ABSTRACT

Title of Document: THE RELATIONSHIP BETWEEN RISK-TAKING AND PSYCHOPATHY IN A SAMPLE OF INNER-CITY DRUG USERS.

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The goal of the current study was to determine whether level of psychopathy (measured using the Psychopathic Personality Inventory; PPI) was a predictor of risk-taking (measured using the Balloon Analogue Risk Task-Revised Automatic Version; BART), controlling for demographic variables, substance use, and psychopathology. The sample consisted of 60 male and 30 female inner-city drug-dependent individuals currently enrolled in a residential substance abuse treatment program. Additionally, we examined punishment and reward reactivity (PR and RR, respectively) as well as the Absolute value of punishment reactivity (APR) and reward reactivity (ARR) as measured by the BART as a function of PPI score. Separate regression analyses failed to find a relationship between PPI total score and BART, PR, RR, APR, or ARR. Looking at PPI subscales, results indicated an inverse relationship between the Blame Externalization subscale of the PPI and BART score. Results also indicated that the PPI subscale Machiavellian Egocentricity predicted PR but in the opposite direction than expected.

Higher scores on the PPI Carefree Nonplanfulness subscales were found to be related to decreased PR and RR. PPI Coldheartedness subscale predicted higher levels of PR and PPI Blame Externalization subscale predicted lower levels of RR. Lower levels of APR and ARR were found to be related to higher scores on the PPI Blame Externalization subscale. Overall, the results were mixed and did not lend strong support regarding the relationship between risk-taking and psychopathy.

THE RELATIONSHIP BETWEEN RISK-TAKING AND PSYCHOPATHY IN A SAMPLE OF INNER-CITY DRUG USERS.

By

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Dedication

This dissertation is dedicated to my father, Michael Bernard Trotman.

Acknowledgments

This dissertation could not have been completed without the help of my supportive, loving, and knowledgeable friends and family; as such, I would like to take this opportunity to acknowledge their extraordinary contributions. I am unable to thank everyone individually; but to everyone who listened to me vent, lent me a shoulder to cry on, pressed me when I wanted to give up, or lent me their academic knowledge or general wisdom, I want to thank you all for your unwavering support. One individual has stood out from the rest and provided me with all that she has and all that she is and that is my mother, Gloria Trotman. I love you with all my heart. This PhD is yours as much as it is mine.

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Chapter 1: Introduction

Overview of the Disorder

Psychopathic Personality Disorder (psychopathy) is a major public health concern with severe and detrimental consequences for individuals, families, and society at large. Indeed, Hare (1995) reported that while only 20% of incarcerated individuals meet criteria for psychopathy, they commit more than 50% of the most severe violent crimes. Further, several studies have reported that psychopathic individuals were charged with more types of crimes as well as more violent crimes than non-psychopathic individuals (e.g., Hare, McPherson, & Forth, 1988; Kosson, Smith, & Newman 1990; Serin & Amos, 1996). Serin and Amos (1996) found that psychopaths were more than twice as likely to have used a weapon, threats, or instrumental aggression, both inside and outside of prison. Finally, research has shown that psychopathy is an unremitting disorder such that psychopaths are more likely to recidivate and more likely to do so sooner following release from prison than non-psychopaths (Laurell, 2005). Due to the obvious threat to public health and safety that psychopaths pose, researchers have made a concerted effort to understand psychopathy as well as the basic deficits underlying the disorder. Although significant progress has been made in understanding the disorder, results from the current research leave more questions than answers.

Psychopathic Personality Disorder (psychopathy) was first characterized by Pinel in the early 1800s, with Pinel (1801/1962) describing the condition as *manie sans delire* (insanity without delirium). The disorder has since been conceptualized as a constellation

of maladaptive affective, interpersonal, and behavioral characteristics including egocentricity; impulsivity; irresponsibility; shallow emotions; lack of empathy, guilt, or remorse; pathological lying; manipulativeness; and persistent deviation from social norms and expectations (Cleckley, 1976). It is characterized by persistent violations of the rights of others, as well as unlawful behavior, deceitfulness, general manipulation, and a reckless disregard leading to the mistreatment of others. Interpersonally, these individuals have been described as grandiose, charismatic, forceful, and "cold-hearted" and are generally unable to maintain close relationships with others (Cleckley, 1976).

Although Cleckley provided the seminal conceptualization of psychopathy, the most current description and measure of psychopathic characteristics and behaviors is the Psychopathy Checklist—Revised (PCL-R; Hare, 1980, 1991). Factor analyses of the PCL-R generally reveal a two-dimensional factor structure of psychopathy (Hare, Hart, & Harpur, 1991; Harpur, Hakstian, & Hare 1988; Harpur, Hare, & Hakstian, 1989). An emotional detachment factor (Factor I) reflects interpersonal and affective characteristics such as egocentricity, lack of remorse, callousness, lack of emotionality or empathy, superficial charm, and a grandiose sense of self-worth (Hare et al, 1991). This factor has been positively associated with low levels of anxiety (Harpur et al, 1989). Further, individuals high in Factor I engage in more instrumental or premeditated aggressive behaviors (Patrick & Zempolich, 1998; Woodworth & Porter, 2002) and are unlikely to benefit from psychotherapy (Hobson, Shine, & Roberts, 2000; Seto & Barbaree, 1999). In contrast, Factor II reflects aspects of psychopathy related to a lifestyle characterized by chronically unstable and dissocial behaviors, including impulsivity, irresponsibility, and thrill-seeking. Factor II correlates higher with a diagnosis of Antisocial Personality

Disorder (Harpur et al, 1989), increased engagement in criminal behaviors, lower socioeconomic background, and higher self-reports of antisocial behavior (Hare, 1991). Higher Factor II scores also are associated with substance abuse (Smith & Newman, 1990), suicidal behaviors (Verona, Patrick, & Joiner, 2001), emotionally laden acts of violent aggression, and prison recidivism (Bonta, Law, & Hanson, 1998; Hare, 1999; Hare, Clark, Grann, & Thornton, 2000; Hemphill, Hare, & Wong, 1998; Salekin, Rogers, & Sewell, 1996).

Comorbidity rates between psychopathy and other psychopathology is generally low (estimated to be less than 10%; Hare, Strachan, & Forth, 1993); however, there are two major exceptions to this rule. First, it has been estimated that up to 90% of individuals with psychopathy also present with comorbid substance use disorders (SUDs; Dinwiddie, 1997; Hesselbrock, Meyer, & Kenner, 1985; Jordan, Schlenger, Fairbank, & Caddell, 1996; Kessler et al., 1997; Knop, Jensen, & Mortensen, 1998; Nedopil, Hollweg, Hartmann, & Jaser, 1995; Smith & Newman, 1990). Although the causes of the comorbidity between psychopathy and substance use disorders are unclear, researchers suggest that this relationship is a function of the core characteristics of psychopathy, such as the need for stimulation/proneness to boredom, as well as impulsivity (Smith & Newman, 1990). A similar comorbid relationship exists between psychopathy and Antisocial Personality Disorder (Martens, 2000; Robins, Gentry, Munroz, & Marte, 1977; Robins & Regier, 1991; Smith & Newman, 1990), although this may be more easily explained by the fact that the diagnostic criteria for both ASPD and psychopathy Factor II scores are based upon dissocial behaviors. It should be noted that Factor I scores *do*

distinguish between ASPD and psychopathy, suggesting that although these two conditions are related, they are distinct entities (Harpur, et. al., 1989).

Psychopathy is unique from both ASPD and SUDs in terms of the extent and severity of engagement in criminal behaviors. Beyond general criminal behavior (i.e., property crimes and theft), estimates indicate that individuals suffering from psychopathy are significantly more likely to engage in violent crimes; specifically, within a population of convicted individuals, 97% of psychopaths versus 74% of non-psychopaths received at least one conviction for violent crime (Hart & Hare, 1989). Psychopaths are also more likely to engage in a variety of different types of aggressive acts than are non-psychopaths (Hare, McPherson, & Forth, 1988). Moreover, individuals with psychopathy have significantly higher recidivism rates than their non-psychopathic counterparts (Serin and Amos, 1995). In fact, not only are psychopaths more likely to recidivate, they have been shown to do so more quickly following release (Gretton, McBride, Hare, O'Shaughnessy, & Kumka, 2001). Additionally, psychopathy is a particularly strong predictor of recidivism in respect to violent crimes (Laurell, 2005). Finally, psychopaths become criminally active earlier and stay more criminally active throughout much of their life span than other offenders, including individuals with non-psychopathic ASPD (Hare, 1991; Hare, Strachan, & Forth, 1993), and this is especially the case for violent criminal activity (Hare, et. al., 1988).

Taken together, these alarming statistics underscore the need to investigate the basic mechanisms underlying this disorder. As such, several researchers have developed theories that attempt to explain the etiology of and deficits resulting from psychopathy. Below, the most widely used theories of psychopathy will be reviewed, taking into

consideration their limitations. Included will also be a novel theory of psychopathy that is promising in its potential to comprehensively address the behavioral deficits exhibited by psychopaths.

Theories of Psychopathy

Behavioral Activation System and Behavioral Inhibition System.

Gray (1981, 1982) holds that two general motivational systems underlie behavior and affect: a behavioral inhibition system (BIS) and a behavioral activation system (BAS). The BAS (Gray 1994) activates approach behaviors in response to reward stimuli. Gray initially proposed a link between the BAS and the septohippocampal system; more recently, he has expanded this to include the amygdala. Dopamine has also been shown to play an essential moderating role in the functioning of reward seeking (Depue & Iacono 1989), but the full relationship of dopaminergic activation and reward is still unclear (Wise & Rompre, 1989). Using an analogy of a car, the BAS serves as the acceleration pedal.

Conversely, the BIS is the braking system of goal-seeking behavior. Signals of non-reward (including punishment, novel stimuli, and innate fear stimuli) lead to behavioral inhibition and increased environmental awareness, as reflected by incremental increases in physiological arousal and attention (Fowles, 1988; Gray, 1982). Within the brain, the BIS has been associated with several brain structures including the septohippocampal system and the prefrontal cortex. Based upon Fowles' (1988) theory, both the BAS and BIS have positive inputs to a third nonspecific arousal system (NAS), which is responsive to their excitatory inputs. An increase in the activity of either behavioral system, BIS or BAS, results in heightened NAS activity. These systems

produce incremental increases in general arousal that aid in the motivation of related approach or refraining behaviors. Based on a review of numerous human and animal physiological studies, Fowles (1980) proposed psychophysiological indices of the BAS and BIS suggesting that in the presence of a stimulus, increases in heart rate (HR) are associated with activity in BAS while increases in electrodermal activity (EDA) are associated with activity in the BIS.

Researchers have applied the BAS/BIS theory to psychopathology suggesting that high sensation-seeking (i.e., engagement in varied, novel, complex, and intense experiences that may involve varying levels of risk; Zuckerman, 1994) is associated with high levels of BAS functioning; anxiety and neuroticism are believed to reflect chronically high levels of BIS function (Gray 1994). As such, negative affect and state anxiety are considered to be markers of BIS activation. Also, depression has been proposed to reflect high BIS and low BAS activity (Clark & Watson 1991).

Applied to psychopathy, Gray (1970) suggests that based on his theory, psychopaths should show normal BAS functioning and weak BIS functioning. Research showing poor learning in passive avoidance (inhibition of a target behavior in order to avoid punishment) exhibited by psychopaths were put forth as support for this theory. It should be noted that Folwes (1980) suggests that although psychopaths have dysfunctional passive avoidance abilities, their active avoidance response abilities (i.e., active behavior to avoid or alleviate an aversive stimulus), as well as active goal-seeking behavior capabilities remain intact, as these behaviors fall under BAS rule. Folwes did, however, indicate that active avoidance behaviors exhibited by psychopaths may be under-socialized when necessary (e.g., feigning remorse or lying to avoid blame for a

misdeed, killing witnesses to reduce the chances of prosecution; Fowles, 1980). Fowles suggests that based on the deficient BIS hypothesis, psychopaths would be less restrained by the potential punishments for making these active avoidance responses. Further, deficits in BIS activation as exhibited in conflict situations predicts that psychopaths would exhibit lower levels of anxiety and arousal associated with BIS functioning as compared to non-psychopaths. The dysfunctional BIS theory is applied to the anecdotal and clinical accounting of diminished anxiety (Cleckley, 1950) as well as empirical evidence of lower levels of arousal across various situations (Lykken, 1957; Arnett, 1997).

The BAS/BIS theory as applied to psychopathy helps to conceptualize certain aspects of disinhibition that are characteristic of psychopaths, but the theory can not provide a comprehensive account of psychopathy because it is difficult to generalize this theory to the full disorder as several of the deficits exhibited by psychopaths (e.g., shallow emotionality, pathological lying) are not addressed by this theory. As an example, although the theory suggests a deficit in BIS functioning combined with intact BAS functioning, it does not explain maladaptive goal-oriented behavior (e.g., instrumental aggression). A hyperactive BAS theory has been purported (Newman, MacCoon, Vaughn, & Sadeh, 2005); however, the data do not support this application of the theory to psychopathy. A final limitation of the BIS/BAS model is that anxiety has been shown to have an effect on task performance in psychopaths (Arnett, Smith, & Newman, 1997), yet this contradicts the theoretical model itself, as a dysfunctional BIS should hypothetically correspond to low levels of anxiety.

Damasio's Somatic Marker Theory

The somatic marker hypothesis (Damasio, 1994) is a neuropsychological model of behavior suggesting that behavior is regulated by an interaction between affective states and information processing. More specifically, Damasio (1994) proposed that individuals make decisions about their behavior based on the emotional impact of specific cognitions. It is suggested that particular emotions "mark" response options. As such, problems in decision-making occur when cognitions are not marked by emotions (somatic states). Somatic markers are created over time through the connection between certain types of stimuli and certain types of affective states based on past events. Once formed, the somatic marker guides behavior by focusing attention on the negative or positive outcomes of a given action and then informing an individual "somatically" to proceed or desist with a certain course of action.

When applied to psychopathic behavior, the somatic marker theory provides a potential integration of motivational, affective, and information-processing deficits. Instead of focusing solely on sensitivity to punishment cues, the somatic marker hypothesis suggests that psychopaths fail to make the emotional connection such that future relevant cognitions do not elicit the "normal" physiological reaction that is associated with a given state of affect (for a more detailed discussion of this topic, see Damasio, Tranel, & Damasio, 1990, Damasio, 1994 as well as LeDoux, 1996). Supporters of this theory purport that the somatic marker hypothesis could provide an explanation for many symptoms of psychopathy, including impulsivity, irresponsibility, and failure to follow any life plan. Unfortunately, results from studies testing the application of this theory to psychopaths are limited, and are mixed at best (Schmitt,

Brinkley, & Newman, 1999; van Honk et al, 2002). In part, this application/extension failure stems from the fact much of the somatic marker work has been based on patients with brain damage (i.e., damage to the ventromedial prefrontal cortex, VMF). Indeed, although patients with VMF damage/lesions may share some the character traits exhibited by psychopaths, specifically, those traits captured by the somatic marker theory (i.e., impulsivity, irresponsibility, and failure to follow any life plan), these shared traits are not unique to psychopathy but instead are common across several impulse-control disorders. The current model fails to address the more central deficits characterized by psychopaths (e.g., shallow emotionality, lack of empathy, excessive risk-taking), and thus, may not provide a comprehensive theory of psychopathy.

