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Impulsivity in Subclinical Borderline Personality Individuals Using a Delay Discounting Task with Social Incentives

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Impulsivity in Subclinical Borderline Personality Individuals Using a Delay Discounting Task with Social Incentives

by

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Submitted in Partial Fulfillment of the Requirements for the Degree Master of Arts in Psychology

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Abstract

Impulsivity was examined in a subclinical sample of college students with borderline personality disorder (BPD) traits. Using the Borderline Personality Questionnaire (BPQ; Poreh et al., 2006) participants were screened for high and low BPD traits. Twenty-six high-BPD and twenty-four low-BPD participants were compared on impulsivity. Impulsivity was assessed using a self-report measure (BIS-11; Patton, Stanford & Barratt, 1995) and three laboratory tasks, the GoStop Impulsivity Paradigm (Dougherty, Mathias, & Marsh, 2003), a delay discounting task (Dixon, Jacobs, & Sanders, 2006) with monetary incentives and a delay discounting task with social incentives. Past research has shown that high- and low-BPD individuals do not discount monetary rewards differently (Dom, De Wilde, Hulstijn, Van Den Brink, & Sabbe, 2006). The present study replicated these results. In addition, the present research hypothesized that high-BPD individuals would discount social rewards more steeply. Results, however, showed no differences between groups in social discounting, nor did high-BPD individuals discount social rewards at a significantly greater rate than monetary rewards, as was expected. Still, there was a significant main effect, showing that, overall, participants discounted social rewards more steeply than monetary rewards. Contrary to what was expected, there was no difference between groups on the GoStop Impulsivity Paradigm. Results did confirm the hypothesis that high-BPD participants were more impulsive than low-BPD participants on the BIS-11. These results suggest that the two groups differ on impulsivity according to self-report measures, but that delay discounting does not discriminate between groups regardless of the reinforcer.
Impulsivity in Subclinical Borderline Personality Individuals Using a Delay Discounting Task with Social Incentives

The nature of borderline personality disorder (BPD) is one of immense instability across a variety of areas of functioning, including interpersonal relationships and impulsivity. The prevalence of BPD is about 1-2% of the general population and can be very debilitating both to those inflicted with it, and to those who care for them (Samuels et al., 2002; Swartz, Blazer, George, & Winfield, 1990; Torgersen, Kringlen, & Cramer, 2001). In psychiatric populations, the prevalence greatly increases, with individuals with borderline personality disorder making up to 8-10% of the outpatient population and 15-20% of the inpatient psychiatric community. Those with BPD require more mental health resources than those with different psychiatric disorders which makes gaining understanding about the nature of the disorder that much more imperative (Lieb, Zanarini, Schmahl, Linehan, & Bohus, 2004; Widiger & Trull, 1993; Widiger & Weissman, 1991; Zimmerman, Rothschild, & Chelminski, 2005). BPD diagnoses are strikingly disparate between genders, with women making up about 70% of cases (Swartz et al., 1990; Widiger & Weissman, 1991; Zanarini, Gunderson, Frankenburg, & Chauncey, 1990b).

Borderline personality disorder, along with all other personality disorders, is an axis II disorder in the *Diagnostic and Statistical Manual of Mental Disorders-IV-TR* (American Psychiatric Association, 2000). Within axis II, the personality disorders are organized into three separate clusters. Cluster A disorders, also known as “odd-eccentric” disorders, include paranoid, schizoid, and schizotypal personality disorders. Borderline personality disorder falls under Cluster B, or “dramatic-emotional” disorders, as does antisocial, histrionic and narcissistic personality disorders. Lastly, the “anxious-fearful” disorders in Cluster C are avoidant, dependent and obsessive-compulsive personality disorders. It is not uncommon for individuals
to have more than one axis II disorder (Ross, Dermatis, Levounis, & Galanter, 2003). In addition, personality disorders such as BPD are commonly comorbid with a variety of axis I disorders, such as mood disorders, specifically major depression and bipolar disorder (Altindag, Yanik, & Nebioglu, 2006; Tamam, Ozpoyraz, & Karatas, 2004; Zanarini et al., 1998b), substance abuse disorders (Skinstad & Swain, 2001; Zanarini et al., 1998b), anxiety disorders, specifically post-traumatic stress disorder (PTSD) (Golier et al., 2003; Zanarini et al., 1998b), eating disorders (Zanarini et al., 1998b), and even body dysmorphic disorder (Semiz et al., 2008).

Borderline personality disorder is defined by the *Diagnostic and Statistical Manual of Mental Disorders-IV-TR* as “a pervasive pattern of instability of interpersonal relationships, self image, and affects, and marked impulsivity” (American Psychiatric Association, 2000, p. 706). A person diagnosed with BPD can be happy one minute, and in total despair the next; they may “alternate between being flooded with emotion and being numb to all feeling” (Moskovitz, 2001). Those with BPD experience intense bouts of rage, which can either be directed at others, or turned inwards on themselves in the form of self-harm or suicidal gestures or attempts. They may also turn to self-destructive and “impulsive” behaviors to soothe their pain, such as using alcohol and drugs, binge eating, reckless spending or promiscuity (Dougherty, Bjork, Huckabee, Moeller, & Swann, 1999; Moskovitz, 2001). They have unstable and intense relationships, as they fear abandonment from others but often push those who care away with mistrust, hostility and degradation.

Despite frequent comorbidity of BPD with axis I and other axis II disorders, BPD does have discriminating features. The central distinct features of BPD are affective disturbance, cognitive disturbance, impulsivity, and unstable relationships. Taken together, these salient
features make up BPD (Lieb et al., 2004) and differentiate it from axis I disorders and other axis II disorders (Fossati, et al., 2007; Gunderson & Kolb, 1978; Zanarini et al., 1990b).

Central Features of BPD

Affective Disturbance in BPD

Those suffering from BPD experience intense and rapidly changing affective states, often negative in nature, such as rage, sorrow, panic, emptiness, and shame (Lieb et al., 2004). People with BPD live with “intense inner pain... on a chronic basis,” (Zanarini & Frankenburg, 2007, p. 522). Not only do patients diagnosed with BPD experience these negative emotions, but they seem to do so to a greater degree than do other patients, leading some to refer to their dysregulation as hyperbolic, or exaggerated (Zanarini & Frankenburg, 1994; Zanarini et al., 1998a). Zanarini and Frankenburg (2007) explain that hyperbolic temperament in regards to BPD is meant to describe the tendency to be offended easily and to try to manage the resulting resentment by “persistently insisting that others pay attention to the enormity of one’s inner pain,” (p. 520). Linehan (1993) explained that individuals with BPD have “no emotional skin,” resulting in immense torment from “even the slightest touch or movement,” (p. 69). Feelings of depression, dysphoria, anger and anxiety are more common in those with BPD than those with other axis II disorders (Zanarini et al., 1990b). They attempt to ameliorate and deal with this inner pain in a variety of ways, which are mostly self-destructive or inappropriate in nature, including uncontrolled bouts of anger, fighting and self-harm (Lieb et al., 2004; Linehan, 1993; Zanarini & Frankenburg, 2007).

In a study by Zanarini et al. (1998a), patients with a BPD diagnosis and a control group of patients without a BPD diagnosis were given the Dysphoric Affect Scale (DAS), a self-report measure designed by these researchers to assess dysphoric emotions and cognitions common to
BPD. Looking specifically at dysphoric states common to BPD but not exclusive or specific to BPD (meaning they were also common among clients with other diagnoses), the researchers found that clients with BPD reported significantly higher frequencies of all twenty five states than did the control group. Affective states in the DAS included unhappy, scared, lonely, empty, hurt, worthless, desperate, and very angry inside. These affect disturbances and extreme fluctuations in mood exacerbate the other symptoms of BPD.

**Cognitive Disturbance in BPD**

Another area in which those with BPD suffer symptoms is their cognitions. The cognitive disturbances individuals with BPD experience are mainly non-psychotic but delusional and disturbing thoughts. Often, these symptoms occur during times of extreme stress triggered by real or imagined abandonment. They are mostly paranoid type thoughts or dissociation but do not last long enough to warrant any kind of additional diagnosis (American Psychological Association, 2000). Zanarini, Gunderson, and Frankenburg (1990a) outlined three levels of these symptoms: disturbed thought, quasi-psychotic thought, and true psychotic thought. Quasi-psychotic thoughts are atypical hallucinations or delusions which are either partially based on reality or totally fantastical; they last less than two days, and involve only one or two areas of the patient’s life (Zanarini et al., 1990b).

Zanarini et al. (1990a) found that 100% borderline participants reported some kind of disturbing, but non-psychotic, thoughts such as nondelusional paranoia, undue suspiciousness, or unusual perceptions. About 40% of BPD individuals reported quasi-psychotic thought (26% quasi-psychotic hallucinations, 20% quasi-psychotic delusions). Similarly, in another study Zanarini et al. (1990b) found that 35% of BPD patients reported quasi-psychotic thought, 71% reported odd thinking, and 93% reported nondelusional paranoia. Individuals diagnosed with
BPD have cognitive distortions that often center on a persistent negative and intensely unstable sense of self, frequently including thoughts of being bad. They can also experience dissociative and depersonalization symptoms (Zanarini et al., 1990a). The DSM-IV-TR defines dissociative symptoms as “a disruption in the usually integrated functions of consciousness, memory, identity, or perception of the environment” (American Psychiatric Association, 2000, p. 519). In layman’s terms, the extreme physical and emotional detachment of dissociation in BPD has been described as “numbing out,” “shutting down” or “go[ing] away” (Moskovitz, 2001, p. 21).

As previously mentioned, Zanarini et al. (1998a) assessed dysphoric cognitions among BPD patients using the DAS. As was found with affective symptoms, the researchers found that the BPD group reported significantly more dysphoric cognitions than control patients without BPD; disturbed cognitions included thoughts such as “I’m misunderstood,” “I’m a complete failure,” “I’m a bad person,” “The pain will never go away,” and “No one cares about me,” (p. 203). Combined with the emotional turbulence, these skewed cognitions make both living with BPD and treating it arduous.

**Interpersonal Relationships & Fear of Abandonment in BPD**

Those diagnosed with borderline personality disorder are notorious for simultaneously striving toward and repelling against relationships with others. They are quick to dive into intense relationships in which they idealize the individual, but can become disenchanted with that same person just as hastily. They have intense fear of abandonment and often make frantic efforts to avoid being left alone, yet they can be very demanding and devaluing of others especially when they feel abandoned or expect they may be left alone (American Psychological Association, 2000; Lieb et al., 2004; Zanarini & Frankenburg, 2007).
Intolerance of being alone is a key facet of the disorder and understanding this is imperative to successfully treating BPD (Gunderson, 1996). This need to be with others and to feel validated leads to long and frequent hospital stays as well as extensive dependence on outpatient therapists (Geller & Brandzel, 1983; Gunderson, 1996). One case study described a twenty-three year old woman diagnosed with BPD who had been admitted to the same inpatient facility sixteen times since the age of eighteen, as well as two admissions to other facilities (Geller & Brandzel, 1983). Often times, her admissions were due to her own insistence that only an admission would prevent her suicide; continuous staff surveillance was frequently necessary to prevent any suicidal gestures.

Difficulties with interpersonal relationships tend to begin early and may stem from difficulties in childhood for those with BPD. Mizenberg, Poole, and Vinogradov, (2006) found that people with BPD have two types of social attachment: attachment-anxiety and attachment-avoidance. Attachment-anxiety is related the fear of abandonment in relationship settings, while attachment-avoidance is related to social distancing, both emotionally and behaviorally; these two styles together represent the paradoxical style of interacting in those with BPD.

Maltreatment and abuse in childhood may play a role in the interpersonal problems that are evident in adulthood. Mizenberg et al. (2006) also found that attachment difficulties in adulthood were related to reports of childhood sexual abuse and maltreatment. In another study by Wonderlich and Swift (1989), seventy-two percent of participants with BPD reported sexual abuse during adolescence, which was significantly higher than those with other personality disorders (twenty-seven percent) or no personality disorder. In the same study, BPD clients reported more hostile and emotionally impoverished family environments than did those with other personality disorders.
This perception of others as being hostile or withdrawn from oneself is pervasive among individuals diagnosed with BPD. They are more likely than mood disordered individuals to view their current relationships as hostile, their maternal relationships as “highly autonomous,” and to perceive themselves as “hostilely recoiled from staff and attacked by other patients” (Benjamin & Wonderlich, 1994, p. 618). Similarly, Wonderlich and Swift (1989) found that people with BPD were more likely than those with other personality disorders to perceive their relationships with both parents as hostile and withdrawn. Patients with BPD seem to have a “deeply held belief that other people are uncaring or malevolent” and constantly feel rejected, yet they keep hoping and yearning for close and meaningful relationships (Zanarini & Frankenburg, 2007, p. 528). This fear of abandonment may be part of what fuels their impulsive behavior in that dangerous behaviors and gestures can elicit help and attention from others, which might also lead to alleviation of their emotional pain (Linehan, 1993).

