathy, there is little research on adolescents (Salekin et al., 2004). Some researchers have found that adolescents with psychopathy typically have an average rate of intelligence (Cleckley, 1976; Salekin et al., 2004) and others have found that those with high psychopathy scores have some cognitive dysfunction and low IQ scores (Farrington, 2005). Differences between the high and low psychopathy groups were not found; however, there was a trend where the high psychopathy group had lower IQ scores than the low psychopathy group. Consistent with Farrington (2005), those with higher psychopathy scores had lower overall cognitive functioning. It is likely that this result is a product of the sample rather than a characteristic of psychopathy as a whole.

However, these results should be noted as well as interpreted with caution. First, the average IQ was much below the mean for the WJ III COG NU standardized sample. This low sample size may have been due to the specific sample. As previously discussed in the literature review, intelligence in Farrington (2005) and these results may have been related to social class and race. Moreover, low levels of cognitive functioning have been related to CD and may not have a relationship with psychopathy. As the majority of the sample also carried CD diagnoses, it is likely that this could be the case. Due to the lack
of consistent research, cognitive functioning should be examined further. Overall, the IQ may be a function of population or it may be a notable trend for future research.

While the GIA was low, the scores on the attention and executive processes were not nearly as low. The means for auditory attention (standard score of 92) and planning (standard score of 90) fell in the average range. Pair cancellation (standard score of 87), numbers reversed (standard score of 87), concept formation (standard score of 84), and auditory working memory (standard score of 84) all fell in the low average range. These results are likely indicative of a lower verbal score and give more support and allow for more generalizability of the results.

The last follow up analysis that was done was factor analysis on the PCL to determine the factor structure for the sample with application to characteristics of psychopathy. However, the callous and emotional factor did not load cleanly onto one factor, and as a result additional analyses were not run separately on each of the factors. The results were interpreted with application to previous research. The adolescent psychopathy literature supports two models for the PCL YV, the three factor model (Cooke & Michie, 2001) and the four factor model (Neumann & Hare, 2005). Many argue that the four factor model describes psychopathy better than the three factor model because it incorporates 18 of the 20 traits whereas the 3 factor only includes 13 traits (Neumann et al., 2006).

The three and four factor models were examined. First, the three factor model was tested. The results indicated that the three factor model was a fairly good fit for the data loading seventeen out of the twenty items with no items cross loading. The factors were labeled interpersonal (factor 1), behavioral (factor 2) and affective (factor 3). Factor one
loaded nine items, factor 2 loaded four items and factor 3 loaded four items. These results also provided additional evidence for the use of the three factor model of the PCL YV with adolescents.

Next, the four factor model was tested. The four factor model also loaded seventeen out of the twenty items also providing a good fit for the data with only one item cross loading onto factors. The factors were labeled affective (factor 1), interpersonal (factor 2), behavioral (factor 3), antisocial (factor 4). Factor 1 loaded seven items, factor 2 loaded four items, factor 3 loaded three items, and factor 4 loaded two items.

There are strengths and weaknesses for each of the models. First, the three factor model more equally and cleanly loaded items onto the factors when compared to the four factor model. For example, the items loaded more equally distributed across the factors, loaded with higher coefficients, and there was no cross loading when compared to the four factor model. The four factor model, on the other hand, is more consistent with the theory and construct of psychopathy. Many of the items that loaded together on the three factor model did not make theoretical sense, whereas on the four factor the items that loaded together made theoretical sense. For example on factor 2 of the three factor model, conning and manipulation loaded with behavioral items rather than personality items like glibness and grandiosity. On the four factor model, all of the items that were expected to load on each factor did with the behavior items loading on the behavior factor, the personality loading on the personality factor, the affective loading on the affective factor. While the four factor model was still not identical to the previous four factor model of Neumann and Hare (2005), it provides a relatively good fit. These results give further
support of this model in adolescent populations. Differences between the two models are likely accounted for by the differences in the sample size and restricted range of the population.

**Limitations**

There were several limitations. However, many of these limitations could not be resolved because the data were obtained from a preexisting database. The limitations include sample size, type of population, how data were collected, how psychopathy was defined, and the type of measures used.

First, the sample size was smaller than desired. While a sample of $n = 62$ was adequate for the chosen statistical analyses, a larger sample of around 100 may have demonstrated more significant differences in some of the areas that approached statistical significance. For example, areas of planning and numbers reversed approached significant, but fell short in the MANOVAs and ANOVAs between adolescents that rated high and low psychopathy.