Response Modulation Theory

Response modulation is defined as a brief shift in attention from the organization and implementation of goal-directed behavior to its evaluation (i.e., going from "doing" to "thinking about what you are doing"; Newman & Wallace, 1993). This brief shift in attention is a relatively automatic process; therefore is not dependant upon effortful processing. However, during goal-oriented behavior, response modulation is necessary for self-regulation processes (i.e., effortful self-monitoring, evaluating, and if necessary, altering of behavior; Newman & Wallace, 1993). As applied to psychopathy, Newman and Wallace (1993) noted that at a behavioral level, psychopaths do not appear to be insensitive to punishment unless there is a competing reward contingency present. They cite go/no-go discrimination tasks in which subjects must inhibit specific responses to avoid punishments as evidence (Arnett et. al., 1997). In these studies, psychopaths commit significantly more passive avoidance errors while responding for rewards;

however, they avoid punishment as well as controls when no competing reward contingency is present (Arnett et. al., 1997; Newman & Kosson, 1986). Specifically, the theory purports that psychopaths have difficulty shifting their attention from the performance of their behavior (e.g., responding in order to gain a specific reward) to the consequences of related behaviors (receiving punishments for incorrect responses that are different than responses for the reward; Newman & Patterson, 1993).

The response modulation theory is a unique model of psychopathy in that its main focus is on attention. Unfortunately, there are several limitations to the model that prevent it from being a comprehensive theory of the disorder. Most notably, the theory fails to translate into real-world deficits, such that few, if any behaviors outside the laboratory would correspond to performance on the task. Moreover, studies testing this theory have shown that psychopaths do as well as or better than controls on tasks, implying that psychopaths may, in fact, have a goal-oriented attentional advantage (Newman, Schmitt, & Voss, 1997; Kiehl, Hare, Liddle & McDonald, 1999).

Integrated Emotion Systems Theory

The Integrated Emotions Systems Theory (IES) ties early amygdaloidal dysfunction to psychopathy. The amygdala dysfunction theory is a promising (albeit new) model of psychopathy (Blair, 2001, 2002; Blair et al., 1999; Patrick, 1994). Support for this theory stems from both neurobiological and behavioral research. As an example, researchers have discovered that individuals with psychopathy have reduced amygdaloidal volume relative to controls (Tiihonen et al., 2000), and show reduced amygdala activation during emotional memory (Kiehl et al., 2001) and aversive conditioning tasks (Veit et al., 2002). Importantly, several of the behavioral deficits that

have been shown to be evident in psychopaths (e.g., aversive conditioning, startle reflex, punishment-anticipatory arousal) are governed by the amygdala (Blair, 2001). Most importantly, the amygdala is crucially involved in the formation of stimulus–reward and stimulus–punishment associations necessary for instrumental learning to occur (Baxter & Murray, 2002). To summarize, the basic thrust of the IES theory is that early amygdaloidal dysfunction associated with psychopaths leads to impaired instrumental learning resulting in a wide variety of the behavioral deficits associated with the disorder.

Numerous studies have implicated the amygdala as a governing factor in instrumental learning (Ambrogi Lorenzini, Baldi, Bucherelli, Sacchetti, & Tassoni, 1999; Everitt, Cardinal, Hall, Parkinson, & Robbins, 2000; Killcross et al., 1997; LeDoux, 2000). Although the true nature of the amygdaloidal dysfunction is unclear, the impact on instrumental learning is a specific, detrimental result. Given the aforementioned evidence that psychopathic individuals do indeed show dysfunction in the region of the amygdala, it is not surprising that such individuals show marked impairment on passive avoidance learning tasks (Newman & Kosson, 1986; Newman & Schmitt, 1998; Thornquist & Zuckerman, 1995) as well as aversive conditioning tasks (Flor, Birbaumer, Hermann, Ziegler, & Patrick, 2002).

Yet despite promising results, studies attempting to link amygdala dysfunction and instrumental learning evidence major limitations. First, instrumental learning consists of conditions of reward, punishment and concurrent reward and punishment. Although the amygdaloidal dysfunction theory suggests that instrumental learning should be impaired in this population, to date there have been no published studies involving conditions of reward only, and only one study examining the impact of increasing reward

during a concurrent reward punishment condition (Blair et. al., 2004). The results of this study actually suggest that instrumental learning within stimulus-reward conditions are not deficient in psychopaths, suggesting that only the amygdala's role in the formation of stimulus–punishment associations is compromised (Peschardt, Morton, and Blair, 2003). However, more recent research has supported the supposition that the amygdaloidal deficit includes both stimulus-punishment and stimulus reward conditions (Blair, Morton, Leonard, and Blair, 2006). Although, this theory may account for the findings cited in previous models and add to those models by addressing more of the behavioral deficits evidenced by psychopaths, additional research examining a wider variety of instrumental learning paradigms related to psychopathy is needed to provide an invaluable piece to the IES puzzle. Until such research is conducted, generalizability of the theory is limited.

In addition to the development of theories of psychopathy, researchers have also taken steps to delineate specific behavioral deficits exhibited by individuals with psychopathy. Based on clinical observations suggesting that psychopaths generally fail to learn from their experiences (as evidenced by their substantially elevated rates of recidivism), a wealth of recent research regarding psychopathic behavioral deficits has focused on specific learning paradigms related to reactions (or sensitivity) to punishment in the presence or absence of reward, including passive avoidance and response reversal.

Learning Paradigms

Passive Avoidance

Passive avoidance is a learning paradigm that requires an individual to inhibit a specific behavioral response to a target stimulus in order to avoid punishment (Lykken, 1957). It is suggested that individuals who show deficits on passive avoidance

performance tasks demonstrate a significant reduction in reflection on negative feedback (i.e., punishment), implying an inability to take sufficient time to reflect on error leading to the decreased opportunity for the evaluation of, and subsequent learning from, incorrect responses. As a result, there is an increased likelihood of future maladaptive behavior (Newman, Patterson, & Kosson, 1987). As an example, failing to slow down for a speeding camera even after repeated traffic citations could be conceptualized as a deficit in passive avoidance.

Lykken (1957) conducted the seminal study of passive avoidance in psychopaths. In this study, low-anxious psychopaths performed significantly worse on a passive avoidance task than low-anxious controls. More recent studies have attempted to replicate these results, with varying degrees of success. For instance, several studies indicate that psychopaths perform significantly worse on these tasks than non-psychopaths, but only under certain conditions (Schachter & Latane, 1964; Schmauk, 1970). Based on results from a study conducted by Schmauk (1970), it was proposed that the nature of the negative reinforcer might affect the degree of impairment shown by individuals with psychopathy (i.e., impairment by psychopaths was not demonstrated when the aversive stimulus was financial loss but did show impairment when the aversive stimulus was electric shock). More recent studies have produced mixed results; however, type of reinforcement does not seem to differentiate psychopathic performance on passive avoidance tasks (Newman & Kosson, 1986; Newman & Schmitt, 1998; Newman, Widom, & Nathan, 1985; Thornquist & Zuckerman, 1995).

A more direct investigation of passive avoidance learning using loss of money was conducted by Newman and Kosson (1986). Using an explicit passive avoidance

paradigm comparing reward- and punishment-based contingencies as well as punishment-only contingencies, 60 psychopathic and non-psychopathic participants performed a go/no go discrimination task in which responding to each of four rewarding stimuli (specific numbers presented on a computer screen) was associated with small monetary gains in the form of a chip (worth 10 cents) and failure to inhibit response to each of four punishing stimuli was associated with the loss of a chip. The entire set of 8 numbers was repeated 10 times and participants were instructed to learn by trial and error when to respond to earn money (reward) and when not to respond to avoid loss of money (passive avoidance). As predicted, there was no difference between psychopaths and controls in learning to respond to rewarding stimuli but psychopaths committed significantly more passive avoidance errors than controls. Further, using the same discrimination task, the researchers examined passive avoidance using punishment incentives only. In this condition, participants started out with a set amount of chips representing 10 cents and they lost a chip whenever they responded to the punishing stimuli and when they failed to respond to "rewarding" stimulus (active avoidance condition). There were no group differences in performance on the task with a punishment only condition. The results of this study suggest that reward plays a role in the relationship between passive avoidance tasks and psychopaths, the specific role remains unclear. Further, a major limitation to the current study is that the subjects were limited to Caucasian male inmates, making the results difficult to generalize to other populations. Additionally, researchers failed to control for substance use.

A study by Arnett, Howland, Smith, & Newman (1993) failed to find group differences in a punishment and reward passive avoidance paradigm. Researchers

examined passive avoidance in 59 low- and high- anxious Caucasian psychopathic and non-psychopathic incarcerated individuals. Their passive avoidance task was similar to the task used by Newman and Kosson (1986) where subjects gain money for responding to the reward stimuli and lose money when they fail to inhibit responding to punishment stimuli. Results found that psychopathy was unrelated to passive avoidance errors on the task regardless of anxiety level. Again, the lack of diversity exhibited by the sample as well as a lack of significant results makes conclusions difficult to draw. In a recent dissertation study of psychopathic and non-psychopathic individuals, passive avoidance deficits were found only in low-anxious psychopaths (Swogger, 2007).

Arnett, Smith, and Newman (1997) compared 29 psychopaths and 29 non-psychopaths on behavioral responding to monetary reward and punishment during a continuous passive avoidance task. The Welsh Anxiety Scale (WAS; Welsh, 1956) was used to control for level of anxiety. In the first experiment, subjects made button presses to reward cues for l minute before confronting a salient punishment cue and a l-minute passive avoidance phase (i.e., a phase where they inhibit button presses to avoid monetary loss). Results showed that there were no differences on passive avoidance learning between low-anxious psychopaths and low-anxious controls. In the second experiment, subjects were exposed to an active avoidance phase (i.e., button presses to prevent punishment) for 1 minute before the passive avoidance phase. There was no differences found task performance in this condition either.

In an attempt to clarify these disparate results, Blair and colleagues (2004) investigated the passive avoidance paradigm in psychopaths with varying levels of reward/punishment in 40 psychopathic and non-psychopathic individuals. The passive

avoidance task was a modified version of the task described above; however individual rewarding/punishing stimuli were associated with specific levels of point reward/punishment. Reinforcement values were plus or minus 1, 700, 1400 and 2000 points for the four different reward and punishment stimuli. Participants had to learn by trial and error to press the spacebar key in response to the rewarding stimuli and to inhibit responding to the punishing stimuli. After each response, participants received feedback on how many points they had won or lost. All participants started with 10,000 points at the beginning of the task, and a running points total was visible on the screen at all times. The results showed that individuals with psychopathy made significantly more passive avoidance errors than non-psychopaths regardless of level of punishment while performance of non-psychopathic individuals was moderated by level of punishment. In regard to omission errors, performance across groups was comparable and was moderated by level of reward. This study is unique in its explicit examination of the differential effects of reward and punishment on passive avoidance tasks and suggests that reward may be play a very important role in the instrumental deficits that psychopaths exhibit. Although these results may help to clarify the impact of reward on passive avoidance learning paradigms, results are limited once again to the lack of diversity of the sample. It should be noted that in this study there was a small number of minority subjects included (n = 5). Therefore, the limited sample precludes the researchers from generalizing the results across different populations. As this study is unique in its design, results will need to be replicated before definitive conclusions can be made.

Overall, research on passive avoidance learning suggests that individuals with psychopathy do indeed show deficits; however, the relationship is at least partially

moderated by reward. It should be noted that the homogeneity of the participants within these studies makes generalizability extremely difficult. Moreover, these studies also fail to take substance use into account, despite the well-documented finding that prevalence rates of SUDs within psychopaths are significantly higher than among non-psychopaths. Future research in this area should continue its focus on the impact of reward in passive avoidance paradigms but should also include a greater percentage of ethnic minorities and address comorbidity issues as a part of their methodological design.

Response Reversal/Extinction

A smaller body of literature has emerged on a variation of the passive avoidance paradigm. Response reversal is similar to passive avoidance; however, in this punishment paradigm individuals are initially rewarded for a target behavior, then following a set number of trials, the behavior is consistently punished. The goal of the task is for the participant to change or extinguish the target behavior upon discovery that it results in punishment; performance is measured as latency to behavior change/extinction. The response reversal paradigm was applied to psychopathy in order to help provide more insight regarding relationship between reward and punishment in psychopaths.

In a study by Newman, Patterson and Kosson (1987), 36 incarcerated Caucasian psychopaths and 36 matched non-psychopathic controls participated in a response reversal task. In the task, subjects were presented with 100 cards in a deck via computer. At the beginning of each trial (card presentation), the participants were asked on the computer screen if they wanted to play that card. If participants indicated that they wanted to play the card the card was displayed along with the words, “YOU WIN” or “YOU LOSE” on the screen. Subjects began the task with 10 chips, each worth 5¢, and

were instructed to play as many cards as they wished. The experimenter gave and took away chips as the subjects won and lost. Subjects won 5¢ whenever a button press was followed by a face card and they lost 5¢ whenever a number card appeared. The probability of losing (i.e., getting a number card) increased by 10% with every block of 10 cards from 10% to 100%. The dependent measure was the number of cards played before quitting. Each subject was grouped into one of three possible conditions: one with immediate win/lose feedback only (group 1), one with win/lose feedback plus information regarding what the last card was (group 2), and one with win/lose feedback, last card information and a five second delay before they were asked if they wanted to play the next card (group 3). The results suggested that overall psychopaths played significantly more cards than controls; however, there were no differences between psychopaths and non-psychopaths within group 3. That is, subjects in the condition where they were told "you win" or "you lose", they were able to see what the last card was, and they were given a five second delay before being asked if they wanted to play the next card, did not differ on overall number of cards played as a function of psychopathy diagnosis. This suggests that perhaps when given feedback information and when forced to have time to consider it, psychopaths may be able to make correct response reversal decisions. It may be the case that individuals with psychopathy have the ability to interpret feedback in order to determine if a behavior is rewarding; however, they may not take enough time to consider this information before deciding on a course of action. One major limitation that renders this study rather difficult to interpret is that all subjects performed near perfectly in the third condition and that possible "floor-effects" (i.e., the task may have been too easy for all participants) preclude any conclusions being drawn

concerning this group/condition interaction. Another major limitation that the current study shares with the majority of the others reviewed is the lack of exclusion of minorities in the subject population and failure to control for substance use.

Mitchell, Colledge, Leonard, and Blair (2002), examined response reversal using a more complex task that presented two stimuli (one rewarding and one punishing) to the participant. Participants had to choose one of the two stimuli, and were rewarded or punished based on whether they chose the correct one. After several learning trials where subjects are given the opportunity to distinguish between the rewarding and punishing characteristics of the stimuli, contingencies switch, requiring the subject to reverse their responding now in order to avoid punishment and receive reward. The task consisted of nine trials with varying degrees of required reversal. The results of the study found that individuals with psychopathy made significantly more response reversal errors than controls. Limitations of the current study are in-line with previous research in the exclusion of minority participants (such that 99% of the participants were Caucasian) and failure to control for substance use. Finally, the nature of the task makes conclusions specifically about response reversal difficult to draw as the complexity of the task may require other abilities in addition to response reversal (e.g., comprehension skills, attention); it could be suggested that a deficit in one of these abilities could have accounted for differences between groups.