**Impulsivity in BPD**

In addition to their unstable relationships with family, friends, romantic partners and mental health professionals, individuals with BPD often exhibit impulsive behavior. Impulsive and destructive behaviors such as self harm, suicidal gestures, sexual promiscuity and substance abuse are common in the BPD population (Feske, Tarter, Kirisci, & Pilkonis, 2006; Zanarini & Frankenburg, 2007). Impulsiveness is a key characteristic of BPD in that it discriminates BPD from all other Cluster B disorders (Fossati et al., 2007).

Though impulsive behaviors (such as binge drinking and eating, reckless spending and promiscuity) are diagnostically separated from self-harm and suicidal behavior in the DSM-IV-TR criteria, impulsivity in the form self-injurious and suicidal behavior is extremely common in BPD (American Psychological Association, 2000). Research has shown that clients with BPD
report engaging in self-harm behavior during adolescence more than those diagnosed with other personality disorders or those without any personality disorder (Wonderlich & Swift, 1989). Self-injurious behavior among borderline individuals is as prevalent as 65-75% (Levy, 2005; Zanarini et al., 2008). Additionally, those with BPD commonly report making suicide attempts, more often than those with other personality disorders do, and much more than those with no personality disorder (Wonderlich & Swift, 1989).

Much research has highlighted the high risk of suicide and parasuicidal behavior among those with BPD (Levy, 2005; Soloff & Fabio, 2008; Zanarini et al., 2008; Zanarini et al., 1990b). Parasuicidal behavior, described by Norman Kreitman (as cited in Linehan, 1993), is the preferred label for suicidal gestures or attempts and refers to any non-fatal but self-injurious behavior. This includes behavior that causes actual tissue damage, illness, or risk of death. Ingesting drugs in excess with the intent to cause harm or death also constitutes parasuicide, while mere threats of suicide without action are not considered parasuicide. Additionally, parasuicide is distinguished from actual suicide where death occurs. It has been estimated that the rate of successful suicides in the BPD population is as high as 10%, which is 400 times greater than the general population (Levy, 2005; Fertuck, Makhija, & Stanley, 2007; Paris & Zweig-Frank, 2001). One study found 60% of individuals diagnosed with BPD reported making multiple suicide attempts, and 30% reported several methods of parasuicide (Zanarini et al., 2008).

The abandonment issues characteristic of BPD likely play a role in the frequency of self-injury and suicide. The anxious attachment style that is common in BPD is also correlated with self-harm behavior and may be a way to keep others close and rouse sympathy or rescue (Critchfield, Levy, Clarkin, & Kernberg, 2008). Brodsky, Malone, Ellis, Dulit, and Mann,
(1997) found that a history of childhood sexual or physical abuse was correlated with higher amounts of previous suicide attempts. Additionally, Brodsky et al. (1997) reported that impulsivity was the only BPD characteristic that was associated with higher rates of suicide attempts and that treatment that targets impulsivity in individuals with BPD is therefore imperative to decrease suicide attempts and rates. To understand impulsivity among people with BPD, it is necessary to try to understand the nature of impulsivity itself, which can be convoluted and diverse.

**Impulsivity as a Construct**

Impulsivity as a construct is quite heterogeneous; the definition may be difficult to pinpoint exactly because it is so multifaceted. Though impulsivity is a crucial feature in many disorders described in the DSM-IV, including ADHD, antisocial personality, borderline personality, and “impulse-control” disorders such as kleptomania and pathological gambling, the manual provides no explicit definition of impulsivity (American Psychiatric Association, 2000). Many attempts at defining impulsivity by others in the field have resulted in a variety of definitions. For example, choosing the lesser of two choices because of an inability to wait (Ainslie, 1975), inability to delay gratification (Mischel & Gilligan, 1964), “quick, unplanned behaviors that appear to lack clear forethought” (Hochhausen, Lorenz, & Newman, 2002, p. 495), and the tendency to contemplate less than most people before taking action (Dickman, 1990) have all been used to describe impulsivity.

Impulsivity can be viewed as a trait—a stable and long-lasting characteristic of a person, or as a state, such as behaving impulsively in a current situation. Research has distinguished between state and trait in regards to impulsivity (Benazzi, 2007; Baca-Garcia et al., 2005) as well as anxiety (Gaudry, Vagg, & Spielberger, 1975; Usala & Hertzog, 1991). Often self report
measures, such as the Barratt Impulsiveness Scale-11 (Patton, Stanford, & Barratt, 1995), focus on trait impulsivity, while laboratory measures, such as the Immediate Memory-Delayed Memory task, target state impulsiveness (Swann, Dougherty, Pazzaglia, Pham, & Moeller, 2004). There are, however, exceptions to this generalization (Guerrieri et al., 2007).

The fact that impulsivity is not a unified construct is recognized by researchers who have attempted to better understand it by identifying separate aspects which are each a part of the overall construct. Eysenck and Eysenck broke down impulsiveness into four parts: risk-taking, non-planning, liveliness, and narrow impulsivity (Eysenck & Eysenck, 1977). Dickman (1990) also subdivided impulsiveness into two types, functional and dysfunctional. Functional impulsivity refers to making quick decisions when doing so is advantageous, while dysfunctional impulsivity refers to “speedy and non-reflective decision-making despite the negative consequences of such actions” (Dickman, 1990; Mobini, Grant, Kass, & Yeomans, 2007, p. 1518).

Other researchers have differentiated between wholly different kinds of impulsivity. Swann, Bjork, Moeller, and Dougherty (2002) identified two major models of impulsivity--inability to delay reward (reward-delay impulsivity), and inability to take environmental context into account when making decisions (rapid-response impulsivity). The researchers used different laboratory tests and a self-report measure to distinguish between the two and found that both types of impulsivity correlated with the Barratt Impulsiveness Scale (BIS; Barratt, 1959). Rapid-response impulsiveness, however, correlated more highly than reward-delay impulsiveness among axis II disordered parents of children with disruptive behavioral disorders (such as oppositional defiant disorder, conduct disorder and ADHD).
Dougherty, Marsh, Mathias, and Swann (2005) also split impulsiveness into separate subtypes, but rather than the two that Swann et al. (2002) previously identified, they created three categories. The first is response initiation, which defines impulsivity as quick and unplanned decision making, or responding before full evaluation of the stimuli has been completed. Response inhibition is the second aspect of impulsive behavior, which they defined as a failure to inhibit an already initiated response. Response initiation coupled with response inhibition is analogous to Swann et al.’s (2002) rapid-response impulsivity. Lastly, consequence sensitivity (analogous to reward-delay) refers to impulsive behavior that continues despite negative or less favorable consequences, such as a loss of a reward (Dougherty, Marsh et al., 2005).

There are numerous laboratory measures that have been employed to measure each aspect of impulsiveness identified by Swann et al. (2002) and Dougherty, Marsh et al. (2005). Each measure coincides with a different aspect of impulsivity, either response initiation, response inhibition or consequence sensitivity/reward-delay.

**Laboratory Measures of Impulsivity**

**Response Initiation**

**The Immediate and Delayed Memory Task (IMT/DMT).**

The Immediate and Delayed Memory Tasks are variants of the Continuous Performance Test (CPT) (Rosvold, Mirsky, Sarason, Bransome, & Beck, 1956), which was originally created to test attention and alertness in brain damaged individuals compared to non-brain damaged persons. In its original form, the CPT included two tasks, the X task and the more difficult AX task. During the X task, the individual looked into a man-made apparatus in which letters were illuminated by a light bulb; participants were to respond by pressing the response key when they
saw the letter X during the X task. The AX task required slightly more prolonged attention and required participants to respond when they saw an X followed by an A. Those with brain damage performed more poorly on both tasks of the CPT (Rosvold et al., 1956).

The Immediate Memory Task (IMT) and the Delayed Memory Task (DMT), though modifications of the CPT, are somewhat different from their predecessor. Both the IMT and DMT are used to measure attention, memory and impulsivity (Dougherty, Marsh, & Mathias, 2002; Dougherty, Steinberg, Wassef, Medearis, Cherek, & Moeller, 1998). IMT/DMT addresses the response initiation aspect of impulsivity, which is the part of impulsivity defined by responses that occur before full evaluation of the stimuli has been completed (Dougherty, Marsh et al., 2005). Both tasks are completed using a computer program which presents a series of 2 to 7 digit numbers on a screen.

The IMT displays each number, one at a time, for 500msec with a 500msec interval between each stimulus. Each number is displayed in black with a white background, and participants are to respond (by clicking the mouse) when the number shown is identical to the one immediately before it. The DMT component also uses a series of numbers and asks participants to identify identical stimuli, but the time delay between stimuli increases because distracter stimuli are presented in between the two stimuli to be compared; participants are instructed to ignore the distracter stimuli. For example, a distracter number such as 12345 might be shown in between the two matching stimuli, looking something like this: 59231...12345...12345...12345...59231 (Dougherty et al., 2002).

For both the IMT and the DMT tasks, there are three different stimuli types that appear during the sessions: target, catch and filler. Target stimuli are those that are identical to the number set shown immediately before; a response to a target stimulus is considered a correct
detection, or a “hit.” Failure to respond to target stimulus is considered an omission error, or a “miss” (Dougherty et al., 1998). Target stimuli measure attention and memory abilities.

The catch stimuli are of particular importance to research on impulsiveness. Catch stimuli are almost identical to the preceding number set, but differ by one digit. Responding to these stimuli is considered a commission error, or a “false alarm”; a high frequency of commission errors is thought to be indicative of impulsivity (Dougherty, Bjork, Marsh, & Moeller, 2000; Dougherty, Bjork, Huckabee, Moeller, & Swann, 1999; Dougherty et al., 1998).

Filler stimuli are novel number sets that are not similar to the prior stimulus. Errors in responding to these fillers are considered filler errors. Such errors do not occur often (Dougherty et al., 2002).

**Response Inhibition**

**Stop tasks.**

In general, all variations of stop tasks aim to measure the same thing—inhibitory control. Measures such as the GoStop Impulsivity Paradigm (Dougherty, Mathias et al., 2003; Marsh, Dougherty, Mathias, Moeller, & Hicks, 2002), the stop-signal paradigm (Logan & Cowan, 1984; Van der Schoot, Licht, Horsley, & Sergeant, 2003), Go/No-Go (Drewe, 1975; Kamarajan et al., 2004), and the Passive Avoidance Learning task (Farmer et al., 2003), all aim to measure the response inhibition aspect of impulsivity, which is defined by the inability to inhibit an already initiated response (Dougherty, Marsh et al., 2005; Dougherty, Mathias, Marsh, & Jagar, 2005).

In the GoStop Impulsivity Paradigm, participants are shown a series of stimuli (5 digit numbers) in black with a white background on computer screen, and similar to the IMT/DMT, are asked to respond if the stimulus is identical to the one shown immediately before it (Dougherty, Mathias et al., 2003; Dougherty, Mathias et al., 2005; Marsh et al., 2002). Half of
the stimuli are target stimuli (identical numbers) and half are filler, or non-matching, stimuli. Of all the target stimuli, half of them are “stop” trials. This occurs when the set of numbers presented are identical to the previous stimuli, but the numbers change from black to red at some point after the onset of the stimulus; this indicates that the participant should then inhibit the already initiated response. Individuals are considered impulsive when they have trouble inhibiting responses once they have been initiated, operationally defined by the number of response inhibition failures relative to the number of responses to go trials (Dougherty, Bjork et al., 2003; Dougherty, Marsh-Richard, Hatzis, Nouvion, & Mathias, 2008; Dougherty, Mathias et al., 2005; Marsh et al., 2002).