Another limitation was the type of population that was examined. The sample was taken from a database and participants were not selected randomly. As a result, the sample had a restricted range or it was homogeneous population. The sample was taken from a low socioeconomic status, primarily African American, low IQ, and special education population. This sample is not a realistic representation of all adolescents with psychopathic characteristics. Thus, it is difficult to generalize these results to other populations. These results can be applied to populations of students who are low achieving minority populations with CD, but have limited applicability to nonminority/higher cognitive functioning samples.
The third limitation is the study’s methodology. The summary provided to the researcher reported that data collection and administration was done according to the manuals and best practices. However, because the data were obtained from a preexisting database, best practice of test administration and data collection cannot be ensured. The first author was involved in some of the test administration and data collection, but not all. It is possible that the tests were not administered and scored as the manual suggests.

An additional limitation in this study was how psychopathy was defined. Typically, it is recommended by researchers and the PCL manual that scores above 30 on the PCL be used to classify psychopathy. Nevertheless, scores above 30 are rarely found in adolescents. Similar to a typical adolescent population, only 2 of the 62 were above the 30 cut off for psychopathy. Consequently, 25 was used to classify high/moderate psychopathy and below classified low psychopathy based on research with adolescents to achieve adequate sample size. Then the quartiles were examined, which was 26 and above for high psychopathy and 18 and below for low psychopathy. While some authors have used similar methodology (Brandt et al., 1997; Kosson, 1998), the majority of authors typically use the cut off score of 30 even in adolescent populations (Gretton et al. 2004; Saliken et al., 2004). However, the PCL YV manual does not recommend using cut off scores with adolescents (Forth et al., 2004).

The last limitation includes the instruments that were used within the study. While each of the measures used have demonstrated reliability and validity, because the author used a preexisting database, the measures were not able to be selective. Furthermore, past researchers have not use the WJ III COG NU to examine differences in neuropsychological functioning in psychology. It is possible that the WJ III COG NU
measures somewhat different skills than measures that have been used such as the Stroop measures and other measures of neuropsychological functioning that eliminate the cognitive demands that may overlap the various areas of attention and executive function. These measures include the continuous performance task or an eye blink/pre pulse inhibition task. Moreover, the WJ III COG NU does not measure bottom up processing related to selective attention, which is likely where the deficit lies in psychopathy.

Implications for Future Research

The results give several implications for future researchers in the construct of psychopathy in adolescents. Furthermore, researchers should examine neuropsychology of psychopathy in adolescents and related callous and unemotional traits, neuropsychological functioning between high and low psychopathy groups in adolescents, and expanding the adolescent psychopathy literature base to non-offender populations.

First, the literature needs to establish reliable findings on the neuropsychological findings in adolescents. The majority of areas in this study were consistent with previous research including sustained attention, shifting attention, and concept formation. However, they were not consistent in the areas of selective attention, planning, and attention capacity. Moreover, additional research is needed to examine selective attention, planning, and attention capacity to determine where specific deficits lie to help understand the construct of psychopathy in adolescents for better treatment planning and intervention.

An additional area that research could further analyze is neuropsychological patterns to callous and unemotional traits. This study pioneered the connection between
callous and unemotional traits and neuropsychological correlates based on the overlapping brain systems between the two. Based on the findings that planning significantly accounts for the variance in self-reported callous and unemotional traits, it is implied that those with high ability to plan also have high callous and unemotional traits. With application to the IES model those with high callous and unemotional traits are not able to make conditioned stimulus connections and in turn are not able to make moral social references. Moreover, the common neurological systems between cognition and emotion are likely to account for the strength in planning with those with high callous and unemotional traits. These difficulties suggest orbital frontal and ventrolateral associations related to amygdala dysfunction (Blair, 2005). Future research is needed to replicate the results of this study in other populations. From there, better treatment options can be developed once the cognitive and emotional profile of psychopathy in adolescents is better understood. From there the IES model can be expanded upon.

Adding to the literature using additional neuropsychological measures will help better understand the construct of psychopathy while also adding validity to these findings. Much of the results on psychopathy only have used found deficits on certain measures. These skill deficits and strengths do not generalized to other measures that are reported to also measure that skill. For example, selective attention deficits have been found using the Stroop task, but have not been found using a variety of other neuropsychological measures. Perhaps the Stroop measure has a connection to the emotional component, and is tapping into that area. The literature needs to expand these findings or make conclusions based upon the specific aspects of selective attention that
the tests measure. By comparing different types of neuropsychological measures of attention and planning in the same study, the specific deficits can be pinpointed.

Last, future research needs to expand the literature base to include nonoffender populations. Currently, research with in adolescent psychopathic characteristics only includes offender samples. Additional research is needed to generalize the results to the entire population.

Conclusions

While there are several limitations and future research is still needed in the area of adolescent psychopathy, several notable findings were discovered. These findings include both significant and nonsignificant results and are essential to developing better interventions for adolescents with psychopathic characteristics. Moreover, the three major findings and other implications in this study are discussed in the section below.