In a more recent study utilizing a similar response reversal task, Budhani, Richell, and Blair (2006) found that psychopathic individuals showed impairment on the reversal aspect of the task, but not the acquisition component, suggesting that the deficits exhibited are not related to comprehension of the task. However, these results showed

that the deficits reflected a decreased likelihood to repeat a rewarded response as opposed to persisting with a response that has been punished. Limitations of the current study include use of volunteer subjects given no incentive to participate. Specifically, the individuals in the study were recruited from a London Prison and received no compensation for their participation nor their performance. This may lead to a notable selection bias as well as confound effort on the task.

The current findings regarding response reversal are promising; however, research examining this behavioral paradigm is clearly still in its initial stages. Further, although both studies reviewed above claim to tap into the same phenomenon, the tasks used to do so are somewhat different (in the first study, the participant must choose to stop responding, yet in the second study, participant must switch his or her behavioral responses), and as such, may not be addressing the same paradigm. A clear operational definition of the construct may be useful in order to understand what deficits are being measured. Again, more research needs to be conducted with more diverse populations before any firm implications can be made.

The studies above provide important inroads to the understanding of some of the basic behavioral deficits associated with psychopathy. It is clear from the research that psychopaths do not perform as well as non-psychopaths on learning tasks that tap into punishment paradigms that also involve reward. However, there are several major methodological limitations that should be considered before conclusions can be drawn. The most glaring and consistent limitation was the homogeneous sample, as well as a consistent failure to control for substance use. Other methodological issues include use of incarcerated samples, and the use of laboratory tasks that may not be ecologically valid

thereby limiting external validity. Additionally, although the dysfunctional behaviors exhibited by psychopaths in their everyday lives may suggest that they fail to learn from punishment, the mixed results from the current literature make it difficult to identify specific punishment sensitivity deficits in psychopaths.

In conclusion, although one potential behavioral deficit in psychopaths is punishment sensitivity, the exact nature of hyposensitivity to punishment in relation to psychopathy is still unknown, as findings differ depending on the presence or absence of a reward in a given paradigm. A reasonable explanation of these mixed findings may be that the punishment paradigms tested may not best represent real-world situations that psychopathic individuals may encounter. Specifically, in the above studies, the rewards and punishments were administered on a discernable schedule with the values of the rewards/punishments remaining stable. Also, these studies target one specific behavior resulting in punishment and a separate behavior (including inhibition of the target behavior) resulting in reward (or lack of punishment). This differs from real-world situations, in that despite the fact that negative consequences (i.e., punishments) are a possible result of a specific behavior, these same behaviors may also result in rewards (of varying value). As such, in making an attempt to better understand the motivational factors related to these dysfunctional behaviors, it is imperative to consider approaches that may be a different proxy of real-world scenarios.

Risk-Taking

One such proxy to real-life situations is that of risk-taking behavior. Risk-taking involves engagement in a behavior that while has potential for reward, also holds the potential for punishment. During a risk-taking situation, one must weigh the internal

value of the reward against both the probability and intensity of the punishment. Clinically, based on Cleckley and on Hare's description of psychopathy, excessive risk-taking behavior has been implicitly associated with the disorder. Several of the behaviors commonly associated with psychopathy (e.g. sexual promiscuity, reckless behaviors, pathological lying, and persistent engagement in criminal activity) could easily be conceptualized as "risky" behaviors based on the above definition. Moreover, disorders that commonly co-occur with psychopathy (i.e., antisocial personality disorder, substance use disorders) are also associated with excessive risk-taking behaviors (Hare, 1995). As such, it is easy to perceive psychopaths as excessive risk-takers.

It is the case, however, that the exact nature of the relationship between risk-taking behavior and psychopathy still remains unclear. In spite of the perceived relationship described above, little can be said in regards to the relationship between psychopathy and risk-taking. The absence of risk-taking as a construct within psychopathy research is evidenced by the exclusion of risk-taking both in the development and testing of the most current and popular theories of psychopathy (Blair, 2004; Damasio, 1994; Fowles, 1988; Smith & Newman, 1987). Further, research examining risk-taking propensity as a construct within this population is very limited.

The few studies that have attempted to examine risk-taking propensity within psychopaths almost all have utilized the Iowa Gambling Task (IGT; Bechara, Damasio, Damasio, & Anderson, 1994; Bechara, Damasio, Damasio, & Lee, 1998; Bechara, Damasio, Tranel, & Anderson, 1998; Damasio, 1994; Damasio, Tranel, & Damasio, 1997; Mazas, Finn, & Steinmetz 2000). In the task, four decks of cards (A, B, C and D) are presented to players with the set goal to increase the given amount of play money.

Cards can be selected from any deck, and the subjects will make a series of 100 card selections. The decision to select from a certain deck is influenced by schedules of reward and punishment (which is not clear to the subjects at the beginning of the task). The key of the task is that although decks A and B are more lucrative ($100 per selection as opposed to $50 for C and D), the subject risks becoming bankrupt at a greater rate; therefore, decks C and D are more advantageous in the long run. The subjects become aware of this implicit rule as they progress throughout the game (Bechara et al, 1994), with those who evidence more poor decision making behavior becoming aware and or using this rule late in the task if at all. Although the task was developed to measure decision-making deficits in individuals with neurological impairment, it has become the hallmark for measuring risk-taking across several different areas of research within psychology (e.g., Aklin, Lejuez, Zvolensky, Kahler, & Gwadz, 2005; Damasio, et. al., 1997; Ernst, 2002).

Despite its popularity, it should be noted that the IGT measures specific risk-taking in a scenario where risky behavior results in an overall negative outcome. In real-world situations, risk-taking involves engagement in a behavior that the individual perceives as rewarding if unpunished, but one that entails an uncertain probability of receiving punishment (Trimpop, 1994). In this scenario, individuals have to weigh both the magnitude of reward/punishment against the likelihood of punishment. Although the outcome is more likely to be averse, it is not guaranteed. It should be noted that the IGT is a proxy of dysfunctional risk-taking in that continued high risk-taking will result in an aversive outcome. Therefore the IGT is perhaps more appropriately described as a task that measures deficits in decision-making or rule-learning. This may be especially the

case as the task was designed to elucidate the decision-making deficits exhibited by individuals with brain damage (Damasio, 1994; Bechara, et. al., 1994; Bechara, et. al., 1998). To summarize, the IGT does not take into account risk-taking that may result in overall reward and therefore, it may not be the risk-taking paradigm that is of most interest to us as it may fail to tap into the underlying construct associated with the set of risky behaviors that are most relevant/dangerous.

An alternative measure that targets more directly risk-taking propensity should entail a condition wherein the opportunity for greater reward is paired with a greater likelihood for punishment and the opportunity for smaller reward is paired with a lesser likelihood for punishment to the exclusion of "advantageous" versus "disadvantageous" choices. That is the premise of Behavioral Analogue Risk Task (BART; Lejuez, et. al., 2002). In brief, during the BART, participants accumulate money in a temporary bank by entering the number of times they wish to pump up a computer-simulated balloon. Each balloon has an explosion point which, if reached, results in the loss of all money earned for that specific balloon. If the balloon does not pop, the money earned from that balloon is transferred to a permanent bank. There are a set number of balloons, and regardless of whether the balloon explodes or money is collected, the participant moves on to the next balloon. In deciding how many times to pump up a balloon, the participant must balance the potential gain of accruing more money against the potential risk of losing all the possible money accrued for that balloon. Thus, unlike the IGT, in which each trial involves a choice between an "advantageous" and "disadvantageous" alternative (i.e., card selection), the BART involves a variable number of choices in a context of increasing risk (i.e., the amount of possible money earned and the probability of losing

that money increases with the number of times an individual decides to pump up each balloon).

In an empirical study comparing the correlation between each of these tasks and real-world risk-taking behaviors in adolescents, a significant positive relationship was found between the BART and risky behaviors. No such relationship was found for the IGT (Aklin et. al 2005). Moreover, higher scores on the BART have been shown to be significantly related to engagement in a variety of real-world risk-taking behaviors including drug use, gambling, unsafe sexual intercourse, infrequent seat belt use, and stealing in both adolescents and adults (Aklin, Lejuez, Zvolensky, Kahler, & Gwadz, 2005; Lejuez et al., 2002; Lejuez, al., 2003; Lejuez, Aklin, Zvolensky, & Pedulla, 2003).

In a recent study, the BART was used to examine the relationship between risk-taking and level of psychopathy in college students. Results of this study indicated that risk-taking behavior on the BART was significantly associated with behavioral factors ofpsychopathy (Hunt, Hopko, Bare, Lejuez, and Robinson, 2005). Although, significant, the magnitude of this relationship was modest at best. More recently, a study completed as a dissertation examined psychopathy and risk-taking using the BART. In this study the population consisted of incarcerated individuals and utilized the Psychopahty Checklist-Revised (PCL-R; Hare, 1987) in order to diagnose psychopathy. The results of the study failed to find a significant relationship between the BART and psychopathy; however, the BART was related to recreational risk taking and proneness to boredom as measured by the PCL-R, suggesting that the BART may tap into certain aspects of risk-taking (Swogger, 2007).

The results of these studies provide us with an in-road to examining the relationship between risk-taking and psychopathy and suggest the BART may be uniquely appropriate as a proxy for measuring real-world risk-taking propensity as related to psychopathy. Interestingly, this study did not examine the BART in terms of punishment and reward reactivity; this may have been an additional and potentially more useful tool for examining participant's level of risk-taking as a function of psychopathy as the main thrust of all of the theories of psychopathy include a learning deficit.

Purpose of the Current Study

Attempts to delineate the specific behavioral deficits exhibited by psychopathy have made significant progress over the last 50 years. Yet, in spite of great strides achieved by research focusing on punishment reactivity in this population, many questions still remain. One important piece of the puzzle that is still missing examines the relationship between psychopathy and situations where the same behavior may result in either reward or punishment. This is an important empirical question as many of the dysfunctional behaviors in which psychopaths engage involve this paradigm, termed risk-taking. Further, excessive risk-taking is implicitly purported to be characteristic of psychopathic personality disorder; however for the most part, the explicit relationship between risk-taking propensity and psychopathy has been neglected empirically. There have been a few attempts to examine one aspect of this paradigm; however, as these studies used a task examining risk-taking behaviors resulting in overall negative outcomes they may not be using best real-world proxy of potentially rewarding risk-taking behaviors. One study has used the BART to examine the relationship between

level of psychopathy and risk-taking behaviors; however, the population used in this study consisted of undergraduate college students and the magnitude of the results were modest (Hunt et. al, 2005). Further, this study did not examine the underlying stimulus-reward/punishment learning paradigm that has been theorized to be deficient in psychopaths.

Therefore, the purpose of the current study was to explicitly examine the relationship between psychopathy and risk-taking propensity as measured by the BART in a treatment-seeking substance abusing population. Additionally, as previous research has shown only modest differences as a function to risk-taking, we also expanded the data analyses of the task in order to examine the relationship between level of psychopathy and reward and punishment responsivity within an alternating reward/punishment operant learning schedule. As underscored by the focus of previous research, in order to capture specific underlying deficits exhibited by individuals with psychopathy, research needs to focus on examining the immediate effects of reward and punishment on future behavior. As such, the current study is unique in its examination of subject performance during both punishment (a popped balloon) and reward (a non-popped balloon) conditions. To date, this is the first study examining immediate, explicit effects of reward and punishment within an alternating schedule in a controlled lab setting.

Study Hypotheses

Aim 1

The first goal of the current study was to explicitly examine the relationship between the PPI and the BART controlling for relevant demographic, substance use, and psychopathology variables and their interactions to determine whether there is a unique link between the two variables.

Hypothesis 1: Based on Cleckley's (1976) conceptualization of the psychopath, as well as the more current theories of psychopathy (Blair, 2004; Damasio, 1994; Fowles, 1988; Smith & Newman, 1987), it was hypothesized that level of psychopathy, measured dimensionally, would be associated with risk-taking behavior as measured by total number of pumps on the BART, above and beyond variables related to BART score (e.g., demographic variables, substance use disorders, and Axis I psychopathology).

Aim 2

Another goal of the current study was to examine explicitly the effects of rewards (a non-popped balloon) and punishment (a popped balloon) on subsequent responding on the BART. This is a novel approach to examining both risk-taking behavior on the BART and general behavioral response patterns to reward and punishment in a unique paradigm in which the same behavior to varying degrees can result in either reward or punishment.

Hypothesis 2a: In line with all of the major theories of psychopathy (Blair, 2004; Damasio, 1994; Fowles, 1988; Smith & Newman, 1987), it was hypothesized that individuals with higher levels of psychopathy would exhibit a diminished reactivity to punishment on the BART.

Hypothesis 2b: Based on the IES theory of psychopathy (Blair, 2004), it was hypothesized that higher levels of psychopathy would predict a decreased sensitivity to reward on the BART. This is an especially useful hypothesis to test because unlike punishment responsivity where most theories hypothesized a diminished reactivity supported by empirical evidence, we empirically examined the aspect of the IES theory that provides an added consideration for reward reactivity that is absent in some theories of psychopathy and stand in direct contrast to the predictions of other theories of psychopathy.

Chapter 2: Methodology

Overview

This study consisted of a sample of 90 inner-city drug users currently in treatment at a residential inner-city treatment program. Exclusionary criteria included current psychosis, an inability to read or comprehend the self-report measures, or history of severe head trauma, as these conditions would have rendered any data provided by the participant difficult to interpret.

All participants provided informed consent, followed by the completion of the following questionnaires and a computerized task: (a) a diagnostic interview; (b) a set of self-report measures addressing demographic information, drug use history, and a measure of psychopathic personality characteristics; (c) a computer-based task measuring behavioral risk-taking. Presentation of these measures was counterbalanced to limit order effects.

Participants

This study contained a multi-source data collection method. The sample consisted of 60 male and 30 female participants who were receiving inpatient drug and alcohol use treatment at the time of the study. Participants for this study were recruited from Salvation Army Harbor Lights Residential Treatment Center following Intramural Review Board approval from the University of Maryland, College Park. Salvation Army Harbor Lights Residential Treatment Center is a residential substance use treatment

facility in the Washington, DC Metropolitan area. Treatment at this center involved a mix of strategies adopted from Alcoholics and Narcotics Anonymous as well as group sessions focused on relapse prevention and functional analysis. As part of their treatment at the center, study participants were required to completely abstain from drugs and alcohol, with the exception of caffeine and nicotine; regular drug testing was provided and any use were grounds for dismissal from the center. Residents were either court-mandated or volunteer treatment-seekers. Complete detoxification was required before treatment began and may be provided by an outside source, if needed, prior to entry into the center. Typical treatment lasted between 30 and 180 days and aside from scheduled activities (e.g., group retreats, physician visits), residents were not permitted to leave the center grounds during the first 30 days of treatment, then only for pre-approved purposes and with supervision provided by another member of the facility deemed responsible.

The data collection took approximately 2 hours for each individual subject. The primary investigator was present to assist in proctoring the group sessions, answering questions, and running the interviews and computerized tasks. The self-report questionnaires given to participants took approximately 60 minutes to complete. The interview took approximately 30 minutes, and the computer tasks took an additional 30 minutes to complete. Participants were paid between $15 and $20 based on BART performance in accordance to the treatment center rules.

Procedure

Potential participants were asked if they would be willing to participate in a study examining the personality and response to various situations among drug abusers. They

were informed that the session lasted approximately 2 hours and that they would be paid between $15 and $20 depending on their performance on the computerized tasks.