The stop-signal paradigm (Logan & Cowan, 1984), which originated before the GoStop Impulsivity Paradigm, similarly asks participants to respond to a stimulus unless they are given a stop signal to inhibit their response. In this case, the stop signal is an auditory tone. There is a go task and stop task. The go task requires the participant to discriminate X and O, and to press a different key on the keyboard depending on which letter they saw on the screen (for example, pressing the “/” key for an X and the “z” key for an O) (Logan, Schachar, & Tannock, 1997). Stop signals, a tone played through the speakers on the computer, are presented on 25% of the trials. Participants are told to inhibit their response to both stimuli if they hear a tone; the delay of the tone varies on each trial. Inhibitory control depends on a “race” between the stop task and the go task. If participants finish the stop task before the go task, they inhibit their response; if they finish the go task before the stop task, the response is not inhibited. Therefore, response inhibition depends on the latency of the response to the go signal (known as the go reaction time) and the latency of the response to the stop signal (stop-signal reaction time). Those who are
impulsive have longer stop-signal reaction times and therefore do not inhibit their responses (Logan et al., 1997).

The Go/No-Go task (Dom et al., 2006) also asks participants to respond to specific stimuli unless given a signal to inhibit that response. Participants are told to move a yellow dot using an electronic pen into a target circle as fast as possible if the target circle is colored dark blue (go trial), but to inhibit that response if the target circle is colored light blue (no-go trial). The number of errors in the no-go trials and reaction time in the go trials are dependent variables in this task (Dom et al., 2006). This task has also been done using circles presented at the top right and bottom left corners of a computer screen as the go signals and circles presented in the top left and bottom right corners as the stop signals (Kamarajan et al., 2004).

The Passive Avoidance Learning Task (PAL) (Farmer et al., 2003) was designed to be similar to the go/no-go task, and also measures the response inhibition aspect of impulsivity. It requires participants to respond to stimuli to acquire reward, as well inhibiting response to avoid punishment (Newman, 1987; Newman & Kosson, 1986). Participants are to respond to positive stimuli (S+), which are various sets of two-digit numbers displayed on a computer screen for up to 3 seconds, to earn a 10 cent monetary incentive. There are six sets of numbers that represent the S+ stimuli. Correctly responding to a S+ stimulus by pressing a key on the keyboard results in the word “Correct” being displayed on the computer screen, as well as the experimenter saying “correct” in neutral tone (Farmer et al., 2003). Other studies have displayed the words, “You WIN 10 cents!” along with a high pitched tone to signal correct responses (Chapman, Leung, & Lynch, 2008). Six other sets of numbers are negative stimuli (S-), which signal participants to inhibit their response; failure to do so results in the presentation of the word “Wrong” (or “You LOSE 10 cents”) and the experimenter saying “wrong” (or a low pitched
sound), (Chapman et al., 2008; Farmer et al., 2003). Impulsivity is measured by the number of passive avoidance errors (PAEs), incorrectly responding to S- stimuli. Omission Errors (OEs), a failure to response to S+ stimuli, are also measured (Chapman, Mayer, Specht, Farmer, & Field, 2003; Chapman et al., 2008; Farmer et al., 2003).

**Consequence Sensitivity/Reward-Delay**

**Two-choice delayed reward.**

The two-choice delayed reward task, also called the two-choice reward task (Marsh et al., 2002) and the two-choice impulsivity paradigm (TCIP) (Dougherty, Mathias et al., 2005), measures one’s ability to wait for a delayed reward. Using a discrete trial procedure, the two-choice delayed reward (TC) task requires participants to choose one of two shapes, or letters, each representing a different delay-reward contingency (Cherek & Lane, 1999; Dougherty et al., 2003; Marsh et al., 2002). Throughout a series of trials, the participant selects either the shape leading to a smaller reward (points) after a shorter delay, or a larger reward after a longer delay. Participants go through a practice session to ensure that they are exposed to the different monetary amounts and delays associated with each letter or shape.

The type of reward contingency can either be fixed or variable. With a fixed contingency, for example, a participant can click either a circle to earn 5 cents after 5 seconds, or click on square to earn 15 cents after 15 seconds. In a variable contingency, however, the length of delay and amount of reward will change according to the participant’s prior response. For example, the length of delay may be increased for the smaller reward after each time that choice is selected, therefore making the attractiveness of the sooner reward diminish. Variable contingencies are useful for determining the indifference point, or the point at which the shorter
and longer delayed reward are of equal value to the individual (Dougherty, Mathias et al., 2005).
Indifference points are determined by an adjusting procedure developed by Mazur (1987).

**Single Key Impulsivity Paradigm (SKIP).**

Similar to the TC, the Single Key Impulsivity Paradigm (SKIP) measures one’s tolerance for a delayed reward (Mathias et al., 2002). The major difference between the TC and the SKIP is that the latter is a free-operant task as opposed to the discrete-trial procedure of the former. The SKIP allows the participant to respond freely by clicking the mouse, with the amount of the reward changing depending on the length of time the person waits between responses. The longer the participant waits between responses, the larger the reward becomes. Participants earn 1 cent for every 2 seconds of waiting, so waiting 20 seconds will earn the participant 10 cents (Mathias et al., 2002). Throughout the 20 minute session, two money counters keep track of the individuals progress, one labeled “Total Accumulated Money” and the other labeled “Most Recent Response Earnings.” This allows participants to infer the delay-reward relationship without being explicitly told that waiting longer results in more money earned (Dougherty et al., 2003; Mathias et al., 2002; Swann et al., 2002). Participants are given the money they earn at the end of the SKIP task.

**Delay of gratification.**

The delay of gratification paradigm was created by Walter Mischel to study self-control and “resistance to temptation” in children (Mischel, Ebbesen, & Zeiss, 1972; Mischel & Gilligan, 1964, p. 412). The paradigm presents two tangible rewards to participants, one available immediately, and the other, though more desirable, available only after a delay. The immediately available reward (such as a toy or preferred food), is set in front of the individual. The experimenter explains to the child that he or she may have that item now, or wait until the
experimenter returns, at which point he or she will be given the more desirable reward. The ability to wait for the more desirable reward is considered impulse control (Mischel & Gilligan, 1964).

**Self-control paradigm.**

Similar to the previously mentioned reward-delay impulsivity tasks, the self-control paradigm is used to study self control and its opposite, impulsiveness (Ainslie, 1974; Rachlin & Green, 1972). Self-control is defined by choosing a delayed reward of higher value over a reward of lesser value available immediately, while impulsiveness is defined by the opposite pattern of decision making (Logue, 1998). An apparatus is used specifically for such tasks, which consists of a wooden box with three different colored light bulbs (green, white and red) which indicate the beginning and end of trials, one or two sterile aluminum straws (to obtain reinforcer) and an aluminum rod that participants push either left or right to indicate their choice. Participants can choose between a more immediate reward and a delayed more desirable reward, such as one kind of juice or their more preferred, delayed flavor of juice (Forzano & Logue, 1995; Forzano, Porter, & Mitchell, 1997). Participants’ sensitivity to reinforcer amount relative to delay is a measure of self-control.

**Delay discounting.**

Delay discounting is the phenomenon in which the value of reward (e.g. money) decreases, or is discounted, by delay (Mazur, 1987; Odum & Rainaud, 2003). This tendency to discount the value of the reward based on the length of delay has been found in both human and non-human subjects (Mazur, 1987; Odum & Rainaud, 2003; Rachlin, Raineri, & Cross, 1991; Richards, Mitchell, de Wit, & Seiden, 1997).
The delay discounting procedure presents a series of choices to the participant, either using a computer program or index cards (Rachlin et al., 1991; Dixon, Jacobs, & Sanders, 2006). The participant chooses between a smaller, immediate hypothetical reward and a larger, but delayed hypothetical reward. For example, using the index card procedure, the amount of monetary incentives is as follows, $1,000, $990, $960, $920, $850, $800, $750, $700, $650, $600, $550, $500, $450, $400, $350, $300, $250, $200, $150, $100, $80, $60, $40, $20, $10, $5, and $1. Delays can range from 1 week, 2 weeks, 2 months, 6 months, 1 year, 5 years, and 25 years (Rachlin et al., 1991; Madden, Petry, Badger, & Bickel, 1997). The individual is first asked to choose between $1,000 immediately and $1,000 after 1 week. The amount of the immediate reward is then adjusted or titrated (decreased to $990, $960 etc.) until the indifference point is identified (the point at which the individual chooses the delayed reward instead of the immediate amount), which represents the point at which the amount of the immediate and delayed reward are subjectively equal (Mazur, 1987). This process is repeated for each delay length. Steeper discounting is considered to be more impulsive. Delay discounting procedures are hypothetical in that participants are never actually given the reinforcement.

**Self Report Measures of Impulsivity**

The following measures are commonly used methods to assess impulsivity in a self report format. There are, however, many other self report measures used in research that will not be discussed here.

**Barratt Impulsiveness Scale**

Originally created by Earnest Barratt in 1959, the Barratt Impulsiveness Scales is currently in its eleventh version (BIS-11; Patton et al., 1995). The BIS-11 is a 30 item self-report questionnaire that assesses trait impulsivity and is the most used self-report measure of
Impulsivity in both clinical and research settings (Stanford et al., 2009). The BIS-11 measures three subtraits of impulsivity: Attentional Impulsiveness (an inability to focus or concentrate), Motor Impulsiveness (acting without thinking) and Non-Planning Impulsiveness (lack of “futuring” or forethought) (Patton et al., 1995). Scores of 72 or higher on the BIS-11 are usually used to classify individuals as highly impulsive. Scores between 52 and 71 are within the normal range of impulsivity. Scores lower than 52 indicate either a person who is over-controlled or has not completed the questionnaire honestly (Stanford et al., 2009).

**Impulsiveness-Venturesomeness-Empathy Questionnaire**

The Impulsiveness-Venturesomeness-Empathy questionnaire (IVE-7) (Eysenck, Pearson, Easting & Allsopp, 1985) has its origins in Sybil Eysenck and H. Eysenck’s theory of personality (Eysenck & Eysenck, 1978) which identified three traits of personality: Psychoticism (P), Extraversion-Introversion (E) and Neuroticism (N). Those high in psychoticism tend to act impulsively, while those high on neuroticism tend to be emotionally unstable. Extraverts are thought to seek stimulation from the environment, while introverts have naturally stimulating internal environments and therefore seek less stimulation in their external surroundings (Acton, 2003). The IVE-7 measures two aspects of impulsiveness: venturesomeness and impulsivity. Impulsivity, acting without thinking or without realizing the risks involved, is correlated with the personality dimension, Psychoticism. Venturesomeness, thrill and risk seeking, is correlated with the Extraversion dimension (Eysenck & Eysenck, 1978; Caci, Nadalet, Baylé, Robert, & Boyer, 2003). The 54 questions on the IVE-7 fall into three separate scales, impulsiveness, venturesomeness and empathy; all items are in yes/no format. Though the main purpose of the questionnaire is to measure impulsiveness, the items focusing on empathy were added partly to breakup an otherwise “monotonous scale of fairly similar items” as well as to investigate
empathy’s relationship to P, E and N (Eysenck & Eysenck, 1978; p. 1249). Though impulsiveness and venturesomeness correlate, they also represent two different aspects of impulsivity, one related to Psychoticism and one to Extraversion. Venturesomeness more correlated with Dickman’s Functional Impulsivity, which will be discussed shortly (Dickman, 1990).

BIS/BAS Scales

Carver and White (1994) created two scales in an attempt to measure Gray’s two dimensions of personality, the behavioral inhibition system (BIS) and behavioral approach system, or behavioral activation system (BAS; Gray 1975, 1977, 1982). The BIS is related to sensitivity to punishment and, if overactive, is associated with anxiety, while the BAS is sensitive to signals of reward and is related to impulsivity. The BIS/BAS scales are made up of four scales: a BIS scale which includes seven items related to punishment and reactions to the anticipation of punishment, and three BAS scales, the Drive scale, the Fun Seeking scale, and the Reward Responsiveness scale. The Drive scale is made up of four items related to “persistent pursuit of desired goals” (Carver & White, 1994, p. 322). The Fun Seeking scale includes four items pertaining to desire for rewards and willingness to approach rewarding environments on “the spur of the moment” (p. 322). Lastly, the Reward Responsiveness scale is made up of five items which focus on positive reactions to potential rewards. Each item is rated on a 4-point Likert scale, ranging from 1, “strongly disagree”, to 4, “strongly agree.” Those who score high on the BAS scales are considered to be impulsive. Low BIS scores may also be related to disinhibition in populations such as psychopaths (Fowles, 1980).
Dickman Impulsivity Inventory

Another self-report measure of trait impulsivity is the Dickman Impulsivity Inventory (DII) (Dickman, 1990). As previously mentioned, Dickman proposes two types of impulsivity, dysfunctional and functional. Both types of impulsivity are defined by the tendency to act with little forethought, or less forethought than most people of equal ability; they differ in that this lack of deliberation leads to difficulty with dysfunctional impulsivity, but leads to optimal consequences with functional impulsivity (Dickman, 1990). The DII distinguishes between the two types of impulsivity with 63 items--17 related to functional impulsivity, 23 to measure dysfunctional impulsivity, and 23 filler items. A high score on either functional or dysfunctional scales identifies someone as impulsive, while low scores classify non-impulsiveness.