The first major finding in this study was that planning significantly accounted for the variance in the ICU. This is a ground breaking result suggesting that the overlap in biological systems affect how adolescents with psychopathic characteristics present cognitively and emotionally, supporting the IES model of psychopathy. This finding helps understand how adolescents process information in relation to emotion and may give light to future interventions to prevent the outcomes that go along with psychopathy.

However, planning was not significant for the PCL between high and low psychopathy. In fact, it correlated the opposite indicating that those with low planning had higher psychopathy scores when compared to the ICU. These results suggest that future research should examine the ICU and PCL YV as measures of psychopathy and closely related callous and unemotional traits in adolescents.
The next finding that is notable is the difference between GIA between high and low psychopathy. While it may be a function of restricted range population, this study proposes that those with psychopathic characteristics have lower GIA than those with low psychopathic characteristics. This finding is inconsistent with previous research, and should be examined by future researchers. This finding limits the generalizability of the results to populations that do not have similar characteristics of low GIA scores due to low verbal scores. However, the subtests that were examined were not nearly as low indicating the results apply to samples with similar characteristics.

When applying low GIA scores to the theory of psychopathy, one should use caution. It is likely that GIA was a product of low verbal ability in this sample and is not indicative of all samples with psychopathy. Some samples have reported lower IQ in those with psychopathy (Farrington, 2005), whereas others have reported above average results (Cleckly, 1976; Salekin et al., 2004). It is likely that those who have higher IQ scores are less likely to get caught and as a result are not sampled in many of the studies that use offender populations. Theory should not reflect our findings unless applying it to samples with similar demographics.

There were several findings in this sample that suggest that many of the RM hypothesis does not apply to this sample. The nonsignificant findings in the areas of selective and shifting attention indicate that there was not a deficit in shifting attention from one task to another. In our sample the RM does not explain cognitive processing in adolescents with psychopathic characteristics of callous and unemotional traits.

The last major finding was the factor structure of the PCL YV. Consistent with previous research, the three and four factor models both provided a good fit for the data.
Both provided their own strengths and weaknesses. The four factor model made more theoretical sense than the three factor model. However, the four factor model did not evenly distribute items onto the factors when compared to the three factor model, which is likely due to differences in the sample. Overall, the both the three and four factor models for adolescent psychopathy as measured by the PCL YV is the supported, and any differences that occur are likely due to sample variance.

In addition to the three major findings, there are also other implications that are important to note for future researchers. These findings include nonsignificant findings that had previously been found as significant and findings that approached significance. For example, both sustained attention and shifting attention have been found to be significant; however, it was not found to be true. While not significant, numbers reversed and planning approached significance between high and low psychopathy as measured by the PCL YV. Both of these areas should be visited by future researchers.

Recently, authors have strived to gear literature to focus on the connection of neuropsychological functioning to callous and unemotional traits due to the overlap in neurotransmitter systems in those with psychopathy (Blair, 2005); neuropsychological functioning of individuals who score high verses low on callous and unemotional traits were compared. Based on preliminary support from Howard and McCallagh (2007) and Malterer et al. (2008), the results provide an avenue for future research connecting the cognitive and emotional systems of psychopathy. All in all, additional research is needed to help clarify the construct of psychopathy in adolescents due to the detrimental life course of violence and manipulation that those who score high on psychopathy show in adulthood (Gacono & Hughes, 2004).
Reference


Bauer, L. O. & Hesselbrock, V. M. (1999). Subtypes of family history and conduct


Buckley, P.E. (1999). The role of typical and atypical antipsychotic medications the management of agitation and aggression. *Journal of Clinical Psychiatry, 60*(Suppl.10), 52-60.


structure and behavioural correlates of the Psychopathy Checklist Revised (PCL-R) in a Brazilian prisoner sample. *Personality and Individual Differences, 45*, 584-590.


the variation in the psychopathic personality. *Journal of Abnormal Psychology, 115*,
221-230.

psychopathic attributes in a noninstitutionalized population. *Journal of
Personality and Social Psychology, 68*, 151-158.

University Press.

self-report measure of psychopathic personality traits in noncriminal populations.
*Journal of Personality Assessment, 66*, 488-524.

drug potentiate on GABA on extinction of positively reinforced behaviour.
*Neuroscience and Behavioral Reviews, 28*, 229-238.


features: 6 year temporal stability and the prediction of externalizing symptoms
during the transition to adulthood. *Aggressive Behavior, 33*, 242-252.

forensic applications. In Ribner, N. G (ed.). *The California School of


Patterson, C. M. & Newman, J. P. (1993). Reflectivity and learn from aversive events:
Toward a psychological mechanisms for the syndromes of disinhibition.

*Psychological Review, 100*, 716-736.