On data collection days, potential participants were called into a large conference room provided for the study by the treatment center. Potential participants were given a brief description of the study and were asked if they were willing to participate. This was done in the absence of treatment center staff to discourage participant coercion. In groups of eight, the consent forms were read aloud in front of all participants and were asked if they had any questions. Given issues of reading comprehension, efforts were made to insure that participants understand all facets of the consent form and the study itself. After all questions were answered and consent forms signed, participants began by completing the self-report measures in the conference room with a proctor present in order to answer any questions they may have had about the measures. The questionnaire battery consisted of questionnaires assessing demographics, treatment pathway, drug use history, psychopathy, & criminality. The order of measures in each packet was randomized. Additionally, two rooms were designated for clinical interviews and two rooms designated for completion of the computer tasks. All four rooms utilized were comparable in size and allowed for privacy. Individually, participants were called at random into either one of the computer task rooms or the clinical interview rooms, where they completed the appropriate portion of the study.

The computerized task was completed using Dell Inspiron Laptops and was proctored by either undergraduate or graduate students trained to proctor the task. Proctors for the computer tasks explained the task to the subject demonstrating the instructions on the computer, and answered any questions. Immediately preceding the

task, participants were reminded that payment is contingent upon task performance. The proctor then exited the room while the participant completed task in order to minimize any potential experimenter effects. Clinical interviews were conducted by trained doctoral students enrolled in a graduate program at the University of Maryland. Once participants were finished with both the computerized task and the clinical interview, they returned to the main conference room, where they completed the remainder of self-report questionnaires. Once the participants were finished, a proctor briefly checked for missing data or mistakes and asked participants to correct them. Following completion of the computerized tasks, the interview, and the questionnaires, participants were told how much money they had earned and they signed a receipt. As per treatment center regulations, monetary payment was added to participant Salvation Army accounts within one week of participation in the study and was distributed to participants in accordance with treatment center regulations.

Materials and Apparatus

The following apparatus was used in the experimental session: a laptop computer with the Balloon Analogue Risk Task (BART; Lejuez, et al., 2002) installed on the hard drive. Paper and pencil measures were employed and a structured clinical interview was conducted on each participant. The measures are explained in detail below.

Demographic Information

General Information. A short self-report questionnaire was administered to obtain age, gender, race, education level, marital status, and total household income. These

variables were used as covariates to control for variability across scores on behavioral measures.

Treatment Classification. A questionnaire regarding pathway to treatment was administered. Treatment pathway was measured dichotomously. Participants indicated whether their treatment was voluntary or court-mandated.

Criminal History Index. Participants were provided with a checklist of criminal acts and were asked to indicate in which of the following they had engaged and how many times. The crimes ranged from theft to murder; however, illicit drug use was included. Items for this questionnaire were derived from the Psychopathy Checklist-Revised (Hare, 1994) diagnostic interview.

Shipley Institute of Living-Revised (SILS-R). The SILS developed in 1940 by Walter Shipley and revised by Robert Zachary (1986) was designed to assess general intellectual functioning in adults and adolescents. The SILS-R is a self-administered test and consists of two subtests: Vocabulary and Abstraction. The Vocabulary subtest consists of 40 multiple-choice questions in which the respondent is asked to choose which of four words is closest in meaning to a target word. Administration time for the subtest is 10 minutes. The Vocabulary subtest relies on verbal skills which include reading ability, verbal comprehension, acquired knowledge, long-term memory, and concept formation. The Abstraction subtest consists of 20 questions in which sequences of numbers, letters, or words with the final element in each sequence omitted. The respondent is required to complete each of the sequences. Administration time for the subtest is 10 minutes. The Abstraction subtest relies more heavily on attentional abilities, letter, word, and number concept formation, abstract thinking, cognitive flexibility,

analysis and synthesis, processing speed, long-term memory, and specific vocabulary and arithmetic skills.

Initially, the current study attempted to utilize the Total score procured from the two subtests and the Abstaction Quotient, which takes into account age and education level as exclusionary criteria and covariate analyses. However, a floor effect was found on the test which was attributed to a general lack of effort by the participants. Several participants were observed completing the task randomly; further, other participants stated that they did not understand the task but when walked through the items, displayed an understanding of both the concept and several answers. Scores supported these observations; therefore the Shipley scores were deemed invalid and were unable to be used in subsequent analyses.

Assessment of Psychopathology

Structured Clinical Interview for DSM-IV (SCID-NP, non-patient version)**.** Lifetime prevalence of Axis I and II diagnoses were determined using the Structured Clinical Interview for DSM-IV (SCID–NP I and II, non-patient version; First, Spitzer, Gibbon, & Williams, 1995 and 1997). The SCID-NP I and II have demonstrated reliability with both Axis I (alphas ranging between .4 and .84) and Axis II (alphas ranging from .35 to .80) diagnoses (Williams, Gibbon, First, Spitzer et al., 1992).

Assessment of Drug Use. In addition to the SCID-NP which will provide a diagnostic decision on whether an individual fits criteria for substance abuse or dependence, we also assessed quantity/frequency of all drug and alcohol use with a standard drug use questionnaire (e.g., Babor & Del Boca, 1992). Specifically, participants were asked if they

had ever used a particular drug in their lifetime, how often they used it in the past year prior to treatment, and how often and for how long they used the drug during the period of their life when they were using it most frequently. A composite score was used to determine severity of drug use.

Psychopathic Personality Inventory (PPI; Lilienfeld, 1990). The PPI was developed by Lilienfeld (1990) to detect psychopathic traits in a covert manner. It consists of 187 items in a 4 point Likert-scale format. The PPI has eight subscales that assess lower-order facets of psychopathy; additionally, the PPI yields a total score representing global psychopathy.

The subscales of the PPI stem from factor analyses and include: Machiavellian Egocentricity (a ruthless willingness to manipulate and take advantage of others), Social Potency (interpersonal impact and skill at influencing others), Fearlessness (a willingness to take physical risks and an absence of anticipatory anxiety), Coldheartedness (callousness, guiltlessness, and absence of empathy), Impulsive Nonconformity (a flagrant disregard for tradition), Blame Externalization (inability to accept responsibilities for one's actions), Carefree Nonplanfulness (an insouciant attitude toward the future), and Stress Immunity (sangfroid and absence of tension in anxiety-provoking situations). For the current study we examined total score as well as scores across each of the individual scales.

Lilienfeld and Andrews (1996) examined the reliability and construct validity of the PPI and reported that the PPI was internally consistent (Cronbach's alphas ranged from 0.90 to 0.93), as were its subscales (Cronbach's alphas ranged from .70 to .90, with 75% of the alpha coefficients in the 0.80 to 0.90 range). In addition, they reported that

the PPI total score displayed a test-retest reliability of $r = 0.95$ over a mean 26 day interval. Test-retest reliabilities of the PPI subscales ranged from $r = 0.82$ to 0.94.

Behavioral Assessment of Risk

The Balloon Analogue Risk Task – Revised Automatic Version (BART; Lejuez et al., in preparation). The BART is a derivative of the original Balloon Analogue Risk Task (Lejeuz et al., 2002). The BART has been successfully used in previous studies to identify currently occurring risk behaviors in adolescents and adults (Aklin, et. al., 2005; Lejuez, Aklin, Jones, et. al., 2003). In the original version, the computer screen displayed four items: a small balloon accompanied by a balloon pump, a reset button labeled "Collect $$$," a "Total Earned" display, and a second display labeled "Last Balloon" that listed the money earned on the last balloon. Each click on the pump inflated the balloon one degree (about 0.125" in all directions). With each pump, money (5 cents per pump) was accumulated in a temporary bank, the holdings of which were never indicated to the participant. When a balloon was pumped past its individual explosion point, a "pop" sound effect was generated by the computer. When a balloon exploded, all money in the temporary bank was lost, and the next uninflated balloon appeared on the screen. At any point during each balloon trial, a participant could stop pumping the balloon and click the "Collect $$$" button. Clicking this button transferred all money from the temporary bank to the permanent bank, during which the new total earned would be incrementally updated, while a slot machine payoff sound was played to confirm payment.

A new balloon appeared after each balloon explosion or money collection until a total of 30 balloons (i.e., trials) were completed. The probability that a balloon would

explode was fixed at 1/128 for the first pump. If the balloon did not explode after the first pump, the probability that the balloon would explode was 1/127 on the second pump, 1/126 on the third pump and so on up until the 128th pump at which point the probability of an explosion was 1/1 (i.e., 100%). According to this algorithm, the average breakpoint was 64 pumps. Modeling real-world situations in which excessive risk often produces diminishing returns and increasing threats to one's health and safety, each successive pump on any particular balloon trial (a) increased the amount to be lost due to an explosion and (b) decreased the relative gain of any additional pump. For example, after the first pump the next pump risked only the 5 cents accrued in the temporary bank and would increase the possible earnings on that balloon by 100%, yet after the 30th pump, the next pump risked three dollars accrued in the temporary bank and increased possible earnings on that balloon trial only by 1.6%. Detailed instructions provided to the participant were based on those provided by Lejuez et al. (2002), yet it is important to note that in this original version, participants were given no precise information about the probability of explosion. Specifically, they were informed that: "It is your choice to determine how much to pump up the balloon, but be aware that at some point the balloon will explode." Further, they also were informed that "the explosion point varies across balloons, ranging from the first pump to enough pumps to make the balloon fill the entire computer screen."

During the instructional portion of the BART, information is provided explaining the best method of performance on the task. It also prompts the subject to type in the number of pumps they want to inflate the balloon by as opposed to having the participant inflate the balloon one pump at a time with the mouse. The computer inflates the balloon

accordingly, thereby allowing the researcher to have a more accurate assessment of how much the subject was willing to risk, regardless of the balloon explosion point. Participants earned 1 cent per pump in this version of the BART. A total of 30 balloons were presented to each subject. Instructions for the task were provided as follows:

> *In this task you will be presented with 30 balloons, one after another, on the computer screen. The goal of this task is to make as much money as possible by pumping up the balloons. For each balloon, you will need to decide the number of times you want to have the computer pump up the balloon and type in that number in a box located below the balloon. You will receive 1 cent per pump. The explosion point varies across balloons, ranging from the first to the 128th pump. The ideal number of pumps is 64. That means if you were to make the same number of pumps on every balloon, your best strategy would be to type in 64 pumps. This strategy would give you the most money over a long period of time. However, keep in mind that the actual number of pumps for any particular balloon will vary, so the best overall strategy may not be the best strategy for any one balloon. Remember, each pump earns 1 cent. But if a balloon explodes, you will lose the money you earned on that balloon and move on to the next balloon. If the balloon does not explode, the money earned for that balloon will be added to your permanent bank and you will move on to the next balloon. Exploded balloons do not affect money earned on*

previous balloons. In the bottom right corner of the screen, there is a box letting you know which balloon you are on. On the bottom left of the computer screen, there is a box indicating at what point the previous balloon would have or did pop. Do you have any questions?

Experimental Design Considerations

One major experimental design consideration was dimensional versus categorical measurement of the dependent variable. Although most research examining psychopathy has utilized categorical groups, this may result in a failure to understand the disorder in terms of potential dimensional implications. Specifically, research that examines differences in psychopathic and non-psychopathic individuals fails to tap into deficits that are present within individuals that do not meet full research criteria for psychopathy but suffer from a sub-threshold form of the disorder. It also fails to target incremental differences that may occur across increasing levels of the disorder. Therefore, the current study examined psychopathy dimensionally in an attempt to capture the full picture of its relationship with risk-taking propensity.

Relatedly, another experimental design consideration involved the sample for the current experiment. Most research examining psychopathy in adolescents and adults are conducted on incarcerated individuals, mainly because the percentage of individuals with psychopathy is significantly higher in these populations than in non-incarcerated populations (Hare, McPherson, & Forth, 1988). The current sample of residential treatment individuals is unique in that although, most participants (75.6%) were court-

mandated, a significant portion (24.4%) were participating in the rehabilitation program voluntarily, and thus, the sample will contain a wider range of criminal veracity than incarcerated populations. Thus, use of the current population provided an opportunity for a wider range of psychopathy-related deficits, allowing greater detection of the relationship between level of psychopathy and risk-taking behaviors.

Beyond potentially providing a greater range of psychopathic deficits, the use of inner-city substance-abusing patients added to the literature by methodologically controlling for the high levels of comorbidity of psychopathy and substance use disorders, and the consequent impact on task performance. Indeed, Hare (1995) estimates that up to 90% of individuals with psychopathy meet criteria for a SUD. Further, there are a host of studies showing that prolonged and/or excessive drug us, especially cocaine and alcohol, can lead to brain damage that may affect cognitive functioning (see Strickland & Stein, 1995, for a review). Taken together, it is surprising that most studies examining psychopaths fail to control (either methodologically or statistically) for drug use. In order to address this issue in the proposed study substance use was controlled for both experimentally (by utilizing an abstaining drug using population) and statistically.

An additional consideration of the study was whether to include or exclude individuals with other Axis I comorbidity. Including such individuals helped to maximize external validity in other studies (Rounsaville, Weiss, & Carroll, 1999). Additionally, considering the comorbidity of SUDs and Axis I disorders, exclusion would make generalizability of the current results extremely difficult. Thus, individuals with co-morbid conditions were included; however, in order to control for the potential confounding effects of comorbidity, Axis I psychopathology was used as a covariate in the analyses.

Finally, issues related to the inclusion of both genders in our study were considered. It is well-established that psychopathy is more prevalent among males then females, with up to 85% of diagnosable cases being male (e.g., Hare, 1994). There is a paucity of evidence bearing on whether the features of this disorder is similar or different across gender; available evidence raises the possibility that there may be striking differences in the presentation, and therefore, in the mechanisms underlying, these disorders as a function of gender (Salekin, et al., 1996). Thus, the inclusion of both genders presented a major strength of the current study.

Data Analytic Strategy

Aim 1

In order to examine the relationship between PPI (the main independent variable; IV) and total number of pumps on the BART (the dependent variable; DV), we initially examined correlates of the BART and PPI scores. Next we entered each of these variables into a regression model, removing non-significant variables until we developed a model that included significant predictors of the BART score and explained a significant amount of variance of BART scores. Next, we examined interactions between the variables in the initial model and included significant interactions in the model.

In order to determine whether the PPI total or subscales predicted BART performance above and beyond variables included in the model described above, we entered the PPI total into the regression model with the above covariates. In a separate regression analysis, we entered the PPI subscales into the regression model with the

covariates. We then removed each non-significant variable, re-running the regression until only significant variables remained and the model was significant.

Aim 2

In order to determine how level of psychopathy is related to Punishment Reactivity (PR) and Reward Reactivity (RR), the initial step for analyses was to define these two variables. Initially, PR was defined as decrease in number of pumps following a popped balloon with a greater decrease in pumps indicating a greater reactivity to punishment; RR was defined as increase in number of pumps following a non-popped balloon, with larger increases in pumps indicating a greater reactivity to reward. The change score for both PR and RR were then standardized in order to make comparisons by transforming the data into *t*-scores. It should be noted that certain individuals went up in number of pumps following a popped balloon and went down in number of pumps following a non-popped balloon. Applying the operational definition of PR and RR stated above, these individuals were considered to have negative reactivity to punishment and reward and were analyzed accordingly. For example, if subject (a) went up an average of four pumps following a popped balloon and subject (b) went down one pump on average following a popped balloon, subject (a) would be considered <u>less</u> reactive than subject (b) because subject (a) responded in the opposite direction than desired by experimenters.