Self-Control Scale

The Self-Control Scale was developed by Tangney, Baumeister, and Boone (2004) to measure the construct of self-control, as defined by the “ability to override or change one’s inner responses,” and “interrupt undesired behavioral tendencies (such as impulses) and refrain from acting on them” (Tangney et al., 2004, p.274). The creators discussed six domains that they believe to be correlated with self-control: (1) achievement and task performance (GPA or work performance), (2) impulse control (eating and alcohol use), (3) adjustment (psychological disorders), (4) interpersonal relationships, (5) moral emotions (e.g. shame leading to less self-control), and (6) the two related personality features of conscientiousness and perfectionism. The Total Self-Control Scale is made up of 36 items in a 5-point Likert format (1 not at all like me, to 5 very much like me). The shorter version of the questionnaire, the Brief Self-Control Scale, is made up of 13 items and is highly correlated with its longer counterpart.
Laboratory Studies of Impulsivity

Various Populations

In the vast area of impulsivity, a wide variety of populations have been studied, including those who are dependent on alcohol, cocaine, heroin or cigarettes, those who pathologically gamble, individuals with attention-deficit/hyperactivity disorder and psychiatric populations (Bickel, Odum, & Madden, 1999; Coffey, Gudelski, Saladin, & Brady, 2003; Dixon, Marley, & Jacobs, 2003; Epstein et al., 2003; Madden, Petry, Badgar, Bickel, 1997; Petry, 2001; Petry, 2002). Researchers have aimed to understand the nature of the impulsive personalities and behaviors that make up those populations.

Drug and alcohol use/abuse & dependence.

Individuals who frequently use or are dependent on drugs and alcohol have been the focus of much impulsivity research. These individuals are considered to be impulsive, when impulsiveness is defined by choosing an immediate, smaller reward over a larger but delayed reward (Logue, 1995; Madden et al., 1997; Rachlin & Green, 1972) as well as choosing small, immediate rewards that have delayed aversive consequences (Logue, 1995).

Field, Christiansen, Goudie, and Goudie (2007) assessed 90 adolescent students who were identified as either heavy drinkers or light drinkers. The researchers employed two delay discounting tasks, one using monetary incentives and the other using alcohol rewards. They found that adolescents who engaged in heavy drinking showed “more short-term focus in decision making” than did light drinking adolescents in that they more steeply discounted both hypothetical monetary and alcoholic incentives (Field et al., 2007, p. 579).

Another study by Petry (2001) looked at delay discounting of monetary and alcoholic incentives, but used participants currently dependent on alcohol, currently abstinent from alcohol...
but with a history of alcohol dependence, and controls with no history of alcohol abuse. Petry found that alcoholic individuals discounted delayed rewards more rapidly than both controls and non-using alcoholics. Additionally, alcoholic clients discounted alcohol rewards more rapidly than money. Interestingly, controls also discounted alcohol more rapidly than money.

Alcohol has also been shown to affect the inhibitory aspect of impulsivity. DeWit, Crean, and Richards (2000) investigated the affect of alcohol on impulsivity by actually administering the drug to healthy participants and assessing the effects on a stop task. They found that drinking alcohol impaired participants’ ability to inhibit behavior.

Studies with drug users are also important in impulsivity research. Similar to alcohol using populations, individuals dependent on cocaine chose the immediate, smaller monetary reward more often than the delayed, larger monetary reward in a study by Coffey et al. (2003); non-cocaine users were better able to wait for the larger reward than their cocaine addicted counterparts. Additionally, cocaine users discounted cocaine even more rapidly than money.

Heroin dependent individuals show the same pattern when compared to non-dependent individuals when it comes to monetary rewards (Madden et al., 1997). Again, greater discounting is seen when hypothetical heroin rewards replace the monetary incentives for heroin addicts.

These significant laboratory findings translate to a lifestyle often seen in individuals addicted to drugs and alcohol: they consistently choose the immediate pleasure of being high or intoxicated over larger but delayed rewards of sobriety (e.g., health, stable family, or employment), (Coffey et al., 2003). The fact that individuals with BPD similarly choose to engage in risky or destructive actions suggests that they too may discount delayed rewards quicker than other individuals.
Cigarette smoking.

Those who smoke cigarettes have also been shown to be more impulsive through laboratory studies such as delay discounting. Bickel et al. (1999) recruited 23 current smokers, 21 ex-smokers and 22 never smokers and had each group complete delay discounting tasks with monetary incentives. Additionally, current smokers completed delay discounting with cigarette incentives. Bickel et al. (1999) found that people who were currently smoking discounted monetary rewards more rapidly than both those identified as ex-smokers and never smokers. Interestingly, ex-smokers did not discount monetary incentives at a faster rate than never smokers. Current smokers also discounted cigarette incentives faster than they did monetary rewards.

A 2003 study again assessed smokers and non-smokers for impulsivity using delay discounting, but added a novel discounting task (Baker, Johnson, & Bickel, 2003). Participants completed a discounting task using monetary incentives, and then also completed one using health incentives. Researchers asked participants to equate a 10% increase in their health with $1,000; participants were asked to identify a length of time that feeling healthier (stronger, less body fat, more energy) would be equal in subjective value to $1,000. This information was used to create values for a delay discount task. The smoking group also completed a discounting task using cigarette incentives. Results showed that smokers discounted monetary rewards to a greater extent than non smokers, and, in accordance with Bickel et al.’s 1999 study, smokers discounted cigarette incentives even more than monetary incentives. Both groups discounted monetary rewards at greater rate than health outcomes, but this result did not reach significance. Smokers and non-smokers did not differ in their discounting rates of health outcomes. Smokers, however, did discount cigarettes at a significantly higher rate than health outcomes, showing that
the drug of dependence is discounted more than equal amounts of incentives such as money and health.

Another study assessed impulsivity in heavy, light and never smokers using delay discounting (Johnson, Bickel, & Baker, 2007). Again, smokers (both heavy and light) discounted monetary rewards more than never smokers, and discounted cigarettes more than monetary incentives. Health outcomes were also used in a delay discounting task; heavy, light, and never smokers did not differ in discounting of health outcomes. Both light and heavy smokers, however, discounted cigarettes more rapidly than health outcomes.

**Gambling.**

Impulsivity is also an important aspect to gambling behavior. Dixon et al. (2003) evaluated a group of twenty individuals identified as gamblers as well as twenty controls who were not gamblers. Each group completed the delay discounting task using index cards similar to the task used in substance use population (Bickel et al., 1999). The researchers found, akin to the research with drug and alcohol users and cigarette smokers, those who gambled discounted monetary rewards more steeply than did the group of controls.

Alessi and Petry (2003) also recruited individuals diagnosed as pathological gamblers and assessed the severity of their gambling and their impulsivity using the IVE-7 and a delay discounting task, as well as other measures. They found that scores on the IVE-7 as well as severity of the gambling predicted results on the delay discounting task. Those who scored higher on the self-report measure discounted money more quickly. Even more predictive was the severity of the gambling problem, with light gamblers discounting 75% of $1,000 in about 6.5 years, and heavy gambler discounting the same amount in only 2 years.
Dixon, Jacobs, and Sanders (2006) again used delay discounting with people diagnosed as pathological gamblers in a 2006 study, but this time researched if the context in which the participants were in affected their discounting. A group of pathological gamblers each completed two discounting tasks, one in a “gambling context” (an off-track betting facility with two bars and televisions broadcasting horse-racing), and one in a “nongambling context” (coffee shops, restaurants or another public location). Participants discounted money more steeply in the gambling context than in the non-gambling environment.

As evidence by previously mentioned studies, substance abusers discount monetary rewards more than do non-substance users; Petry and Casarella (1999) also reported the same result regarding substance abusing participants versus controls, and additionally found that substance abusers who were also problem gamblers discounted monetary incentives more than substance abusers who did not have co-occurring gambling problems.

The fact that those diagnosed with pathological gambling, a population that like clients with BPD are considered to be impulsive by definition (DSM-IV-TR; American Psychiatric Association, 2000), have been shown to be impulsive using delay discounting suggests that perhaps the same could be true of those with BPD.

**Attention-deficit/hyperactivity disorder (ADHD).**

Impulsivity is included in the DSM-IV-TR criteria for diagnosing in ADHD (American Psychiatric Association, 2000) and thus this population has also been an important part of impulsivity research. Epstein et al. (2003) investigated differences in performance on the CPT between children with ADHD and those without. They found that children diagnosed with ADHD committed more commission and omission errors and had more variable overall reaction times.
Gomez (2003) used a go/no-go task to measure impulsivity in children diagnosed with ADHD and healthy controls. Gomez used three different conditions of the task, a reward only condition, a punishment only condition and a reward + punishment condition. In the reward only condition, participants would earn money for responding correctly to “good” numbers or refrained from responding to “bad” numbers, but would not lose anything if they responded in error to “bad” numbers. Conversely, in the punishment trials, participants lost money if they failed to respond to “good” numbers or responded to “bad” numbers. Lastly, participants would earn money for correct responses and lose money for responding to “bad” numbers. Gomez found that those with ADHD were more impulsive in all three conditions in that they committed more commission errors (responding to “bad” numbers). Additionally, the ADHD group showed varied impulsivity in the three kinds of tasks, while the control group did not; those with ADHD were more impulsive in the reward + punishment condition than in the other two conditions.

**Antisocial personality disorder & aggressive populations.**

A personality disorder that falls in the same cluster B category as BPD is antisocial personality disorder (ASPD). Individuals diagnosed with ASPD are also known to have impulsive behavior patterns and, because of this, they are another population studied using laboratory measures of impulsivity. Petry (2002) used a delay discounting task to compare discounting between substance abusing individuals who also had ASPD and substance abusing individuals without a comorbid personality disorder. Each group was also compared to a control group with no substance abuse or ASPD. Results showed that, again, substance abusing persons discounted money more steeply than controls. More importantly, the substance abusing ASPD group discounted monetary rewards even more than substance abusers with no ASPD. Because
the two groups had similar substance abuse characteristics, it was concluded that the difference in discounting rates was due to the ASPD diagnosis, not the substance abuse.

Another study, though not specifically with participants diagnosed with ASPD, examined impulsivity with aggressive and nonaggressive male parolees (Cherek, Moeller, Dougherty, & Rhoades, 1997). Based upon criminal history, the parolees were separated into two groups, nonviolent and violent. Both groups completed a two choice self-control task; pressing the microswitch button labeled A would result in a 5 second delay and a reward of 5 cents on the counter, while pressing the B button resulted in a 15 second delay and 15 cents being added to the counter. The researchers found that the violent parolees were more impulsive during the task. Violent parolees chose the impulsive choice (A) more than half of the time. The mean number of impulsive choices for the violent group was 35.8, while the mean number for the nonviolent group was 21.2 (t=3.47, p<.002). Additionally, violent parolees scored higher on the BIS-11 than did their nonviolent counterparts.

Newman and Schmitt (1998) investigated inhibitory control of low-anxious psychopaths compared to low-anxious controls. After screening a group of inmates using the Revised Psychopathy Checklist (PCL-R; Hare, 1991), Newman and Schmitt administered a passive avoidance task to inmates identified as psychopathic and a group of control inmates. The researchers found that the low-anxious psychopaths committed more passive avoidance errors than low-anxious controls.