*Aggressive Behavior, 29*, 393-405.


primary psychopathy. *Journal of Personality Assessment, 62*, 130–144


Smidts, D. P., Jacobs, R., Anderson, V. (2004). The Object Classification Task for


ON, Canada: Multi-Health Systems.


### Table 11

**Pearson Correlation Matrix Results Among Study Variables**

|   | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    | 12    | 13    | 14    | 15    | 16    | 17    | 18    | 19    | 20    | 21    | 22    | 23    | 24    | 25    | 26    | 27    | 28    | 29    | 30    | 31    | 32    | 33    | 34    | 35    |
|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1. Item 1 | 1     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     |
| 2. Item 2 | .57*  | 1     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     |
| 3. Item 3 | .24   | .28*  | 1     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     |
| 4. Item 4 | .31*  | .05   | .16   | 1     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     |
| 5. Item 5 | .51   | .33*  | .12   | .09   | 1     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     |

**Note:** *p<0.05 (list each of the variables). Intper = Interpersonal Factor, Affect = Affective Factor, Antisocial = Antisocial Factor, Lifestyle = Lifestyle Factor, B atten = Broad attention, Exec Proc = Executive Processes, N Rev = Numbers Reversed, Aud Atten = Auditory Attention, Con Form = Concept Formation, Pair Can = Pair Cancellation, Aud WM = Auditory Working Memory
<table>
<thead>
<tr>
<th>Item Number</th>
<th>Item Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Glibness/superficial charm</td>
</tr>
<tr>
<td>2</td>
<td>Grandiose sense of self-worth</td>
</tr>
<tr>
<td>3</td>
<td>Need for stimulation/proneness to boredom</td>
</tr>
<tr>
<td>4</td>
<td>Pathological lying</td>
</tr>
<tr>
<td>5</td>
<td>Conning/manipulative</td>
</tr>
<tr>
<td>6</td>
<td>Lack of remorse or guilt</td>
</tr>
<tr>
<td>7</td>
<td>Shallow affect</td>
</tr>
<tr>
<td>8</td>
<td>Callous/lack of empathy</td>
</tr>
<tr>
<td>9</td>
<td>Parasitic lifestyle</td>
</tr>
<tr>
<td>10</td>
<td>Poor Behavioral controls</td>
</tr>
<tr>
<td>11</td>
<td>Promiscuous sexual behavior</td>
</tr>
<tr>
<td>12</td>
<td>Early behavior problems</td>
</tr>
<tr>
<td>13</td>
<td>Lack of realistic, long-term goals</td>
</tr>
<tr>
<td>14</td>
<td>Impulsivity</td>
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<tr>
<td>15</td>
<td>Irresponsibility</td>
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<tr>
<td>16</td>
<td>Failure to accept responsibility for own actions</td>
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<tr>
<td>17</td>
<td>Many short term marital relationships</td>
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<tr>
<td>18</td>
<td>Juvenile delinquency</td>
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<tr>
<td>19</td>
<td>Revocation of conditional release</td>
</tr>
<tr>
<td>20</td>
<td>Criminal Versatility</td>
</tr>
</tbody>
</table>
Table 13

PCL YV Items Numbers and their Corresponding Labels

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Item Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Impression management</td>
</tr>
<tr>
<td>2</td>
<td>Grandiose sense of self-worth</td>
</tr>
<tr>
<td>3</td>
<td>Stimulation Seeking</td>
</tr>
<tr>
<td>4</td>
<td>Pathological lying</td>
</tr>
<tr>
<td>5</td>
<td>Manipulation for personal gain</td>
</tr>
<tr>
<td>6</td>
<td>Lack of remorse</td>
</tr>
<tr>
<td>7</td>
<td>Shallow affect</td>
</tr>
<tr>
<td>8</td>
<td>Callous/lack of empathy</td>
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<tr>
<td>9</td>
<td>Parasitic orientation</td>
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<tr>
<td>10</td>
<td>Poor anger control</td>
</tr>
<tr>
<td>11</td>
<td>Impersonal sexual behavior</td>
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<tr>
<td>12</td>
<td>Early behavior problems</td>
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<tr>
<td>13</td>
<td>Lacks goals</td>
</tr>
<tr>
<td>14</td>
<td>Impulsivity</td>
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<tr>
<td>15</td>
<td>Irresponsibility</td>
</tr>
<tr>
<td>16</td>
<td>Failure to accept responsibility</td>
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<tr>
<td>17</td>
<td>Unstable interpersonal relationships</td>
</tr>
<tr>
<td>18</td>
<td>Serious criminal behavior</td>
</tr>
<tr>
<td>19</td>
<td>Serious violations of conditional release</td>
</tr>
<tr>
<td>20</td>
<td>Criminal Versatility</td>
</tr>
</tbody>
</table>