It could also be argued that although subjects who went up after a popped balloon, and went down after a non-popped balloon responded in a manner contrary to what was desired, that the focus is on level of reactivity and not direction. In this case, subject (a) from above would be considered <u>more</u> reactive than subject (b) because the absolute

value of change was higher (4 versus 1). In the current study we decided to examine PR and RR in both ways. For the second set of analyses, the absolute value of reactivity to punishment (APR) and reward (ARR) were taken. Additionally, for both sets of analyses, one subject was removed due to the fact that he did not pop any balloons; therefore, we could not measure PR.

In order to determine the effects of punishment and reward on subsequent responding, the following regression model was utilized:

$\Delta pumps(t, t+1)_i = \alpha_i + \beta_i pop_i(t) + \varepsilon_i$, where alpha represents RR and beta represents PR. For Hypothesis 2a, potential covariates of PR were examined with the goal of entering significant correlates into a regression model to be used as covariates. Next we entered each of these variables into a regression model, removing non-significant variables until we developed a model that included significant predictors of PR and explained a significant amount of PR variance.

In order to determine whether the PPI total or subscales predicted PR above and beyond variables included in the model described above, we entered the PPI total into the regression model with the above covariates. In a separate regression analysis, we entered the PPI subscales into a regression model with the covariates as well. As in aim 1, we removed each non-significant variable and re-ran the regression analyses until only significant variables remained and the model was significant. For hypothesis 2b, this process was repeated with RR as the DV in order to build the best regression model predicting RR. In separate analyses, the same strategy was employed in order to build regression models for APR and ARR. Results for both procedures are presented below.

Chapter 3: Results

Descriptive Statistics

Demographics

The sample consisted of 60 males (66.7%) and 30 females (33.3%). Eighty-two of the 90 subjects identified themselves as African-American. Of the remaining eight participants, six were Caucasian, one was Latino, and one was Native American. The majority of the sample completed high school (or its equivalent) or more (63.3%; see Table 1 for full demographic information).

Although, most research on psychopathy has focused on men, there is some literature suggesting that there may be some differences between males and females in terms of psychopathy regarding prevalence as well as correlates (e.g., Berardino, et.al., 2005; Hamburger, Lilienfeld, and Hogben, 1996). As such, gender differences in substance use and psychopathology variables along with differences in PPI and BART scores were examined.

Psychopathology

As the subject pool for the current study was a substance use treatment facility, all of the participants were diagnosed with at least one substance use disorder. Specific break-down of levels of abuse across substances are provided in Table 2. Sixty-three percent of the sample was diagnosed with two or more substance use disorders. Significant gender differences were found only in cocaine use disorders (50% of men

versus 86.7% of women were cocaine dependent; $p < 0.01$). Axis I psychopathology, Antisocial and Borderline Personality Disorder prevalence are presented in Table 3. Gender differences were found in history of Major Depression, (21.7% of men, 43.3% of women; $p = 0.03$), Bipolar Disorder (15% of men, 43.3% of women; $p < 0.01$), PTSD (5% of men and 30% of women; $p < 0.01$), and Borderline Personality Disorder (23.3% of men, 46.7% of women; $p = 0.24$).

PPI Scores

Internal consistency (Cronbach's alpha) was high for the PPI total score within (0.87) and acceptable for the PPI subscales within the current study (0.68 - 0.89). The mean PPI total score was 381.68 (*SD* = 38.37). There was no significant difference in PPI score across gender; men (*M* = 379.43, *SD* = 40.45); women (*M* = 386.17, *SD* = 0.45; $p = 0.436$). It should be noted, however, that although female participants' scores were similar to previous research involving incarcerated women (*M* = 381.59, *SD* = 40.29; Berardino, Meloy, Sherman, and Jacobs, 2005), the mean score for males in the current sample was elevated compared to previous research examining incarcerated males (*M* = 350, *SD* = 40; Verschuere, Crombez, De Clercq, and Koster, 2005). Gender differences were found across three PPI subscales. Men (*M* = 44.52, *SD* = 7.42) scored significantly higher on the PPI Cold Heartedness subscale than women (*M* = 40.33, *SD* = 7.30), t (88) = -2.54, $p = 0.01$. Males (*M* = 31.35, *SD* = 5.38) also scored higher on the PPI Stress Immunity scale than females (*M* = 25.77, *SD* = 6.22), t (88) = -4.40, $p = 0.001$. On the Blame Externalization subscale, however, women (*M* = 49.20, *SD* = 10.24) scored higher than the men (*M* = 45.67, *SD* = 7.71), t (88) = 2.87, $p = 0.005$.

BART Total Scores

The mean number of total pumps on the BART for the total sample was 1292.11 (*SD* = 481.93). Men and women did not significantly differ on total number of BART pumps.

PR, RR, APR, and ARR Scores

The standardized mean PR score was -1.67 (*SD* = 1.83). The standardized mean RR was 0.84 (*SD* = 1.12). Subjects adjusted significantly more following a popped balloon than a non-popped balloon $t(88) = 8.27$, $p < 0.01$. Men (*M* = -1.36; *SD* = 1.87) were significantly less reactive to punishment than women (*M* = -2.39; *SD* = 1.59), $t(87) = -2.32$, $p = 0.023$. This was also the case for RR; women (*M* = 1.30; *SD* = 1.20) exhibited higher RR than men (*M* = 0.61; *SD* = 1.01), $t(87) = 2.863$, $p = 0.005$.

Similar results were found for APR and ARR scores. The standardized mean APR was 2.07 (*SD* = 1.36). The standardized mean RR was 1.11 (*SD* = 0.85). Overall, individuals adjusted significantly more following a popped balloon than a non-popped balloon $t(88) = -11.21$, $p < 0.01$. It should be noted that men (*M* = 1.92; *SD* = 1.29) and women (*M* = 2.36; *SD* = 1.48) did not differ significantly on APR; however, women (*M* = 1.42; *SD* = 1.05) exhibited higher ARR than men (*M* = 0.95; *SD* = 0.69), $t(87) = 2.5$, $p = 0.014$.

Aim1

Explicitly examine the relationship between the PPI and the BART controlling for relevant demographic, substance use, and psychopathology.

Covariate Analyses for Hypothesis 1

Correlations between demographic variables, drug use and psychopathology variables, and PPI scores are in Table 4. PPI total score was significantly correlated with age (r = -0.35, $p < 0.01$), history of depression (r = 0.32, $p < 0.01$), diagnosis of bipolar disorder (r = 0.27, $p < 0.05$), and diagnosis of a cannabis use disorder (r = 0.28, $p < 0.05$).

Correlations between demographic variables, psychopathology and BART scores are presented in Table 5. Total number of pumps on the BART was significantly related to education (r = 0.22, $p < 0.05$), diagnosis of post-traumatic stress disorder (r = 0.21, $p < 0.05$), and diagnosis of an alcohol use disorder (r = 0.226, $p < 0.05$). As such, each of the variables related to BART score was entered into an initial regression model.

Age, gender and diagnosis of a heroin use disorder also were entered into the model as covariates because they have been found to be related to BART score in previous research. This model was significant, F (7, 82) = 2.15, p = 0.05; however, the majority of variables were not significant predictors of BART score. As explained above, we removed each non-significant variable until only significant variables remained. This model included education level and alcohol use disorder and explained 9% of the variance, F(2, 87) = 4.52, p = 0.01. Next, we examined all possible interactions between the demographic variables from the initial model and included significant interactions in this model. Only second order interactions were found; this model consisted of the following variables: age, heroin use disorder, PTSD diagnosis, age x heroin, and age x PTSD. This final demographic model explained 23% of the variance, F(5, 84) = 5.08, $p < 0.01$ (see Table 6 for a summary of these models).

Hypothesis 1

Is level of psychopathy associated with total risk-taking behavior after controlling for relevant covariates?

The next step was to determine whether PPI scores accounted for unique variance in predicting BART scores. Correlations between BART scores and PPI scores are listed in Table 7. The initial regression model examined the predictive ability of PPI total score. This model showed that PPI total score did not predict BART score above and beyond the variables already in the current regression model, $p = 0.10$. The next step of this process involved entering the PPI subscales into the regression model with the covariates. Each non-significant PPI subscale was removed beginning with the least significant and the regression analyses were re-run until the PPI Blame Externalization (PPI BE) was the only variable left in the model.

The final regression model included the demographic variables as covariates plus PPI BE subscale. This model explained 25% of the total variance $F(5, 84) = 5.67$, $p = 0.001$, increasing the overall explained variance by 2% ($\Delta R^2 = 0.02$). It should be noted that all variables in the final model are significant at the 0.05 level, except for age ($p = 0.17$); age remains in the model, however, because it is one of the variables in the age x heroin interaction. A summary of these regression models is presented in Table 8.

Aim 2

Examine explicitly the effects of rewards and punishment on subsequent responding on the BART in order to determine whether level of psychopathy is related to level of PR, RR, APR and ARR.

Covariate analyses for Hypotheses 2a and 2b with PR and RR

A correlation table examining the relationship between PR, RR and relevant variables is presented in Table 9. PR was found to be significantly correlated to RR (r = -0.89, $p < 0.01$), gender ($r = 0.24$, $p < 0.05$), heroin use disorder, ($r = 0.27$, $p < 0.01$), and cocaine use disorder ($r = 0.21$, $p < 0.05$). RR was found to be related to gender (r = -0.29, $p < 0.01$), heroin use disorder, (r = -0.30, $p < 0.01$), and cocaine use disorder ($r = 0.21$, $p < 0.05$). As such these variables were entered into the regression model predicting PR and RR, respectively.

Hypothesis 2a for PR

Is level of psychopathy related to diminished reactivity to punishment on the BART?

The final regression model examining the predictive ability of the PR correlates included gender and heroin use and alone these variables accounted for 13% of the variance, $F(2, 86) = 6.44$, $p = 0.002$. Cocaine was not included in the final model as it was not a significant predictor of PR above and beyond gender and heroin use.

In examining PPI total score and PR in a regression model controlling for gender and heroin use, the model was significant $F(3, 85) = 4.25$, $p = 0.01$; however, PPI Total

score was not a significant predictor of PR, $p = 0.94$ and did not add to the total variance accounted for by the model, $R^2 = 0.13$.

Next, we examined the relationship between PR and the PPI subscales, once again controlling for gender and heroin use, removing non-significant variables until a significant model was revealed. The final regression model included gender, heroin use, and PPI ME, PPI CH, and PPI CN subscales; this model was statistically significant and predicted 27% of the variance, $F(5, 83) = 6.04$, $p < 0.01$ (see Table 10 for a summary of these regression models).

Hypothesis 2b for RR

Is level of psychopathy related to diminished reactivity to reward on the BART?

The final regression model examining the predictive ability of the RR correlates included gender and heroin use and accounted for 17% of the variance, $F(2, 86) = 8.94$, $p < 0.01$. Once again, cocaine was not included in the final model as it was not a significant predictor of RR above and beyond gender and heroin use.

In examining PPI total score and RR in a regression model controlling for gender, and heroin use, the model was significant $F(3, 85) = 5.89$, $p = 0.01$; however, PPI Total score was not a significant predictor of RR, $p = 0.98$.

Next, we examined the relationship between RR and the PPI subscales, once again controlling for gender and heroin use, removing non-significant variables until a significant model was revealed. The final regression model included gender, heroin use, and PPI ME, PPI BE, and PPI CN subscales; this model was statistically significant and

predicted 26% of the variance, $F(5, 83) = 5.81$ $p < 0.01$ (see Table 11 for a summary of these regression models).

Covariate analyses for Hypotheses 2a and 2b with APR and ARR

A correlation table examining the relationship between gender, PPI and BART variables, APR and ARR is presented in Table 12. APR was not significantly related to any of the other variables measured in the current study. Of note, the only covariate variable related to ARR was gender ($r = -0.26$, $p = 0.01$). Although BART total score and BART explosions were related to ARR, they were not used in the regression analyses as ARR was derived from the BART.

Hypothesis 2a for APR

Is level of psychopathy related to diminished absolute reactivity to punishment on the BART?

In examining PPI total score and APR in a regression model controlling for gender, we found no relationship between PPI total score and PR, $F(2, 86) = 1.06$, $p = 0.35$. Next, we examined the relationship between APR and the PPI subscales controlling for gender, removing non-significant variables until a significant model was revealed. The final regression model included gender and PPI BE subscale; this model was statistically significant and predicted 8% of the variance, $F(2, 86) = 3.51$; $p = 0.03$ (see Table 13).

Hypothesis 2b for ARR

Is level of psychopathy related to diminished absolute reactivity to reward on the BART?

The model predicting ARR with PPI total and gender was significant, $F(2, 86) = 3.11$, $p = 0.05$; however, PPI total was not significantly related to ARR in this model, $p = 0.864$. Thus, total PPI failed to predict ARR. In a similar analytic strategy to the one employed to test hypothesis 2a, we examined the relationship between the PPI subscales and ARR controlling for gender, removing non-significant variables. The final model included gender and PPI BE and explained 11% of the variance, $F(2, 86) = 5.24$; $p = 0.07$ (see Table 14).

Additional Findings

Based on traditional behavioral learning paradigms, the target reaction to a non-popped balloon (appetitive consequence) was an increase in number of pumps on the subsequent balloon. Relatedly, the desired reaction to a popped balloon (averse consequence) was a decrease in number of pumps on the subsequent balloon, hence the use of the terms reward and punishment, respectively. It should be noted that 19 subjects decreased on average following a non-popped balloon and two subjects had an average change of zero. So, these individuals either reacted in the opposite direction than anticipated or failed to react at all.

Additionally, 18 subjects, on average, increased their number of pumps following the administration of an averse consequence. More interestingly, 16 of these 18 subjects were also members of the aforementioned 19 subjects who decreased following a non-

popped balloon. Specifically, these 16 individuals failed to learn the proper response in both punishment and reward conditions following several learning trials.

To further understand these individuals, we examined the differences between these 16 subjects and the rest of the sample on several measures of interest, including gender, BART score, and PPI scores. The only significant difference between these two groups was on the BART score. Specifically, individuals who responded in the opposite direction than desired following both popped and non-popped balloons (n = 16) had significantly higher BART scores (M = 1605.19; SD = 318.60) than the rest of the population (n = 71; M = 1240.79; SD = 478.57), $t(85) = 2.897$, $p = 0.005$.

Chapter 4: Discussion

The violent manifestations as well as the pervasive and recidivistic nature of psychopathy underscore the strong need to gain a better understanding of this disorder. As such, researchers have developed several theories attempting to identify the underlying mechanisms of psychopathy. A common link between these theories is the supposition of a deficit in some aspect of learning (i.e., instrumental learning, classical conditioning, or operant conditioning). Therefore, much of the research available examining the underlying deficits of psychopathy attempts to delineate what aspect(s) of learning are impaired in these individuals in controlled, laboratory experiments. Although, promising findings are evident, a better understanding of the deficits in stimulus-reward and stimulus-punishment learning conditions that psychopaths exhibit is needed. One step would be to utilize a laboratory measure that is a more realistic proxy of the schedules of reward and punishment associated with the maladaptive behaviors in which psychopaths actually engage. Specifically, a more suitable paradigm may be one that includes an alternating stimulus-reward/punishment condition where the same behavior to varying degrees determines the likelihood of both punishment and reward. Risk-taking is such a paradigm. Unfortunately, there has been little research examining the relationship between psychopathy and risk taking behaviors.