**Borderline Personality Disorder**

Impulsiveness among individuals with BPD has been routinely studied in the laboratory setting with various outcomes. Researchers have used multiple laboratory measures as well as self-report measures to try to get at the essence of impulsivity in the borderline population.
In their study of female inmates with BPD, Hochhausen et al. (2002) used a passive avoidance task as well as the self-report questionnaire, the Impulsiveness-Monotony Avoidance-Detachment inventory (IMD; Schalling, 1978). The IMD was developed to evaluate dimensions responsible for dysregulated behavior in psychopaths, but it has a specific Impulsivity scale. The researchers found that those inmates with BPD showed greater impulsivity than non-borderline inmates using a passive avoidance task, as defined by committing more commission errors (responding to the wrong stimuli) than controls. Inmates diagnosed with BPD also reported greater impulsivity than non-BPD inmates on the Impulsivity scale of the IMD.

In their 2006 study, Dom et al. evaluated individuals with alcoholism who did or did not have a cluster-B personality disorder diagnosis and compared their impulsivity in a variety of ways. Both groups had been abstinent from alcohol for at least three weeks. Of those diagnosed with a personality disorder, 15 had BPD, 3 had ASPD, 2 had both BPD and ASPD and 2 were diagnosed with narcissistic personality disorder. Both groups were given two self report measures (BIS-11 and the Dutch adaption sensation-seeking scale), and three behavioral measures of impulsivity. The first was the Go/no-go task, then the Stroop color word test was given, (which is often used as a measure of behavioral inhibition), and finally a delay discounting task. Each measure yielded quite disparate results. The researchers found that participants who had a co-occurring personality disorder diagnosis scored higher on both self-report measures of impulsivity than those who did not. Those with a personality disorder also showed more impulsivity on the Go/no-go task (more errors). There was, however, no significant differences found between groups on either the Stroop test or the delay discounting task. From these results, the researchers concluded that people diagnosed with both alcoholism and a personality disorder have difficulty with behavioral inhibition compared to those with
alcoholism and no personality disorder, but they do not differ in activation impulsivity or the ability delay gratification.

Another study also addressed impulsivity in alcohol dependent individuals with and without cluster-B personality disorders (Rubio et al., 2007). Researchers used the BIS-11 to measure trait impulsivity, as well as CPT, the Stop-Signal Task and Differential Reinforcement of Low-Rate Responding (DRLR) as behavioral impulsivity measures. DRLR is another type of delay task that measures a person’s impulse control and their ability to avoid a premature response. Participants press a button, are instructed to “wait a while” and then press it again. If they wait at least 6 seconds a point reward is given signaled by a flashing light. If they respond too quickly, the timer resets and no reward is given. In this study, researchers found that those with a cluster-B disorder (BPD or ASPD) performed worse on all behavioral tasks than those alcoholics without a personality disorder and the controls. More specifically, participants with BPD committed more omission errors on the CPT, while individuals with ASPD were more impaired on the DRLR. These results again suggest that those with BPD have more trouble with inhibition than with delay of rewards.

Though Rubio et al. (2007) found that patients with BPD committed more errors in the CPT, another study by Ferrez et al. (2009) found contradicting results. Though they once again found that individuals with BPD scored significantly higher on all the subscales of the BIS-11 than did healthy controls, they did not replicate the finding that participants with BPD committed more errors on the CPT measure. They did, however, find that the BPD group made more random errors, which they hypothesized may have been evidence of a lack of motivation to respond correctly, a possible explanation for their non-significant results.
Dougherty, Bjork et al. (1999) employed a two-choice delayed reward task and the BIS-11 to measure impulsiveness in inpatients with BPD compared to inpatients without BPD. In the impulsivity laboratory task the participants could choose between pressing the ‘A’ button to receive 5 cents after a short delay (impulsive choice) and pressing the ‘B’ button to receive 15 cents after a longer delay. Two kinds of data from the two-choice delay task were utilized: the percentage of “impulsive” choices, and the longest delay before the reward presentation in a trial. The researchers found that the BPD group scored significantly higher on the total score and the attentional subscale of the BIS-11 compared to controls. As for the behavioral measure, there was no significant main effect between groups in overall impulsive responding. Patients with BPD did have a longer average delay before responding in the first session than the controls did, but in the second session the BPD group changed their responding patterns to avoid long delays (switching between short delay and long delay response in consecutive trials) while the control groups remained stable. The maximum delay before reward dropped by 50% in the second session for the BPD group, but remained the same for the control group. The researchers connected this change in responding to the BPD groups’ higher score on the attentional subscale of the BIS-11. Overall, however, the two-choice delayed reward did not differentiate between patients with BPD and controls.

Subclinical samples, such as undergraduate college students high on borderline traits, have also been used to study impulsivity and have shown marked impulsivity compared to those undergraduates low on borderline traits (Chapman et al., 2008). Chapman et al. utilized a passive avoidance learning task to measure impulsivity in a group of students who they categorized into either a “high-BPD” (a score of 38 or higher on the Personality Assessment Inventory—Borderline Features Scale, or PAI-BOR) or a “low-BPD” group (a score less than 23
on the PAI-BOR). They found that the high-BPD group committed significantly more passive avoidance errors than did the low-BPD group. This replicated the findings of Hochhausen et al. (2002) in a nonclinical sample. Though no laboratory measures of impulsivity were used in their study, Fossati et al. (2004) also used a nonclinical sample to measure borderline traits and impulsivity. Using the Personality Diagnostic Questionnaire-4+ (as cited in Fossati et al., 2004), the researchers created two groups, one group having borderline traits and one having antisocial traits. They found that the level of impulsivity as measured by the BIS-11 was significantly correlated with BPD symptoms.

Though laboratory measures that assess initiation and inhibition aspects of impulsivity such as PAL and Go/no-go tasks, and CPT measures in some instances, have been shown to produce significant differences between those with BPD and those without, the use of the delay discounting tasks and other delay type tasks have not been as successful. It would seem plausible that those who are impulsive would have trouble delaying the reward and would choose the immediate but smaller reward; the propinquity of the first reward is too tempting, and waiting a longer period makes the larger reward seems distant and not worth the wait. Despite this, the preference for immediate small rewards among individuals with BPD has not been shown in a research study as of yet. This may be explained by the fact that impulsivity itself has different operational definitions, and perhaps patients with BPD are not impulsive when it comes to intolerance of delay. Before this conclusion can be drawn with confidence, however, further investigation is necessary. Another possibility is that the incentives used are not reinforcing enough for this population, which is why there is not a heightened sensitive to delay. Research has pinpointed several variables related to the reinforcer that affect impulsivity.
Variables that Affect Impulsivity

Preference for the Reinforcer

Research has shown that participants will wait for the delayed reward more when they prefer that reward. Forzano and Logue (1995) conducted two experiments, one with preschool boys and one with adult women to assess the affect of food preference on self-control. After assessing the participants’ preferences for a Cheerio, raisin or M&M, the boys completed a series of conditions with varying delays and reinforcers. The researchers found that participants showed more self-control, (they endured the longer delay), when it produced the more preferred reward. Additionally, participants chose the smaller, more immediate reinforcer when it was the most preferred reward. Similarly, women in the second experiment were less sensitive to reinforcer amount relative to sensitivity to delay (a measure of impulsivity) when the reinforcement was the most preferred reward. Overall, these two experiments demonstrate that preference for the reinforcer is an important variable in impulsivity and self-control.

Time of Reinforcer Delivery

Forzano and Logue (1994) conducted three experiments to investigate the reason why individuals are more impulsive for food as reinforcement than for points exchangeable for money. The first experiment used juice as a reinforcer available during the session as well as points exchangeable for money. The second, used points exchangeable for money and the third experiment was the same as the second except it used points exchangeable for juice. The researchers found that participants showed greater self-control when the reinforcer was available at the end of the session (points exchangeable for money or juice) than for the reinforcer available during the session (juice). Because there were also no differences in self-control for points exchangeable for money and those exchangeable for juice, researchers concluded that the
increase in self-control for the reinforcers available after the session was at least partly due to the
time of the delivery, not the reinforcer itself. When the reinforcer is closer and more tangible at
the time the choice is being made, self-control is more difficult. These results support past
research in which Mischel and Ebbesen (1970) found that children had more self-control when
the food reinforcer was not visible, but were more impulsive when the reinforcer was visible.

**Primary vs. Secondary Reinforcers**

Another possible variable that affects impulsivity is the nature of the reinforcer itself, that
is, whether it is a primary or secondary reinforcer. A primary reinforcer, or an unconditioned
reinforcer, is one that is intrinsically reinforcing to the person, such as food or water, and does
not need to be learned through conditioning (Cooper, Heron, & Heward, 2007). A secondary, or
conditioned reinforcer, such as money, is one that becomes reinforcing through experience and
through pairing with something already reinforcing (Cooper et al., 2007). Though both types
affect behavior in a similar way, they can affect impulsivity differently.

As mentioned previously, those with drug or alcohol dependence discount their drug of
choice significantly more rapidly than they do money (Coffey et al., 2003; Field et al., 2007;
Madden et al., 1997; Petry, 2001). Odum and Rainaud (2003) investigated this phenomenon
using three different reinforcers and a group of individuals without past problems with money or
history of alcohol abuse. Participants completed delay discounting tasks with two
primary/consumable reinforcers, food and alcohol, and one secondary/non-consumable
reinforcer, money. Much like the studies with drug and alcohol dependent individuals,
participants discounted food and alcohol more steeply than money. Additionally, food and
alcohol were discounted at a similar rate. The researchers suggest that this pattern in discounting
may be due to the fact that food and alcohol are primary and consumable reinforcers, as opposed
to the secondary reinforcing quality of money. This may also explain why Petry (2001) found that the control group, not just the alcoholic group, discounted alcohol more than they did money.

The Present Study

The present study aimed to further investigate the nature of impulsivity in borderline personality disorder using a subclinical sample of undergraduate students. Using the Borderline Personality Questionnaire (BPQ; Poreh et al., 2006) students were screened to determine those high and low on borderline traits. Both groups were then given a series of measures to assess impulsivity. Though past studies did not find significant differences in impulsivity between participants with BPD and those without BPD when using delay discounting with monetary reinforcers, it was thought that using a more salient reinforcer might affect impulsivity in the same way alcohol, drugs, cigarettes and money affect discounting for alcoholics, drug dependent individuals, smokers and gamblers respectively (Baker et al., 2003; Bickel et al., 1999; Coffey et al., 2003; Dixon et al., 2003; Madden et al., 1997; Petry, 2001).

Because interpersonal relationships and the need for attachment are important features of BPD (American Psychological Association, 2000; Gunderson, 1996; Mizenberg et al., 2006; Zanarini et al., 2007) it was thought that the use of some kind of social incentive within the delay discounting task might augment impulsivity in this population. Prior studies had suggested that future research should use social or physical incentives in similar impulsiveness tasks, but no such study had yet been conducted (Chapman et al., 2008).

For those with BPD, social contact was thought to possibly be a more salient reinforcer than money. Social reinforcement, like food and alcohol (Odum & Rainaud, 2003), could be viewed as a primary reinforcer, or at least a generalized reinforcer, due to the inherent
reinforcing quality of attention and contact with others, which is apparent even early in life. For example, human touch was found to be a reinforcer for infants (Pelaez-Nogueras, Gewirtz, Field, Cigales, Malphurs, Clasky, & Sanchez, 1996). Infants made more eye-contact, more vocalizations, smiled more and cried less when they were reinforced with adult attention that included touch compared to when they were reinforced with adult attention that did not incorporate touch. Other studies have also shown that interaction is reinforcing to humans. When interaction and attention from others was made contingent on a target behavior, that behavior often increased (Jerome & Sturmey, 2008; Milby, 1970). Attention and interaction can take a variety of forms, such as eye contact, positive talk, nodding, close proximity to the client, (Jerome & Sturmey, 2008) or time with a preferred staff member (Milby, 1970). Some studies also suggest that social contact may reinforce negative behaviors such as self-injurious behavior (Oliver, Hall, & Murphy, 2005).

In the present study, social reinforcement took the form of time with a loved one. To compare discounting rates for monetary incentives and social incentives, the two needed to be equated in some way. A method similar to the one used in previous research on delay discounting with drug dependent populations (Coffey et al., 2003; Madden et al., 1997) was used to do this. For example, Madden et al. (1997) used the street price of heroin to equate the amount of the drug to the monetary amounts; at $35 per bag, 28.5 bags of heroin were equal to $1,000. In the present study, the social reinforcement, time with a loved one, was given a monetary value as well. Participants were asked to indicate their hourly wage at their current or most recent job, which was used to obtain an average hourly wage for all participants willing to participate in the laboratory sessions. This process assigned a monetary value to one hour of time.
and was used to determine how many hours equal about $1000, allowing the two discounting
tasks to be compared.