The current study had two major goals. The first was to examine explicitly the relationship between psychopathy and global risk-taking propensity using a laboratory risk-task. We examined the relationship between level of psychopathy as measured by the

PPI and risk-taking as measured by the BART; after controlling for demographic variables including age, heroin use, and PTSD, the PPI total score was not found to be related to participants' risk-taking as measured by the BART. We also examined the relationship between the subscales of the PPI, which measure several different conceptual aspects of the disorder, and risk-taking on the BART, with a specific goal of determining which, if any, aspects could account for the variance among BART scores above and beyond demographic and other relevant variables. This regression model did find a significant relationship between the PPI BE and the BART score, such that even after controlling for demographic and psychopathological variables, lower PPI BE scores predicted higher scores on the BART.

In addressing the lack of relationship between PPI total and BART score, the first possible explanation is that there is no relationship between level of psychopathy and risk-taking, although, based on the nature of the disorder, this is highly unlikely to be the case. Another possible explanation may be that the relationship between these two variables is not linear. Specifically, it may not be a relationship wherein as an individual becomes "more psychopathic" he also progressively becomes riskier; instead, it may be a relationship that only exists when comparing true psychopaths and non-psychopaths (as measured by a *diagnostic* scale). Therefore, individuals with psychopathy may be more risky than non-psychopaths; however, this relationship may not be one that can be brought to light using a dimensional measure of psychopathy. Unfortunately, as the PPI was not designed to diagnose psychopathy, we are unable to divide the current population into dichotomous groups in order to make comparisons. Relatedly, taking the top 10-20%

would be inappropriate as well as we are unable to determine if individuals in this range have true psychopathy.

It should be noted that a previous study examining the relationship psychopathy (utilizing a different dimensional measure of psychopathy) and BART score found a modest, albeit significant relationship between the BART and the behavioral aspects of psychopathy (Hunt, et.al., 2005). This may suggest one other alternative explanation. Although the PPI subscales have been divided into Factor 1 (psychopathic traits) and Factor 2 (antisocial behaviors) categories in previous research (Patrick, Edens, and Poythress, 2006), it was designed to examine traits, attitudes and willingness to engage in psychopathic behaviors, as opposed to direct propensity, which would address actual behavioral engagement (Lilienfeld and Andrews, 1996). Hence, the PPI may not be the most sensitive measure of the relationship between psychopathy and actual risk-taking behaviors.

Nevertheless, the Blame Externalization subscale of the PPI did contribute to the variance on the BART above and beyond the demographic variables included in the model. This finding was notable in that it was in the opposite direction than was expected. Specifically, higher scores on the BE subscale predicted lower scores on the BART. At first glance this may seem counterintuitive. However, several things need to be considered. The first possibility is that blame externalizers may not feel responsible for the consequences of their actions, and therefore are less likely to feel as though they played a direct role in the outcome. They may not be as affected by the consequences of their behavior leading to less of an overall effort, resulting ultimately in a lower BART score. For example, if an individual wins $0.30 on a balloon but feels that it is due to luck

as opposed to interpreting that gain as a result of choosing a "good number" of pumps based on some personal efficacy on the task, he is less likely to try to use that information to gauge how much he should bet on the next balloon, leading to an overall diminished effort across trials, likely resulting in a lower BART score. Conversely, individuals who do believe that they are responsible for their actions may be more likely to take risks because they feel more in control of the outcome. This phenomenon has been seen in locus of control research. Locus of control, simply stated, is an individual's perception of the degree to which a given outcome is contingent upon his behavior (Lefcourt, 1966). If an individual has an internal locus of control, she believes that her actions can affect what happens in her life. An individual with an external locus of control generally attributes the consequences of situations to outside factors. Applied to BE, individuals with high BE tend to attribute the consequences of their behaviors to outside forces (bad luck, other people, etc.) and in that way exhibit an external locus of control. Individuals with low BE accept responsibility for their actions, acknowledging the role that their behaviors played in a given outcome. These individuals possess an internal locus of control. Related to risk taking, individuals with an internal locus of control have been found to be willing to take monetary risks. For example, Duxbury, Haines, and Riding, (1996) found that individuals who engaged in monetary risk taking behaviors (i.e., investments) were more likely to have an internal locus of control than individuals who do not take that risk. The results of the current study support these findings. It may also be the case that although these individuals are less likely to engage in monetary risks, they may be willing to engage in other risky behaviors that have a higher likelihood of immediate reward and an uncertain or delayed risk of punishment (e.g., risky sexual behavior, drug use, etc.).

Future research should examine the contribution of these potential mediators in replications and extensions of the current study.

Another possible explanation may be that this particular risk taking measure does not tap into the type of risky behaviors which high BE individuals engage. Intuitively, it was not expected that blame externalization would be related to risk-taking behavior. As such, it may be the case that this particular subscale does not tap into the maladaptive aspect of psychopathy resulting in risky behaviors as a whole. Of note, neither of the PPI subscales that would intuitively predict risk-taking (i.e., the Fearlessness, purported to measure a willingness to take physical risks, and Carefree Nonplanfulness, purported to measure a nonchalant attitude toward the future) were predictors of BART score. The reason for this lack of relationship remains unclear.

This study introduced a novel approach in examining punishment and reward sensitivity within a risk-taking paradigm. Specifically, we examined how participants responded immediately to both punishment and reward when the same target behavior to varying degrees may result in either consequence. This is distinct in that most research examining punishment and reward paradigms have separate behaviors allotted for each contingency. Even in extinction and response reversal tasks, the same behavior is initially rewarded and then eventually is punished; however, the same behavior is not targeted for either reward or punishment across all trials (Mitchell, Colledge, Leonard, and Blair, 2002; Newman, Patterson and Kosson, 1987). This unique approach to measuring reward/punishment sensitivity is particularly useful in the current study as it examines learning deficits in these areas in a controlled manner that can be easily applied to real-life situations.

The second goal of the current study was to examine the relationship between level of psychopathy and reactivity to punishment and reward. Based on previous research examining PR across different learning paradigms (e.g., Mitchell, Colledge, Leonard, and Blair, 2002; Newman and Kosson, 1986) it was hypothesized that there would be a relationship between level of psychopathy and PR such that individuals with higher levels of psychopathy would exhibit lower levels of PR. Overall, individuals in the current study exhibited higher PR than RR. This is in line with basic behavioral research that suggests individuals are more reactive to punishments than to rewards (Gray and Tallman, 1987). Women were significantly more responsive than men to both punishment and reward; additionally, individuals with a heroin use disorder were less responsive to both punishment and reward than individuals who did not have a diagnosis. After controlling for these variables, the PPI total score failed to yield any relationship to PR. We examined the subscales of the PPI in order to determine what, if any, of the aspects of psychopathy are related to PR. Results indicated that, controlling for gender and heroine use, PPI ME, PPI CH and PPI CN were significantly related to PR. In examining the relationship between the PPI subscales and RR, PPI ME, PPI BE and PPI CN were found to be significant predictors of RR. The results that are congruent for both PR and RR are discussed below first, followed by the findings related exclusively to PR, and then those exclusively to RR.

The ME subscale of the PPI taps into an individual's willingness to manipulate and take advantage of others for personal gain (Lilienfeld and Andrews, 1996). The current study suggests that individuals higher in PPI ME are more sensitive to both punishment and reward. If an individual is manipulative, it is generally in order to obtain

a specific goal, as such individuals high in ME may be conceptualized as goal-oriented. One possible explanation for the current results is that these individuals may be more reactive to punishment and reward in order to better enable them to adjust their behaviors in order to obtain a specific goal. Although interesting, it should be noted, that similar to the findings with the BART total, these results are counterintuitive to most theories of psychopathy.

The CN subscale taps into a nonchalant attitude towards the future (Lilienfeld and Andrews, 1996). The current study found a significant relationship between PPI CN (or impulsivity) and diminished reactivity to both reward and punishment. This is in line with previous research that has found a negative relationship between punishment reactivity and impulsivity (Potts, George, Martin, and Barratt, 2005). These results also lend limited support to the IES theory of psychopathy, suggesting that this aspect of psychopathy may be related to the purported deficient amygdaloidal functioning resulting in a diminished reactivity to both reward and punishment. It may be that these individuals are unable to utilize the information provided by the consequences of the previous trials in order to inform subsequent responding.

The PPI CH subscale was positively related to PR. That is, callous, and cold-hearted individuals are more responsive to punishment based on the findings of the current study. Although these findings are also counterintuitive to most theories of psychopathy, one possible explanation for the current results may be that individuals who are cold-hearted in their behavior do so as a preemptive strategy to avoid the aversive aspects of not obtaining a desired consequence. Specifically, individuals high in CH may be more likely to engage in instrumental aggression, lying, and callous behaviors as a

way to increase the likelihood of obtaining a specific outcome in order to protect themselves from the increased negative experience of not obtaining a specific goal.

Finally, PPI BE was found to be negatively related to RR. Specifically, individuals higher in BE were less responsive to rewards. This is inline with the hypothesis related to psychopathy and RR. Previous research has shown that individuals are generally more sensitive to punishments than to rewards (Gray and Tallman, 1987). This is consistent with the findings in the current study. It may be the case that individuals with high BE exhibit a stimulus-reward learning deficit such that linking their behaviors with subsequent rewards is even more difficult resulting in their being even less affected by the reinforcers for specific behaviors.

In examining the relationship between psychopathy and APR and psychopathy and ARR, similar to the results above for PR and RR individuals in the current study exhibited higher APR than ARR. Additionally, women exhibited higher ARR than men; however, unlike above, no gender differences were found in APR. After controlling for demographic variables, the PPI total score failed to yield any relationship to APR. We examined the subscales of the PPI in order to determine what, if any, of the aspects of psychopathy were related to APR. Results indicated that, controlling for gender, PPI BE was found to be negatively related to APR.

Similar results were found for ARR. The PPI total score was not found to be related to ARR in the current study. However, we examined the subscales of the PPI in order to determine what characterological aspects of the disorder were related to ARR. After controlling for gender, ARR was also found to be inversely related to PPI BE.

These results, while limited, fit the IES theory of psychopathy suggesting that there is a stimulus-response learning deficit that affects both stimulus-punishment and stimulus-reward learning within individuals with psychopathy; moreover, these data suggest that this deficit is related to the aspect of psychopathy that encompasses BE. One interpretation of these results may be that it is not that psychopaths with high BE are unwilling to take responsibility for their actions, but rather, they suffer from a learning deficit that prevents psychopaths from linking their behaviors to respective consequences.

Certain findings were obtained in the current study that fell outside of the scope of the current aims but were interesting and noteworthy. The first noteworthy finding was the interaction between age, PTSD and heroin use and their relationship to the BART. The results of the regression model showed that in individuals without PTSD or a heroin use disorder, BART score increased as a function of age. Within individuals with PTSD, BART score also increased even more sharply based on age; this is consistent with PTSD research showing a relationship between PTSD and risk-taking (e.g., Holmes, Foa, and Sammel, 2005; Hutton, et. al., 2001; McFall and Cook, 2006). Conversely, the interaction between age and heroin suggested that within heroin users, BART scores decreased based on age. These results suggest that there is something about the presence of a heroin use disorder that decreases risk-taking behaviors in older individuals. It is likely that older heroin addicts have a longer drug use history; as such they may evidence an overall decrease in goal-oriented behavior related to the cumulative effects of the drug and its related lifestyle.

An additional noteworthy finding was the presence of a subset of individuals who both went up after popped balloons and went down after non-popped balloons. Also of

note, these individuals scored significantly higher on the BART than the rest of the sample, suggesting that, as a whole, these individuals are more risky. It may be the case that there is something specific about these individuals which leads to a failure to appropriately learn a target behavior based on these specific reward/punishment conditions. Based on gambling research, it is likely the case that these scores are indicative of the employment of the "gambler's fallacy." Specifically, these individuals are engaging in actions to "chase" the money lost on popped balloons based on the assumption that because the last balloon popped, the next one is less likely to do so. In terms of their decrease in pumps following non-popped balloons, it may be the case that when they do manage to gain money from a balloon they believe that the next balloon is more likely to pop and as such decrease their number of pumps. The extremely high correlation between PR and RR adds support to this interpretation of the data. This should be considered in future gambling studies as they may delineate a model for problem gambling.

Conclusions

The current study examined the relationship between psychopathy and risk-taking, as well as the relationship between psychopathy and reward and punishment reactivity. The goal of the study was to determine whether level of psychopathy was related to risk behavior across three levels: overall propensity, sensitivity to punishment, and sensitivity to reward. Results showed that although total PPI scores did not predict BART performance, there was a relationship found between an unwillingness or inability to accept responsibilities for one's actions and lower scores on the BART. While initially, this result was surprising, it was in line with other research suggesting that a belief that

one is not in control of one's behavioral outcomes relates to an unwillingness to take monetary risks (Duxbury, Haines, and Riding, 1996).

This study also examined the immediate effects of reward and punishment in a unique, risk-taking learning paradigm as a function of demographic variables as well as a function level of psychopathy. Again, the PPI total score failed to yield any significant relationships between reactivity to either punishment or reward. However, viewing the relationship between these phenomena and PPI subscales did yield some significant findings. Specifically, PPI ME and CN were both shown to be significant predictors of both PR and RR. Additionally, PPI CH was a significant predictor of PR and PPI BE was a significant predictor of RR. When examining APR and ARR, an inverse relationship was found between these variables and PPI BE.

Overall, these results provide little support for the relationship between risk-taking and psychopathy. Specifically, the PPI total score was not found to be related to any of the dependent variables. Moreover, out of eight subscales the BART was found only to be related to PPI BE and in the opposite direction than hypothesized. Possible explanations for this lack of findings are discussed below. In terms of PR, only three out of eight subscales were found to be related, and two were in the opposite direction than hypothesized. Similar results were found with RR; three of eight subscales were found to be related; one was in the opposite direction than hypothesized. Even more sparse findings were revealed utilizing APR and ARR as dependent variables; only one PPI subscale was found to be related to these variables, although it was in the direction hypothesized.

Limitations and Future Directions

There are several limitations of the current study that need to be addressed. The first limitation was the use of a dimensional measure of psychopathy. Specifically, the PPI was developed to measure level of psychopathy across different subscales within non-psychopathic populations. Although there has been research supporting its utility within incarcerated populations where the rates of psychopathy are higher (Berardino, et. al., 2005; Verschuere, et. al., 2005), the measure was not designed and cannot be used to diagnose psychopathy. Therefore, we are limited in the conclusions that can be drawn regarding psychopaths per se. Future research should focus on examining the predictive power of an actual psychopathy diagnosis related to risk-taking; there should also be research conducted comparing psychopaths versus non-psychopaths on risk-taking propensity.

A second limitation of the current study was the ethnic homogeneity of the sample. The examination of a minority population adds to the total literature as these individuals are grossly underrepresented in psychology research as a whole; however, findings from the current study were limited in the same manner as utilizing an almost exclusively Caucasian population: specifically, generalizability across different ethnic populations is restricted. Future research should include diverse populations allowing for both better generalization of the results as well as allowing for the examination of possible differences across ethnic groups.

Another issue regarding generalizability of the results stems from the use of a residential drug treatment sample. It may be the case that these individuals are unique from individuals who are in outpatient treatment, non-treatment drug dependent

abstainers, as well as actively using drug dependent individuals. As such, future research should seek to replicate and extend the current results of the current study to other types of drug using populations.

Another limitation related to the current population is the unique quality of the female drug users. Although the PPI mean scores for females were close to those found in incarcerated women (Berardino, et. al., 2005), previous research suggests that females score significantly lower on the PPI than males (Lilienfeld and Andrews, 1996). This was not the case in the current study. Females, in fact, had a higher (albeit non-significantly) mean score than the males in this population. Previous research with a similar population (i.e., different cohort of subjects from the same treatment center), have found other unique qualities regarding the females within their samples. Specifically, crack/cocaine use and dependence were found to be significantly higher in women (Bornovalova, et.al., 2005). This is consistent with what was found in the current study. However, this is in contrast to epidemiological data among community samples indicating that females evidence less frequent use and dependence across illicit substances including cocaine (SAMHSA, 2004). Until there is a clear understanding as to why this is the case, conclusions should be made with caution.

A methodological limitation of the current study involves the number of women within the sample. Only 1/3 of the sample consisted of women. This makes conclusions regarding the findings concerning the females in the current sample more difficult to interpret. Previous research has purported that there may be a different manifestation of psychopathy within women than in men (Salekin, Rogers, and Sewell, 1997) underscoring the need for the inclusion of women in these studies for comparison

purposes. In line with the overall dearth in psychopathy literature examining the disorder in women, future research should focus on a greater inclusion of women in order to determine what, if any, differences there are in the etiology, deficits, and behavioral manifestations of psychopathy based on gender.

There were several limitations related to the BART as well. First, as we indicated to subjects the best strategy to be utilized on the BART, we may have limited its utility as a measure of learning confounding information obtained regarding reward and punishment reactivity. Further, as each pump was only worth one cent, saliency of both reward and punishment are questionable. If the contingencies were not salient to the subject, then it may be the case that effort on the task was limited. This is a specific concern as there was a lack of effort evidenced by the participants on the SILS-R. Although this is a distinct possibility, it should be noted that the BART was not administered in a test-like fashion as was the SILS-R; additionally, subjects were informed that payment was contingent upon BART performance; they were not paid based on effort on self-report measures. Therefore, it is quite possible that subjects put forth appropriate effort on the BART but not on the SILS-R.

Based on both current findings and previous research, the BART may not be the best behavioral measure of risk-taking within psychopaths. In each of the two previous studies and in the current study a relationship has been gleaned from certain aspects of psychopathy and risk-taking. However, overall, it has consistently failed in terms of delineating significant relationship between risk-taking and psychopathy utilizing three different measures of the disorder.

The current study included a new approach to examining risk-taking as a basic, learning paradigm. However, it may be the case that the PR and RR as measured in the current study do not accurately measure their intended respective constructs. Specifically, in contrast to learning, it may be decision making that is being measured. That may better account for the individuals within this population who failed to respond in the anticipated manner to stimuli deemed reinforcing and punishing. Alternatively, it may be the case that the alternating aspect of the conditions (i.e., the fact that the same behavior resulted in both rewards and punishments) may have complicated these results. Relatedly, as all 30 trials were completed consecutively, it is difficult to verify how much each trial affected subsequent responding. As such, we are unable to know that the pop of balloon 15 was what resulted in decrease in pumps on balloon 16; it could be the non-pop (and reward) following balloon 14 that is more salient to a subject. Although informative, this particular paradigm may not measure learning as conceptualized by traditional behavioral theories. It may be more fruitful to conceptualize risk-taking as a decision-making process and approach determining the relationship between psychopathy and risk-taking from that standpoint. An additional limitation related to reactivity was the difficulty in determining what role direction of response played. In analyzing the data both ways we were able to see that it does make a difference; however, we were unable to determine which measure was more accurate.

That being said, several interesting results outside the scope of the current study were found. Specifically, a) individuals are significantly more sensitive to punishment than to reward; b) women are more sensitive to reward than men but may or may not be more sensitive to punishment; and c) although the majority of the subjects decreased the

target behavior following a punishment and increased the behavior following reward, a notable amount of individuals responded in the opposite manner. More so, of these individuals a vast majority responded in the opposite manner across both conditions. A limitation of the current study was the lack of total subjects who responded in this manner preventing us from being able to examine any differences between these groups. Future research should examine these individuals as a potential subset of individuals with a specific type of stimulus-response deficits to see how this relates to risk-taking and psychopathy.

In summary, the current study failed to find a significant relationship between risk-taking, PR, and RR as measured by the BART and psychopathy as measured by the PPI. However, there were some relationships found between subscales of the PPI and these measures suggesting that a relationship between risk-taking and psychopathy exists. Future research should take these findings into consideration when developing studies designed to delineate the underlying mechanisms of psychopathy.

Table 1. Demographic Information (n = 90).

	Males	Females
Age *M* (SD)	42.9 (10.19)	43.5 (6.70)
Ethnicity %		
African American	90.0	93.3
Caucasian	6.7	6.7
Latino	1.7	0.0
Native American	1.7	0.0
Education Level		
Grade School	11.7	20.0
Some High School	25.0	16.7
High School Diploma	30.0	30.0
Some College	25.0	23.3
College Graduate or More	8.3	10.0

Table 2. Prevalence of Substance Use Disorders (n = 90).

	Males	Females
Substance Use Disorder %		
Alcohol		
No Diagnosis	60.0	50.0
Abuse	15.0	10.0
Dependence	25.0	40.0
Sedative		
No Diagnosis	98.3	96.7
Dependence	1.7	3.3
Cannabis		
No Diagnosis	76.7	86.7
Abuse	10.0	6.7
Dependence	13.3	6.7
Stimulants		
No Diagnosis	98.3	100.0
Dependence	1.7	0.0
Hallucinogens		
No Diagnosis	86.7	96.7
Abuse	3.3	0.0
Dependence	10.0	3.3
Heroin		
No Diagnosis	63.3	66.7
Dependence	36.7	33.3
Cocaine**		
No Diagnosis	43.3	6.7
Abuse	6.7	6.7
Dependence	50.0	86.7
# of Substances Abused/Dependent		
1	42.7	26.7
2	45	53.3
3	10	13.3
4	3.3	6.7

** indicates a significant difference in gender at the $p < 0.01$ level.

Table 3. Prevalence of Axis I Psychopathology, Borderline Personality Disorder, and Antisocial Personality Disorder (n = 90).

	Males	Females
Psychopathology %		
Major Depression Present	13.3	16.7
Major Depression Past*	21.7	43.3
Bipolar Affective Disorder**	15.0	43.3
Agoraphobia w/o Panic Disorder	10.0	16.7
Social Phobia	11.7	13.3
Obsessive Compulsive Disorder	0.0	3.3
Post Traumatic Stress Disorder**	5.0	30.0
Generalized Anxiety Disorder	8.3	13.3
Attention Deficit/ Hyperactive Disorder	11.7	10.0
Antisocial Personality Disorder	61.7	60.0
Borderline Personality Disorder*	23.3	46.7

* indicates a significant difference in gender at the $p < 0.05$ level.
** indicates a significant difference in gender at the $p < 0.01$ level.

Table 4. Bivariate Correlations between Psychopathic Personality Inventory (PPI) Scores and Demographic Variables (n = 90).

	PPI Total	PPI ME	PPI SP	PPI F	PPI CH	PPI IN	PPI BE	PPI CN	PPI SI
Age	-0.35**	-0.13	-0.30*	-0.31**	-0.08	-0.14	-0.09	-0.29**	-0.15
Gender	-0.08	-0.19	-0.10	0.10	0.26*	-0.16	-0.29**	-0.08	0.43**
Education	-0.02	-0.07	0.16	0.12	-0.03	0.06	-0.14	-0.29**	0.26*
MDD present	-0.01	0.04	-0.15	-0.23*	0.03	0.02	0.16	0.21*	-0.23*
MDD past	0.32**	0.24*	-0.06	0.20	-0.09	0.45**	0.30**	0.41**	-0.32**
Bipolar	0.27*	0.13	0.06	0.18	-0.03	0.28**	0.14	0.33**	-0.09
PTSD	0.14	0.13	-0.10	0.09	-0.15	0.15	0.27*	0.32**	-0.27**
GAD	0.08	0.09	-0.19	0.01	-0.13	0.19	0.23*	0.29**	-0.28**
ASPD	0.46**	0.43**	0.13	0.14	-0.12	0.49**	0.31**	0.35**	-0.11
BPD	0.26*	0.29*	0.01	0.07	-0.11	0.22*	0.43**	0.29*	-0.38**
Alcohol	0.11	0.11	-0.12	0.01	0.10	0.12	0.03	0.35**	-0.19
Cannabis	0.26*	0.17	0.25*	0.18	0.06	0.09	0.02	0.145	0.23*
Cocaine	-0.02	0.05	-0.11	-0.09	-0.14	0.08	0.12	0.10	-0.21*
# of Drugs Used	0.31**	0.29**	0.11	0.16	0.12	0.21*	0.06	0.28**	-0.09

* indicates a significance at the $p < 0.05$ level
** indicates a significance at the $p < 0.01$ level
PPI = Psychopathic Personality Inventory; ME = Machiavellian Egocentricity; SP = Social Potency; F = Fearlessness; CH = Coldheartedness; IN = Impulsive Nonconformity; BE =Blame Externalization; CN = Carefree Nonplanfulness; SI = Stress Immunity; MDD = Major Depressive Disorder; PTSD = Post Traumatic Stress Disorder; GAD = Generalized Anxiety Disorder; ASPD = Antisocial Personality Disorder; BPD = Borderline Personality Disorder

Table 5. Bivariate Correlations between Balloon Analogue Risk Task (BART) Scores and Demographic Variables (n = 90).

	BART Total
Age	-0.11
Gender	-0.01
Education	0.22*
Post Traumatic Stress Disorder	0.21*
Alcohol Use Disorder	0.23*

* indicates a significant difference in gender at the $p < 0.05$ level.

Table 6. Regression Models Predicting Total Balloon Analogue Risk Task (BART) Score (n = 90).

Independent Variable	Standardized Coefficient	SE	*t*	*p*
Regression 1				
Age	-5.42	5.60	-0.97	0.34
Gender	59.24	110.62	0.54	0.59
Education	108.01	43.89	2.46	0.02*
Alcohol	94.83	57.94	1.64	0.11
Heroin	-31.80	54.16	-0.59	0.56
MDD Present	236.12	152.70	1.55	0.13
PTSD	173.97	164.96	1.06	0.30
R^2= 0.16				
Regression 2				
Education	84.82	41.56	2.04	0.04*
Alcohol	129.62	54.98	2.36	0.02*
R^2= 0.09				
Regression 3				
Age	4.37	6.33	0.67	0.50
Heroin	1004.39	272.14	3.69	0.01**
PTSD	-1124.91	751.33	-1.50	0.14
Age x Heroin	-22.70	5.97	-3.80	0.01**
Age x PTSD	34.62	18.23	1.90	0.06
R^2= 0.23				

* indicates a significance at the $p < 0.05$ level
** indicates a significance at the $p < 0.01$ level
MDD = Major Depressive Disorder; PTSD = Post Traumatic Stress Disorder

Table 7. Bivariate Correlations between Psychopathic Personality Inventory (PPI) Scores and Balloon Analogue Risk Task (BART) Scores (n = 90).

	BART Total
PPI Total	-0.01
PPI ME	-0.06
PPI SP	-0.01
PPI F	0.09
PPI CH	-0.06
PPI IN	0.03
PPI BE	-0.09
PPI CN	0.14
PPI SI	0.00

PPI = Psychopathic Personality Inventory; ME = Machiavellian Egocentricity; SP = Social Potency; F = Fearlessness; CH = Coldheartedness; IN = Impulsive Nonconformity; BE =Blame Externalization; CN = Carefree Nonplanfulness; SI = Stress Immunity

Table 8. Regression Models with Psychopathic Personality Inventory (PPI) Scores Predicting Total Balloon Analogue Risk Task (BART) Score (n = 90).

Independent Variable	Standardized Coefficient	SE	t	p
Regression 1				
Age	2.46	6.36	0.39	0.70
Heroin	1162.13	285.91	4.07	0.01**
PTSD	-930.56	753.07	-1.24	0.22
Age x Heroin	-25.73	6.19	-4.16	0.01**
Age x PTSD	30.68	18.20	1.69	0.10
PPI Total Score	-2.28	1.39	-1.65	0.10
R^2= 0.26**				
Regression 2				
Age	7.28	6.89	1.06	0.29
Heroin	1198.50	294.91	4.06	0.01**
PTSD	-877.38	801.37	-1.09	0.28
Age x Heroin	-26.43	6.34	-4.17	0.01**
Age x PTSD	29.82	19.52	1.53	0.13
PPI ME	-5.53	4.95	-1.12	0.27
PPI SP	2.57	5.87	0.44	0.66
PPI F	3.23	6.56	0.49	0.62
PPI CH	-10.94	7.46	-1.47	0.15
PPI IN	-1.07	8.52	-0.13	0.90
PPI BE	-11.87	7.20	-1.65	0.10
PPI CN	6.75	6.91	0.98	0.33
PPISI	3.77	10.91	0.35	0.73
R^2= 0.31**				
Regression 3				
Age	8.24	5.97	1.38	0.17
Heroin	1194.24	273.41	4.37	0.01**
PTSD	371.80	140.47	2.65	0.01**
PPI BE	-13.21	5.40	-2.45	0.02*
Age x Heroin	-26.62	5.97	-4.46	0.01**
R^2= 0.25**				

* indicates a significance at the $p < 0.05$ level

** indicates a significance at the $p < 0.01$ level

ME = Machiavellian Egocentricity; SP = Social Potency; F = Fearlessness; CH = Coldheartedness; IN = Impulsive Nonconformity; BE =Blame Externalization; CN = Carefree Nonplanfulness; SI = Stress Immunity; PTSD = Post Traumatic Stress Disorder

Table 9. Correlations between Punishment Reactivity, Reward Reactivity, and Relevant Variables (n = 89).

	Punishment Reactivity	Reward Reactivity
Punishment Reactivity	--	-0.89**
Reward Reactivity	-0.89**	--
Gender	0.24*	-0.29**
Heroin	0.27**	-0.30**
Cocaine	-0.21*	0.21*
BART	0.19	0.10
PPI Total	0.04	-0.03
PPI ME	-0.07	0.08
PPI SP	-0.09	0.15
PPI F	0.02	-0.05
PPI CH	-0.08	-0.01
PPI IN	0.13	-0.09
PPI BE	0.09	-0.08
PPI CN	0.19	-0.14

* indicates a significance at the $p < 0.05$ level
** indicates a significance at the $p < 0.01$ level
BART = Balloon Analogue Risk Task; PPI = Psychopathic Personality Inventory; ME = Machiavellian Egocentricity; SP = Social Potency; F = Fearlessness; CH = Coldheartedness; IN = Impulsive Nonconformity; BE =Blame Externalization; CN = Carefree Nonplanfulness; SI = Stress Immunity

Table 10. Regression Models Predicting Punishment Reactivity (n = 89).