Because past research found that individuals diagnosed with BPD have difficulty with
response inhibition (Chapman et al., 2008; Dom et al., 2006; Hochhausen et al., 2002), the
present study also included the GoStop Impulsivity Paradigm (Dougherty, Mathias et al., 2003)
to assess the participants’ ability to inhibit responses. This specific measure of response
inhibition had not yet been used in a subclinical population, so including it added to the literature
regarding inhibition aspect of impulsivity in BPD. It also made for a more thorough assessment
of the heterogeneous impulsivity construct within this study.

Due to the rich evidence that the Barratt Impulsiveness Scale-11 successfully measures
impulsiveness in those with BPD (Cherek et al., 1997; Dougherty et al., 1999; Ferrez et al., 2009;
Fossati et al., 2004), it was used in the present study as well to hopefully replicate findings that
the BIS-11 can be used to measure impulsivity in nonclinical populations of BPD (Fossati et al.,
2004).

Hypotheses

There were several hypotheses in the current study. The main hypothesis was that high-
BPD individuals would discount more steeply in a delay discounting task (hence demonstrate
more impulsivity) when the reinforcers used were of a social or interpersonal nature. As found
previously (Dom et al., 2006), it was expected that there would be no difference in discounting
rates of monetary rewards between the low-BPD group and the high-BPD group. High-BPD
individuals, however, would discount social rewards more steeply than they did monetary
rewards and more steeply than did low-BPD participants. High-BPD individuals would also
discount social rewards at significantly steeper than they did monetary rewards. A significant
finding would demonstrate that impulsivity among those with BPD traits could be measured using a delay discounting task if a social incentive was incorporated. This would further suggest the importance of interpersonal relationships and attachment when it comes to impulsivity for individuals with BPD.

Next, it was hypothesized that the high-BPD group would exhibit greater difficulty inhibiting responses than the low-BPD group on the GoStop Impulsivity Paradigm. These results would replicate findings that BPD individuals have difficulty with response inhibition (Chapman et al., 2008; Dom et al., 2006; Hochhausen et al., 2002), and would also be the first to use the GoStop task with a subclinical BPD population.

Finally, replicating previous research (Cherek et al., 1997; Dougherty et al., 1999; Ferrez et al., 2009; Fossati et al., 2004), it was hypothesized that the high-BPD group would score significantly higher on the Barratt Impulsiveness Scale-11 than the low-BPD group, showing that nonclinical groups are still distinct in their self-reported impulsivity. Additionally, if the BIS-11 discriminated between groups as predicted, such results would help validate the BPQ as a measure that accurately identifies individuals with traits of BPD.

Method

Participants

Undergraduate students from the PSH 110, Principles of Psychology courses at the College at Brockport, State University of New York were initially recruited for this study. Participants were recruited in two waves, the first in the Fall 2009 semester and the second during Spring 2010 semester. During the first wave, additional College at Brockport students from psychology courses other than PSH 110 were later recruited in order to obtain enough participants for the initial screens, due to lower than expected initial response rates. The students
in the first wave ranged in age from 18 to 48 years, with a mean age of 20.4 years. Two-hundred and sixty-eight participants were initially screened with the BPQ (Poreh et al., 2006), resulting in approximately 57 potential participants (23 low and 34 high) for the laboratory sessions. Thirty-eight participants participated in the laboratory session. After exclusion criteria (as used by Dixon, Jacobs, & Sanders, 2006) was applied to the data (explained below), there were 15 high-BPD participants (a score of 33 or greater on the BPQ), and 14 low-BPD individuals (score of 5 or lower) for a total of 29 participants in wave I.

One hundred and thirty-one participants, ranging in age from 18 to 39 years (M=19.2 years), were screened with the BPQ for the second wave, resulting in 42 potential laboratory participants, (21 low and 21 high). A total of 33 individuals participated in the laboratory session, which, after exclusions, resulted in 11 high-BPD individuals (a score of 26 or greater on the BPQ) and 10 low-BPD participants (a score of 4 or lower) and a total of 21 participants in wave II.

Overall, 399 participants, ranging in age from 18 to 48 years (M=20.02 years), were screened between the two waves. Wave I and II combined resulted in 50 participants successfully completing the laboratory session, with 24 in the low-BPD group and 26 in the high-BPD group. As predicted by past research, (Swartz et al., 1990; Widiger & Weissman, 1991; Zanarini et al., 1990b), most of the participants were female (84.2% in wave I, 87.9% in wave II, and 85.9% for the two groups combined). Participants from PSH 110 received one credit of their research requirement for their participation in the initial screening, and then another one credit if they qualified and agreed to participate in the laboratory session. The participants from other psychology courses were given extra credit for the screening and
additional extra credit for the laboratory session, with the amount of extra credit determined by each course instructor.

Materials

**Borderline Personality Questionnaire (BPQ).**

The Borderline Personality Questionnaire (BPQ; Poreh et al., 2006; see Appendix A) is an 80-item, true/false measure which assesses the nine DSM-IV criteria for borderline personality disorder. The BPQ has high reliability for the overall score (Kuder-Richardson coefficient = 0.94) and satisfactory reliability for each subscale (ranging from KR-20 = 0.65 to KR-20 = 0.84). It also shows high convergent validity with the MMPI-2 BPD (r = 0.85; Poreh et al., 2006). When compared to three other measures, the McLean screening Instrument for Borderline Personality Disorder (MSI-BPD), the BPD items from the International Personality Disorder Examination Screen Questionnaire and the BPD items from the Structured Clinical Interview for DSM-IV Axis II disorders (SCID-II) Personality Questionnaire, the BPQ was found to have the highest overall diagnostic accuracy (0.85) and the highest test-retest reliability (ICC = 0.92; Chanen et al., 2008).

According to the literature, high scores on the BPQ are 57 or higher, while the average score is around 21 (Chanen et al., 2008; Poreh et al., 2006). Though the researcher planned to use 57 as the high cut-off score and 20 as the low cut-off score, the need to change the criteria arose once completed questionnaires were scored. Since very few participants scored 57 or higher in either wave, the mean and standard deviation of each sample was calculated (M=18.62, SD=13.61 for wave I; M=14.98, SD=10.79 for wave II). Using one standard deviation below and above the mean, new cut-off scores of 33 and 5 were used to create the two groups in wave I.
Cut off scores of 26 and 4 were used for wave II. Though the BPQ is relatively long, it only took participants 10 to 15 minutes to complete.

**Demographic questionnaire.**

As part of the screening session, necessary demographic information was collected from all participants using a short questionnaire (see Appendix B and Appendix C). The participants' age and gender were of primary importance for the current study. As previously mentioned, they were also asked to indicate their hourly wage at their current or most recent job in order to obtain an average hourly wage for all participants qualified for the laboratory sessions. The average wage for wave I participants was $8.71 per/hour (115 hours equaling $1000). The average wage for wave II participants was $8.27 per/hour (121 hours equaling $1000). Lastly, participants were asked whether they were interested in being contacted to participate in the second part of the study should they qualify.

**Contact form.**

Participants who answered “yes” to being contacted for the second part of the study were directed to fill out the contact information form (see Appendix D) including their name and phone number. This allowed the researcher to contact those participants who qualified for the laboratory session.

**Delay discounting tasks.**

The present study used a delay discounting task using a computer program called delay discounting (gains) program (Chelonis, 2006). Hypothetical monetary rewards of various amounts were presented on the left and right side of the computer screen. The larger, delayed amount appeared on the left side of the screen, while the smaller, immediate amount appeared on
the left side. Participants chose which amount they preferred by pressing either the ‘q’ or ‘p’ key. The program then titrated the next choice based on the participants’ previous choice.

For example, the first choice was between receiving $1000 in a week (on the left side of the screen) and receiving $500 immediately. The participant indicated their choice by pressing ‘q’ or ‘p’. If the participant chose the delayed choice, the next trial would titrate the immediate choice to a higher amount: $1000 in one week, or $750 immediately. If the participant chose the immediate reward, the amount of immediate reward was decreased on the next trial. This process continued until the computer had enough information to calculate the individual’s indifference point (or the point at which the delayed and immediate amounts were subjectively equal). There were eight sets of delays that the computer went through using the same process: 1 week, 1 month, 6 months, 1 year, 3 years, 5 years, 10 years and 25 years.

The same program was used, with slight revisions, for the social discounting task. As previously explained, instead of $1000, the large, delayed amount of incentive was hours with a loved one (115 hours for wave I and 121 hours for wave II). The immediate small amount was titrated the same way and the participant indicated their choice by pressing the same keys.

**GoStop Impulsivity Paradigm.**

The GoStop Impulsivity Paradigm was completed on a computer using the software developed by Dougherty, Mathias et al. (2003). This paradigm was used to measure response inhibition for both groups. There were three types of trials: no-stop, stop and novel trials. Five-digit numbers were presented on the computer screen in rapid sequence. In the no-stop trial, a 5-digit number identical to the one before it (a target stimuli) was presented in black on the screen; this was a go signal and the participant was to respond by clicking the right mouse button. For half of the target trials, the go signal was accompanied by a stop signal unexpectedly, which was
when the number changed from back to red at some point after the onset of the stimulus (ranging from 50 to 350 msec after the presentation of the stimulus). This was a stop trial and signaled to the participant to inhibit their response. A novel trial was when the second number was a randomly generated 5-digit number that was not the same as the previous stimulus and required no response. The dependent variable for this task was the percentage of inhibited responses, or the percentage of Stop trials where no response occurred. The GoStop program provided an inhibition percentage for each stimulus delay period (50msec, 150msec, 250 msec, and 350 msec). For the purposes of data analysis, only the 150msec data was used because research shows that that set of data most accurately discriminates between groups (Dougherty et al., 2008, Marsh et al., 2002). Lower numbers indicated greater difficulty inhibiting responses.

Instructions on how to complete the task were presented to participants before they began (see Appendix F).

**Barratt Impulsiveness Scale (BIS-11).**

The eleventh edition of the Barratt Impulsiveness Scale (see Appendix E) was administered to both the low-BPD and high-BPD groups to measure self-reported impulsivity. Highly impulsive individuals are designated by scores of 72 or higher, while scores of 52 to 71 are indicative or normal levels of impulsiveness (Stanford et al., 2009). The 30-item questionnaire took about 5 minutes to complete.

**Procedure**

The screening process was done over several weeks. To ensure confidentiality, participants were given a folder with their participant number on it which contained all necessary materials. The folder consisted of a consent form (see Appendix G and Appendix H), a
demographics questionnaire (see Appendix B and Appendix C), a contact form (see Appendix D), and the BPQ (see Appendix A).

Participants were instructed to complete the top consent form first before proceeding with additional forms and to return their competed folder to the researcher when finished. They were handed a debriefing sheet (see Appendix I) on their way out. Each screening session took about 15 minutes.

Once all BPQs were scored, the participants who scored either high (33 or higher in wave I and 26 or higher in wave II) or low (5 or lower in wave I and 4 or lower in wave II) on the BPQ were contacted via telephone and/or email and asked to return for another session (see Appendix J and Appendix K). Each lab session was done with a maximum of seven participants at a time in Holmes Hall. The lab consisted of seven small rooms, each with a computer, table and chair. Low-BPD and high-BPD students were able to sign up for any session, regardless if members of the opposite group were in that session.

During the laboratory session, after obtaining informed consent (see Appendix L and Appendix M), each participant completed the three computer tasks individually, the GoStop Impulsivity Paradigm, the delay discounting task with monetary incentives and the delay discounting task with social incentives. The order in which these tasks were completed was counterbalanced and randomly assigned to participants ahead of time. Though the order of the GoStop and the two delay discounting tasks changed, the delay discounting tasks always occurred one after the other (with some participants doing the monetary version first and some completing the social incentive version first). In all, there were four possible combinations of the tasks. Once the participants were contacted and signed up for a session, the researcher pre-assigned everyone to the order in which they were to complete the tasks by picking conditions...
from a hat. Because the BIS-11 could be very reactive, all participants completed the questionnaire last.

Though each session was scheduled for an hour, no participant used a whole hour to complete all the tasks. The GoStop task took about 15 minutes to complete while each delay discounting task took about 5 minutes. The directions for the monetary version of the delay discounting task appeared on the screen as follows:

In this game you will be required to make hypothetical choices between a smaller, immediate monetary reward and a larger, delayed reward. The larger, delayed amount will be presented on the left side of the screen. The smaller, immediate amount of money will be present on the right side of the screen. Press q to choose the larger, delayed reward or p to choose the smaller, immediate reward for each trial. Press q or p to begin.

Prior to beginning the social version of the delay discounting task, each participant was given a piece of paper asking them to please indicate the person they most like to spend their free time with and why they enjoy spending time with this person (see Appendix N). They were asked to think of this person as they completed the social version of the delay discounting task. The instructions for this task appeared on the screen as follows:

In this game you will be required to make hypothetical choices between a smaller, immediate amount of time with the person you most enjoy spending free time with and a larger, delayed amount of time with this person. The larger, delayed amount will be presented on the left side of the screen. The smaller, immediate amount of time will be present on the right side of the screen. Press q to choose the larger, delayed reward or p to choose the smaller, immediate reward for each trial. Press q or p to begin.

The BIS-11 was completed after all three computer tasks were finished. Once each participant finished the four tasks, they were verbally debriefed (see Appendix O) and given a hand out of contact information in case they had questions or wished to seek help regarding any items they encountered during the session (see Appendix P).
Results

First, the BPQ was scored. Each item was true or false and was worth either 1 point or 0 points. In most cases, an answer of ‘true’ resulted in 1 point, while ‘false’ was scored as zero. Some items, however, were reversed scored and in those items an answer of ‘false’ resulted in a point. The total score was derived from the adding points from all the items. Table 1 provides each participant’s demographics information as well their BPQ score and group (high or low).

Several steps were necessary to calculate discounting rates for each individual. The delay discounting program provided indifference points for each participant for each delay amount. Those indifference points were then be used to calculate the $k$ value, or sensitivity to delay. The hyperbolic discounting function originated by Mazur (1987) was used to calculate $k$:

$$V_a = \frac{A}{1 + kd}$$

This equation has been used in multiple studies to measure delay discounting (Alessi & Petry, 2003; Coffey, 2003; Johnson et al., 2007; Madden et al., 1997; Navarick, 2004). In this equation, $V_a$ equals the subjective discounted value of the reward (the indifference point). The objective value of the reward is represented by $A$ ($1000), and $d$ is the delay duration (represented in years). The equation was used to solve for $k$ and to determine each individual’s best fit $k$, or their sensitivity to the delay, with lower values indicating less sensitivity to delay and higher values indicating higher sensitivity to delay and steeper discounting (greater impulsivity). The individual proportions of variance ($R^2$) accounted for by the hyperbolic model were also calculated, where an $R^2$ of 1.0 indicates responses that fit perfectly with the hyperbolic model. The indifference points, $k$ values, and $R^2$ values for each participant can be found in Table 2.
As done in previous research (Dixon, Jacobs, & Sanders, 2006; Dixon, Marley, & Jacobs, 2003), some participants were excluded from data analysis due to responses inconsistent with the delay discounting. The following exclusion criteria, developed by Dixon et al. (2006), were used to assess each participant’s data for both discounting tasks. The indifference points could not increase more than once across successive delays. Additionally, the mean indifference points from the four shortest delay conditions had to exceed the mean of the indifference points from the four longest delays. Using these criteria, the social discounting results for seven individuals and the monetary discounting scores for two individuals were excluded in wave I. In wave II, eight social discounting scores were excluded, and six monetary discounting scores were excluded. Two monetary discounting scores in wave I and one monetary discounting score in wave II were also excluded due to computer difficulties in either the saving or retrieving of data (see table 1).

The GoStop Impulsivity Paradigm program provided the dependent variable, percentage of inhibited responses, or the percentage of stop trials where no response occurred. The inhibition percentage was calculated for each stimulus delay, 50msec, 150msec, 250msec and 350 msec. Lower numbers indicated greater difficulty inhibiting responses (more impulsivity) while higher percentages indicated greater ability to inhibit responses (less impulsivity). Table 1 also contains each participant’s inhibition scores on the GoStop at 150msec.

The items of the BIS-11 were scored 1, 2, 3, or 4, with 4 assigned to the most impulsive answer. For example, item 1 states, “I plan things carefully”; here an answer of “Rarely/Never” would receive a 4 and an answer of “Almost Always/Always” would receive a 1. Item 2, on the other hand, states, “I do things without thinking”; here “Almost Always/Always” would be the
most impulsive answer and would therefore receive a 4. The total score was found by adding the points from every item. Table 1 contains the total BIS-11 scores for each participant.

**Wave I and II**

A one-way between-subjects MANOVA was used to examine the differences between the low-BPD and high-BPD groups on delay discounting tasks for monetary and social incentives (k values), the GoStop Impulsivity Paradigm (inhibition percentage), and the BIS-11 (total scores). Table 3 displays the means and standard deviations for each group on each dependent variable.

**Delay discounting.**

There was no difference between groups on either delay discounting task. As expected, high-BPD individuals in wave I did not discount money (M=22.13, SD=59.56) at a significantly greater rate, $F(1, 28)=0.584, p=.451$, than the low-BPD participants (M=8.81, SD=27.47). Similarly, there was no significant difference, $F(1, 28)=.235, p=.632$, in discounting rate of social incentives between the high-BPD (M=50.86, SD=104.72) and low-BPD groups (M=34.19, SD=77.20) in wave I. Similar results were found for wave II participants. There was no significant difference between high-BPD participants (M=29.80, SD=53.83) and low-BPD participants (M=8.37, SD=18.93) in monetary discounting, $F(1,20)=1.42, p=.248$. In addition, high-BPD participants (M=34.56, SD=93.26) and low-BPD participants (M=114.77, SD=264.92) did not significantly differ in their rate of social discounting, $F(1,20)=.891, p=.357$.

Differences in monetary versus social discounting within groups was also calculated using a repeated-measures t-test. High-BPD individuals did not discount monetary (M=22.13, SD=59.56) and social rewards (M=50.86, SD=104.72) differently in wave I, $t(14)= -0.89, p=.39$. Similarly, the low-BPD wave I group did not discount monetary rewards (M=8.81, SD=27.47) at
a significantly lower rate than they did social rewards ($M=34.19$, $SD=77.20$), $t(13)=-1.82$, $p=0.09$. Similar results were found in wave II participants. High-BPD individuals did not
discount monetary rewards ($M=29.81$, $SD=53.83$) differently than social rewards ($M=34.56$, $SD=93.26$), $t(10)=-0.14$, $p=.89$. Low-BPD participants also did not discount monetary rewards
($M=8.37$, $SD=18.93$) at a significantly lower rate than social rewards ($M=114.77$, $SD=264.92$), $t(9)=-1.30$, $p=.23$.

**GoStop Impulsivity Paradigm.**

High-BPD participants and low-BPD participants did not differ in their ability to inhibit
responses on the GoStop Impulsivity Paradigm. As previously mentioned, only results from the
150msec delay were used since that data most accurately discriminates between groups,
(Dougherty et al., 2008, Marsh et al., 2002). For wave I, high-BPD individuals inhibited 61.33% of the time and low-BPD inhibited 59.64% of the time, $F(1,28)=.034$, $p=0.85$. High-BPD
individuals in wave II inhibited 62.27% of the time and low-BPD participants inhibited 52%,
$F(1,20)=.87$, $p=.36$. The differences between high and low groups were not significant in either
wave.

**BIS-11.**

For wave I, results showed that there was a significant difference between groups on the
BIS-11, $F(1,29)=7.54$, $p=.01$, with the high-BPD group scoring significantly higher ($M=71.93$, $SD=13.10$) than the low-BPD group ($M=60.21$, $SD=9.44$). Similar results were found for the
second wave of participants, with the high-BPD participants scoring significantly higher
($M=63.55$, $SD=8.45$) than the low-BPD group ($M=56.20$, $SD=5.85$), $F(1,21)=5.253$, $p=.03$. 
Combining Wave I and II

In order to determine that the two waves of participants were not significantly different from each other and therefore able to be combined for additional analysis, a one-way ANOVA was done to compare the scores of the low-BPD participants in wave I versus wave II, and the high-BPD participants in wave I versus wave II. There were no significant differences between the wave I high-BPD group and the wave II high-BPD group on any of the dependent variables, except for the BIS-11 (see Table 4). High-BPD participants in wave I scored higher (M=73.64, SD=14.07) than high-BPD individuals in wave II (M=65.83, SD=8.72) on the BIS-11, $F(1, 39)=4.20$, $p=.047$. Despite this significance, the strength of the relationship was not very strong, with an effect size of 0.10, only 10% of the variance. There was no significant difference between the wave I low-BPD group and the wave II low-BPD group on any of the dependent variables (see Table 5). Therefore, the two waves of participants were combined, resulting in 24 low-BPD individuals and 26 high-BPD individuals and a total of 50 participants.

Combined Analysis

A one-way between-subjects MANOVA was again used to examine the differences between the low-BPD and high-BPD groups on delay discounting tasks for monetary and social incentives (k values), the GoStop Impulsivity Paradigm (inhibition percentage), and the BIS-11 (total scores). Again Table 3 shows the means and standard deviations for each group on each dependent variable.

As was found for each separate wave, no differences were found between groups in monetary or social discounting. High-BPD individuals did not discount monetary rewards (M=25.38, SD=56.22) more steeply than low-BPD individuals (M=8.63, SD=23.81),
\[ F(1, 49) = 1.83, p = .18, \] nor did they discount social rewards (\( M = 58.05, SD = 116.45 \)) at a significantly greater rate than low-BPD individuals (\( M = 67.77, SD = 180.21 \)), \( F(1, 49) = .05, p = .82. \)

Differences between monetary and social discounting within groups were also analyzed using a repeated-measures t-test. High-BPD individuals did not discount monetary (\( M = 25.38, SD = 56.22 \)) and social rewards (\( M = 58.05, SD = 116.45 \)) differently, \( t(25) = -1.23, p = .23. \)
Similarly, low-BPD participants did not discount social rewards (\( M = 67.77, SD = 180.21 \)) at a greater rate than monetary rewards (\( M = 8.63, SD = 23.81 \)), \( t(23) = -1.685, p = .11. \)

In addition, a 2 x 2 mixed-design ANOVA was done with group (high or low) as the between-subjects independent variable and discounting (monetary and social) as the repeated measures dependent variable. The main effect for discounting was significant, \( F(1, 49) = 4.44, p = .04. \) The main effect for group was not significant, \( F(1, 49) = .024, p = .88. \) There was no significant interaction between group and discounting, \( F(1, 48) = .37, p = .55. \)

On the GoStop, there was no significant difference between the high- and low-BPD groups in their ability to inhibit responses at 150msec, (\( M = 61.73, SD = 25.84 \) and \( M = 56.46, SD = 22.72 \) respectively), \( F(1, 49) = .58, p = .45. \)

Again, there was a significant difference between the high and low-BPD participants on the BIS-11 when the two groups were combined. The High-BPD group scored significantly higher (\( M = 68.38, SD = 11.94 \)) than the low-BPD group (\( M = 58.54, SD = 8.24 \)), \( F(1, 49) = 11.33, p = .002. \)

**Discussion**

The present study aimed to increase understanding of impulsivity in a subclinical population of those with borderline personality disorder traits. Though previous studies had not found reward-delay impulsivity in those with BPD or BPD traits using delay discounting, the
present study examined whether changing the reinforcer used in the delay discounting task to one social in nature would heighten impulsivity for high-BPD individuals. It was hypothesized that high-BPD individuals would not discount monetary incentives a significantly greater rate than their low-BPD counterparts. It was also hypothesized, however, that high-BPD participants would in fact discount social incentives at a significantly steeper rate compared to low-BPD participants (showing greater impulsivity). In addition, high-BPD participants would discount social rewards at significantly greater rate than they did monetary rewards. To supplement the investigation of impulsivity in this sample, the GoStop Impulsivity Paradigm, a laboratory measure used to evaluate response-inhibition, and the BIS-11, a self-report measure of impulsivity, were also used. It was hypothesized that the high-BPD group would display greater difficulty inhibiting responses (greater impulsivity) on the GoStop compared to the low-BPD group. Additionally, it was hypothesized that high-BPD individuals would report higher levels of impulsivity than the low-BPD group on the BIS-11.

As was found in previous research (Dom et al., 2006) it was expected that there would be no difference between low-BPD and high-BPD individuals in discounting rates of monetary incentives. The present study replicated results found by Dom et al. (2006) and increased confidence that there is no difference between groups in delay discounting of monetary rewards. In addition, these results extend this knowledge to a different population, since college students with BPD traits were used in the present study while a population of abstinent alcoholic inpatient individuals with personality disorders was used in the previous study.