Independent Variable	Standardized Coefficient	SE	t	p
Regression 1				
Gender	0.90	0.39	2.34	0.02**
Heroin	0.51	0.19	2.67	0.01**
R^2= 0.13				
Regression 2				
Gender	0.91	0.39	2.33	0.02**
Heroin	0.51	0.20	2.60	0.01**
PPI Total	0.00	0.01	0.07	0.94
R^2= 0.13				
Regression 3				
Gender	1.26	0.41	3.06	0.01**
Heroin	0.73	0.19	3.92	0.01**
PPI ME	-0.05	0.02	-2.95	0.01**
PPI SP	0.02	0.02	0.80	0.43
PPI F	-0.04	0.02	-1.86	0.07
PPI CH	-0.06	0.03	-2.43	0.02*
PPI IN	0.07	0.03	2.20	0.03*
PPI BE	0.04	0.03	1.73	0.09
PPI CN	0.06	0.02	2.84	0.01**
PPI SI	0.04	0.04	0.99	0.32
R^2= 0.34**				
Regression 4				
Gender	1.10	0.38	2.91	0.01**
Heroin	0.66	0.18	3.57	0.01**
PPI ME	-0.03	0.01	-2.18	0.03*
PPI CN	-0.06	0.02	-2.66	0.01**
PPI CN	0.07	0.02	3.34	0.01**
R^2= 0.27**				

* indicates a significance at the $p < 0.05$ level

** indicates a significance at the $p < 0.01$ level

PPI = Psychopathic Personality Inventory; ME = Machiavellian Egocentricity; SP = Social Potency; F = Fearlessness; CH = Coldheartedness; IN = Impulsive Nonconformity; BE =Blame Externalization; CN = Carefree Nonplanfulness; SI = Stress Immunity

Table 11. Regression Models Predicting Reward Reactivity (n = 89).

Independent Variable	Standardized Coefficient	SE	t	p
Regression 1				
Gender	-0.68	0.23	-2.92	0.01**
Heroin	-0.34	0.11	-2.99	0.01**
R^2= 0.17				
Regression 2				
Gender	-0.68	0.23	-2.90	0.01**
Heroin	-0.34	0.12	-2.93	0.01**
PPI Total	0.01	0.01	0.03	0.98
R^2= 0.17				
Regression 3				
Gender	-0.75	0.26	-2.90	0.01**
Heroin	-0.44	0.12	-3.76	0.01**
PPI ME	0.02	0.01	2.14	0.04*
PPI SP	0.01	0.01	0.40	0.69
PPI F	0.02	0.01	1.29	0.20
PPI CH	0.02	0.02	1.42	0.16
PPI IN	-0.03	0.02	-1.64	0.10
PPI BE	-0.03	0.02	-2.04	0.04*
PPI CN	-0.03	0.01	-2.01	0.05*
PPI SI	-0.04	0.03	-1.48	0.14
R^2= 0.32**				
Regression 4				
Gender	-0.76	0.23	-3.25	0.01**
Heroin	-0.38	0.11	-3.37	0.01**
PPI ME	0.02	0.01	2.27	0.03*
PPI BE	-0.03	0.01	-2.06	0.04*
PPI CN	-0.02	0.01	-2.01	0.05*
R^2= 0.26**				

* indicates a significance at the $p < 0.05$ level

** indicates a significance at the $p < 0.01$ level

PPI = Psychopathic Personality Inventory; ME = Machiavellian Egocentricity; SP = Social Potency; F = Fearlessness; CH = Coldheartedness; IN = Impulsive Nonconformity; BE =Blame Externalization; CN = Carefree Nonplanfulness; SI = Stress Immunity

Table 12. Correlations between Absolute Punishment Reactivity, Absolute Reward Reactivity, and Relevant Variables (n = 89).

	Absolute Punishment Reactivity	Absolute Reward Reactivity
Gender	-0.16	-0.26*
PPI Total	0.01	0.00
PPI ME	0.08	0.10
PPI SP	0.05	0.09
PPI F	0.05	-0.02
PPI CH	0.09	-0.03
PPI IN	-0.01	-0.01
PPI BE	-0.17	-0.12
PPI CN	-0.14	-0.08
PPI SI	0.07	-0.04
BART Total	-0.08	0.30**

* indicates a significance at the $p < 0.05$ level
** indicates a significance at the $p < 0.01$ level
PPI = Psychopathic Personality Inventory; ME = Machiavellian Egocentricity; SP = Social Potency; F = Fearlessness; CH = Coldheartedness; IN = Impulsive Nonconformity; BE =Blame Externalization; CN = Carefree Nonplanfulness; SI = Stress Immunity; BART = Balloon Analogue Risk Task

Table 13. Regression Models Predicting Absolute Punishment Reactivity (n = 89).

Independent Variable	Standardized Coefficient	SE	*t*	*p*
Regression 1				
Gender	-0.44	0.31	-1.45	0.15
PPI Total	0.00	0.01	0.03	0.98
R^2= 0.02				
Regression 2				
Gender	-0.83	0.34	-2.43	0.02*
PPI ME	0.03	0.02	2.22	0.03*
PPI SP	-0.02	0.02	-1.16	0.25
PPI F	0.03	0.02	1.35	0.18
PPI CH	0.02	0.02	1.02	0.31
PPI IN	-0.01	0.03	-0.52	0.61
PPI BE	-0.05	0.02	-2.47	0.02*
PPI CN	-0.03	0.02	-1.60	0.11
PPI SI	0.01	0.03	0.12	0.91
R^2= 0.17				
Regression 3				
Gender	-0.64	0.31	-2.06	0.04*
PPI BE	-0.04	0.02	-2.19	0.03*
R^2= 0.08*				

* indicates a significance at the $p < 0.05$ level
PPI = Psychopathic Personality Inventory; ME = Machiavellian Egocentricity; SP = Social Potency; F = Fearlessness; CH = Coldheartedness; IN = Impulsive Nonconformity; BE =Blame Externalization; CN = Carefree Nonplanfulness; SI = Stress Immunity

Table 14. Regression Models Predicting Absolute Reward Reactivity (n = 89).

Independent Variable	Standardized Coefficient	SE	t	p
Regression 1				
Gender	-0.47	0.19	-2.49	0.02*
PPI Total	0.00	0.01	-0.17	0.86
R^2= 0.07*				
Regression 2				
Gender	-0.59	0.22	-2.708	0.01**
PPI ME	0.02	0.01	1.843	0.07
PPI SP	-0.01	0.01	-.242	0.81
PPI F	0.01	0.01	.689	0.49
PPI CH	-0.01	0.01	-.048	0.96
PPI IN	-0.01	0.02	-.738	0.46
PPI BE	-0.03	0.01	-2.434	0.02*
PPI CN	-0.01	0.01	-.708	0.48
PPI SI	-0.01	0.02	-0.18	0.86
R^2= 0.16				
Regression 3				
Gender	-0.57	0.19	-3.01	0.01**
PPI BE	-0.02	0.01	-2.00	0.05*
R^2= 0.11**				

* indicates a significance at the $p < 0.05$ level
** indicates a significance at the $p < 0.01$ level
PPI = Psychopathic Personality Inventory; ME = Machiavellian Egocentricity; SP = Social Potency; F = Fearlessness; CH = Coldheartedness; IN = Impulsive Nonconformity; BE =Blame Externalization; CN = Carefree Nonplanfulness; SI = Stress Immunity

Appendix A

Demographics Form

Age: _____
Sex: ___Female (0) ___ Male (1)

Marital/Relationship Status:
_____ (1) Single (never married, living alone, divorced, widowed, etc.)
_____ (2) Living with a partner as if married
_____ (3) Married BUT separated
_____ (4) Married

Ethnicity / Race:
___ (1) White/Caucasian ___ (4) Hispanic /Latino
___ (2) Black/African American ___ (5) Native American
___ (3) Asian/Southeast Asian

Education (the highest grade or degree you have completed):
___ (1) None
___ (2) 1st to 8th Grade
___ (3) Some High School
___ (4) High School Graduate
___ (5) G.E.D.
___ (6) Some College
___ (7) Technical or Business School
___ (8) College Graduate
___ (9) Some Graduate School
___ (10) Graduate or Professional Degree

Totally Family/Household Income (Please check one):

___$0 - 9,999	___$40,000 – 49,999	___$80,000 – 89,999
___$10,000 – 19,999	___$50,000 – 59,999	___$90,000 – 99,999
___$20,000 – 29,999	___$60,000 – 69,999	___$100,000 or more
___$30,000 – 39,999	___$70,000 – 79,999	

Employment Status
PRIOR TO TREATMENT/CORRECTIONAL FACILITY ENTRY:
___ (1) unemployed ___ (4) full-time student ___ (5) home-maker
___ (2) employed part-time (working 1-30 hours a week) ___ (6) part-time student
___ (3) employed full-time (working more then 30 hours a week ___(7)retired

Appendix B

MEDICATION AND TREATMENT QUESTIONAIRE

1. List all medications you are currently using on a daily or scheduled basis.

Medication	Strength/Dosage	Frequency	When did you start?

2. What is the condition you have that requires the medication you are taking?

3. When were you diagnosed?

1. When did you enter Harbor Lights Treatment Center?_____

2. When are you scheduled to leave Harbor Lights?_____

3. Do you have a legal obligation to be here?
   Yes No

   a. If you had no legal obligation, would you have come for treatment?
      Yes No

Appendix C

The following questions will ask whether you have used certain types of drugs. Please circle the number that indicates whether you have used these drugs (1=yes) or not (0=no).

		Yes (1)	No (0)
1.	Have you ever used cannabis (for example, hash, marijuana, THC, or other)?	**1**	**0**
2.	Have you ever used alcohol?	**1**	**0**
3.	Have you ever used cocaine (for example, intranasal, IV, crack, freebase, "speedball," or other)?	**1**	**0**
4.	Have you ever used MDMA (also known as Ecstasy, E, and X)?	**1**	**0**
5.	Have you ever used stimulants that were <u>not</u> prescribed for you by a doctor (for example, amphetamine, "speed," crystal meth, dexadrine, Ritalin, "ice")?	**1**	**0**
6.	Have you ever used sedatives, hypnotics, or anxiolytics that were not prescribed for you by a doctor (for example, Xanax, Quaaludes, Valium, Librium, barbiturates, Miltown, Ativan, Dalmane, Halcion, Restoril, Seconal, or other)?	**1**	**0**
7.	Have you ever used opiates that were not prescribed for you by a doctor (for example, heroin, morphine, opium, Methadone, codeine, Demerol, Darvon, Perdocan, Dilaudid, or other)?	**1**	**0**
8.	Have you ever used hallucinogens other than PCP (for example, LSD, mescaline, peyote, psilocybin, STP, mushrooms, "angel dust," or other)?	**1**	**0**
9.	Have you ever used PCP?	**1**	**0**
10.	Have you ever used inhalants (for example, glue, gasoline, paint, nitrous oxide, "laughing gas," or other)?	**1**	**0**
11.	Have you ever used nicotine (for example, cigarettes, dip, chew, cigar, or other)?	**1**	**0**

Please circle the answer that is correct for you.

	Never	**One Time**	**Monthly or less**	**2-4 times a month**	**2-3 times a week**	**4 or more times a week**
1a. About how often did you use cannabis (i.e., marijuana) *in the past year*?	0	1	2	3	4	5
1b. *During the period in your life when you were using cannabis/marijuana most frequently,* about how often were you using?	0	1	2	3	4	5
2a. About how often did you use alcohol *in the past year*?	0	1	2	3	4	5
2b. *During the period in your life when you were using alcohol most frequently,* about how often were you using?	0	1	2	3	4	5
3a. About how often did you use cocaine *in the past year*?	0	1	2	3	4	5
3b. *During the period in your life when you were using cocaine most frequently,* about how often were you using?	0	1	2	3	4	5
4a. About how often did you use ecstasy *in the past year*?	0	1	2	3	4	5
4b. *During the period in your life when you were using ecstasy most frequently,* about how often were you using?	0	1	2	3	4	5
5a. About how often did you use stimulants *in the past year*?	0	1	2	3	4	5
5b. *During the period in your life when you were using stimulants most frequently,* about how often were you using?	0	1	2	3	4	5
6a. About how often did you use sedatives *in the past year*?	0	1	2	3	4	5

	Never	One Time	Monthly or less	2-4 times a month	2-3 times a week	4 or more times a week
6b. *During the period in your life when you were using sedatives most frequently,* about how often were you using?	0	1	2	3	4	5
7a. About how often did you use heroin *in the past year*?	0	1	2	3	4	5
7b. *During the period in your life when you were using heroin most frequently,* about how often were you using?	0	1	2	3	4	5
8a. About how often did you use hallucinogens *in the past year*?	0	1	2	3	4	5
8b. *During the period in your life when you were using hallucinogens most frequently,* about how often were you using?	0	1	2	3	4	5
9a. About how often did you use PCP *in the past year*?	0	1	2	3	4	5
9b. *During the period in your life when you were using PCP most frequently,* about how often were you using?	0	1	2	3	4	5
10a. About how often did you use inhalants *in the past year*?	0	1	2	3	4	5
10b. *During the period in your life when you were using inhalants most frequently,* about how often were you using?	0	1	2	3	4	5
11a. About how often did you use nicotine *in the past year*?	0	1	2	3	4	5
11b. *During the period in your life when you were using nicotine most frequently,* about how often were you using?	0	1	2	3	4	5

1. How often *during the past year* have you found that you were not able to stop using drugs once you had started?

Never	Less than Monthly	Monthly	Weekly	Daily or almost daily
(0)	(1)	(2)	(3)	(4)

2. How often *during the past year* have you failed to do what was normally expected from you because of your drug use?

Never	Less than Monthly	Monthly	Weekly	Daily or almost daily
(0)	(1)	(2)	(3)	(4)

3. How often *during the past year* have you had a feeling of guilt or remorse after using drugs?

Never	Less than Monthly	Monthly	Weekly	Daily or almost daily
(0)	(1)	(2)	(3)	(4)

4. How often *during the past year* have you been unable to remember what happened the night before because you had been using drugs?

Never	Less than Monthly	Monthly	Weekly	Daily or almost daily
(0)	(1)	(2)	(3)	(4)

5. How often *during the past year* have you used drugs to keep yourself from experiencing withdrawal symptoms?

Never	Less than Monthly	Monthly	Weekly	Daily or almost daily
(0)	(1)	(2)	(3)	(4)

6. Have you or someone else been injured as a result of your drug use?

No	Yes, but <u>not</u> in the past year	Yes, in the past year
(0)	(1)	(2)

7. Has a relative or friend, or a doctor or other health worker been concerned about your drug use or suggested you cut down or stop?

No	Yes, but <u>not</u> in the past year	Yes, in the past year
(0)	(1)	(2)

Appendix D

Criminality Index

Please indicate the number of times you have **committed** or **attempted to commit** (not necessarily been arrested or charged with) the following crimes. If you have never committed a particular crime please put 0. If you cannot remember the number of times exactly please give us your best approximation, if it is over 100 times, you can write 100+.

Type of Crime	**# of Times Attempted/Committed**
1. Driving under the Influence of Drugs/Alcohol	_____
2. Selling of Illegal Drugs	_____
3. Carrying an illegal weapon	_____
4.Vandalism/Property Damage	_____
5. Prostitution or "sex for drugs"	_____
6. Theft of less than $50	_____
7. Theft greater than $50	_____
8. Auto Theft	_____
9. Burglary—includes Breaking and Entering	_____
10. Assault without a Weapon	_____
11. Assault with a Weapon	_____
12. Hit Spouse or Partner	_____
13. Sex-related offenses	_____
14. Unarmed or Strong-arm robbery	_____
15. Armed Robbery	_____
16. Unarmed Carjacking	_____
17. Armed Carjacking	_____
18. Murder	_____

Appendix E

Copywrited Material

Shipley Institute of Living-Revised (SILS-R; Zachary, 1986)
Available at:
http://portal.wpspublish.com/portal/page?_pageid=53,69321&_dad=portal&_schema=PORTAL

Psychopathic Personality Inventory (PPI; Lilienfeld, 1990):
Available at:
http://www3.parinc.com/

Structured Clinical Interview for DSM-IV (SCID-NP, non-patient version):
Available at:
http://www.scid4.org/index.html

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