Though it was not surprising that the two groups did not discount monetary incentives differently, the present study hypothesized that there would be a significant difference between low-BPD and high-BPD individuals in discounting rates of social reinforcement. Further, it was
expected that the high-BPD group would discount social rewards at a greater rate than they did monetary rewards. Unfortunately, neither hypothesis was confirmed. High-BPD participants did not discount social rewards more rapidly than low-BPD participants, nor did high-BPD individuals discount social incentives at a significantly greater rate than monetary rewards.

Several explanations exist for these results. First, it is possible that the kind of the incentive used does not matter and that using a different reinforcer does not heighten impulsivity. However, given the dearth of research showing that the several variables related to the reinforcer do affect impulsivity, this explanation seems unlikely. As previously mentioned, preference for the reinforcer, time of delivery, and whether the reinforcer is primary or secondary in nature all impact impulsivity (Forzano & Logue, 1994; Forzano & Logue, 1995; Odum & Rainaud, 2003).

Another possible explanation is that a delay discounting task does not measure impulsivity in the BPD population. The fact that using a social incentive still did not result in different rates of discounting for high-BPD individuals adds to the existing evidence that the kind of impulsivity present in BPD is not one of reward-delay, but more likely one of response inhibition (Dom et al., 2006; Hochhausen et al., 2002; Rubio et al., 2007).

It is also possible that a delay discounting task for loss may be more likely to find significant differences between groups in delay discounting than the delay discounting task for gains used in this study. Such a task would be similar to the delay discounting task for gains, but participants would be losing money either immediately or at a delay instead of being paid that hypothetical amount of money (e.g. losing $500 now or losing $1000 in week and so on). Due to the presence of negative affects, negative cognitions and fear of abandonment in BPD (American Psychiatric Association, 2000; Zanarini & Frankenburg, 2007; Zanarini et al., 1998a), those with BPD or BPD traits may be more sensitive to delay when presented with hypothetical loss of
reinforcers. Delay discounting for loss of reinforcers may therefore result in a better measure of impulsivity in BPD. Future research could explore this possibility.

A fourth possibility as to why there is no difference between groups in delay discounting of social incentives is the incentive itself. The first problem is that it is unclear how to define social reinforcement. As previously mentioned, past research has defined social reinforcement in several ways, including physical touch, verbal interaction, eye-contact, and time with others, (Jerome & Sturmey, 2008; Milby, 1970; Pelaez-Nogueras et al., 1996). Clearly, social reinforcement could be interpreted numerous ways, and perhaps hypothetical “time with others” was not a clear operational definition. The second difficulty with the social incentive used in the present study is that it is very different from money and does not have a definite or explicit monetary value as do drugs, alcohol or food. No previous research has attempted to equate time with others to money, and the method used in the present study could be flawed. The fact that more social discounting data than monetary discounting data was excluded due to inconsistent responding lends credence to these explanations. Fifteen (65.2%) of the 23 excluded data points were social discounting. Additionally, the fact the variability in the discounting rates of social rewards was so vast also suggests that the reinforcer may not have translated well. The social discounting standard deviations for both high and low-BPD groups were unusually large, larger than those for the monetary discounting task. This variability may also account for why there was no significant difference within the groups, despite the fact that the social discounting means were larger than the monetary discounting means in each group. Given this evidence, it seems probable that either the method used to equate “time with others” to money was flawed, or “time with others” was not an ideal representation of a social reinforcer, or even both. Further research
could investigate other possible social reinforcers, or a different method to better equate the social reinforcer with its monetary counterpart.

Despite the fact that there were no significant differences between or within groups on the two discounting tasks, there was a significant main effect for discounting. Overall, participants discounted more steeply on the social discounting task than on the monetary discounting task. This may be because a social reinforcer, such as time with a loved one, could be considered a primary reinforcer, while money is a secondary reinforcer. As previously mentioned, Odum and Rainaud (2003) found similar results when they investigated discounting in individuals without a history of alcohol abuse or gambling; participants in that study discounted food and alcohol at a similar rate, and they discounted both more steeply than they did money. This was attributed to the fact that food and alcohol are primary reinforcers, while money is secondary. Similarly, Petry (2001) found that, though participants with alcohol problems discounted both money and alcohol more steeply than controls, as well as discounting alcohol more steeply than money, controls also discounted alcohol more steeply than money. This same phenomenon could be at work here, which would explain why all participants, regardless of high or low-BPD status, discounted social rewards more steeply than monetary incentives.

Despite the expectation that high-BPD individuals would have more difficulty inhibiting responses on the GoStop Impulsivity Paradigm, results of the present study did not support this hypothesis or the past research which showed that those with BPD struggle with response-inhibition impulsivity (Chapman et al., 2008; Dom et al., 2006; Hochhausen et al., 2002). This could be due to the fact that the two groups were not different enough, especially since the cut-scores used to create the groups were lower than originally planned. However, the fact that the
BIS-11 still showed significant difference between the two groups on impulsivity makes this explanation less likely. Another possibility for the disparate results is that the previous researchers employed different tasks to measure response-inhibition impulsivity, including passive avoidance learning tasks (Chapman et al., 2008; Hochhausen et al., 2002) and the go/no-go task (Dom et al., 2006). Though all three tasks have similarities and intend to measure the same aspect of impulsivity, the slight differences in the tasks may account for the unexpected results in the present study. The populations used in the previous three studies were also unlike the population in the current study. Though Chapman et al. (2008) also studied a non-clinical population, they utilized a different measure to create the high- and low-BPD groups (the PAI-BOR; Morey, 1991). Both Dom et al. (2006) and Hochhausen et al. (2002) studied clinical populations in their research. Either of these factors, or the combination of the two, could explain why the present study did not replicate results showing difficulties in response-inhibition impulsivity.

As found in previous studies of impulsive populations, including BPD (Cherek et al., 1997; Dougherty et al., 1999; Ferrez et al., 2009), high-BPD individuals were expected to score significantly higher on the BIS-11 than their low-BPD counterparts. Results from the present study did in fact show that high-BPD participants reported being more impulsive than the low-BPD individuals on the BIS-11. This shows that even subclinical populations of borderline individuals differ on self-reported trait impulsivity. This also increases confidence that the BPQ accurately discriminated between groups, even when different cut-scores were used.

Because of the importance of impulsivity and fear of abandonment in the borderline personality diagnosis, this study aimed to increase understanding of both aspects BPD. Though previous research supported difficulties with inhibition impulsivity in the BPD population.
(Chapman et al., 2008; Dom et al., 2006; Hochhausen et al., 2002), research using delay
discounting and other reward-delay impulsivity tasks had yet to find delay-reward impulsivity in
BPD (Dom et al., 2006; Dougherty et al., 1999; Rubio et al., 2007). The present study is no
exception. Because research supports differences in impulsivity as a function of the specific
reinforcer used (Forzano & Logue, 1995; Odum & Rainaud, 2003), it seemed necessary to
examine reinforcers that may be more salient for those with BPD in order to more completely
assess reward-delay impulsivity in BPD. The lack of significant results, however, suggests that
those with BPD traits are not impulsive on delay discounting tasks regardless of the reinforcer.
Barring further research, the present study adds to the evidence that nature of impulsivity in
those with BPD is more likely one of response-inhibition and not reward-delay impulsivity.
References


*Psychological Science, 8*(1), 60-64.


*Review of General Psychology, 2*(2), 221-238.


Table 1

Participant Demographics and Scores

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aData excluded based on exclusion criteria (inconsistent responding).

bData missing due to technical error in saving or retrieving of data.
Table 2

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**Indifference Points and $k$ Values for Monetary and Social Incentives**

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aData excluded based on exclusion criteria (inconsistent responding).

bData missing due to technical error in saving or retrieving of data.
Table 3

*Overall Mean and Standard Deviations*

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Table 4

One-Way ANOVA within High-BPD Groups

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One-way ANOVA within Low-BPD Groups

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Appendix A

BPQ

Date: ___/___/____  Participant #: ______________

Instructions: Please put a circle around the response that you feel best DESCRIBES YOUR USUAL SELF (for the past two years or longer) in relation to each statement. Circle T if you think the statement is true. Circle F if you think the statement is false. There are no right or wrong answers and there are no trick questions. Please respond as honestly as you can, but don't ponder too long over each item.

Please answer every question, even though sometimes you may find it hard to decide.

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<tr>
<td>2. I often become depressed or anxious 'out of the blue'.</td>
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<tr>
<td>3. People often leave me.</td>
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<tr>
<td>4. I am rarely disappointed by my friends.</td>
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<tr>
<td>5. I feel inferior to other people.</td>
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<td>6. I have threatened to hurt myself in the past.</td>
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<td>7. I do not believe that I have the skills to do anything with my life.</td>
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<td>8. I rarely get angry at other people.</td>
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<td>9. Sometimes I feel like I am not real.</td>
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<td>10. I will not have sex with someone unless I have known them for quite some time.</td>
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<td>11. I sometimes feel anxious or irritable and become sad a few hours later.</td>
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<td>12. When people close to me die or leave me, I feel abandoned.</td>
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<td>13. I often exaggerate the potential of friendships only to find out later that they will not work out.</td>
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<td>14. If I were more like other people I would feel better about myself.</td>
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<td>15. I have deliberately tried to hurt myself without trying to kill myself.</td>
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<tr>
<td>16. In general, my life is pretty boring.</td>
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<td>17. I frequently get into physical fights.</td>
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<tr>
<td>18. People are sometimes out to get me.</td>
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<td>19. My friends have told me that my mood changes very quickly.</td>
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<td>20. I am afraid to spend time alone.</td>
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<td>21. People who seem trustworthy often disappoint me.</td>
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<td>22. I have made a suicide attempt in the past.</td>
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<tr>
<td>23. I often feel like I have nothing to offer others.</td>
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<tr>
<td>24. I have trouble controlling my temper.</td>
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<tr>
<td>25. I can read other people's minds.</td>
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<tr>
<td>26. I have tried 'hard' street drugs (e.g. cocaine, heroin).</td>
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<tr>
<td>27. My mood frequently alternates throughout the day between happiness, anger, anxiety and depression.</td>
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<tr>
<td>28. When my friends leave, I am confident I will see them again.</td>
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<tr>
<td>29. My friends often disappoint me.</td>
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<td>30. I have cut myself on purpose.</td>
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<td>31. I often feel lonely and deserted.</td>
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<tr>
<td>32. I have no difficulty controlling my temper.</td>
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<tr>
<td>33. I sometimes see or hear things that others cannot see or hear</td>
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<td>34. It is not unusual for me to have sex on the first date.</td>
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<td>35. I sometimes feel very sad but this feeling can change quickly.</td>
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<td>36. People often let me down.</td>
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<td>37. I wish I could be more like some of my friends.</td>
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<td>38. I used to try to hurt myself to get attention.</td>
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<td>39. I am often different with different people in different situations so that sometimes I am not sure who I am.</td>
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<td>40. I easily become irritated by others.</td>
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<td>41. Sometimes I can actually hear what other people are thinking.</td>
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<td>42. I get high on drugs whenever I feel like it.</td>
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<td>43. I rarely feel sad or anxious.</td>
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<td>45. When I trust people, they rarely disappoint me.</td>
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<td>46. I feel that people would not like me if they really knew me well.</td>
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<td>47. I get angry easily.</td>
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<td>48. It is impossible to read others' minds.</td>
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<td>50. I find it difficult to depend on others because they will not be there when I need them.</td>
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<td>51. The relationships with people I care about have lots of ups and downs.</td>
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<td>52. I feel comfortable acting like myself.</td>
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<td>54. I rarely feel lonely.</td>
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</tr>
<tr>
<td>55. I often find that the littlest things make me angry.</td>
<td>T</td>
</tr>
<tr>
<td>56. Sometimes I can't tell between what is real and what I have imagined.</td>
<td>T</td>
</tr>
<tr>
<td>57. When I drink, I drink too much.</td>
<td>T</td>
</tr>
<tr>
<td>58. I consider myself to be a moody person.</td>
<td>T</td>
</tr>
<tr>
<td>59. I have difficulty developing close relationships because people often abandon me.</td>
<td>T</td>
</tr>
<tr>
<td>60. My friends are always there when I need them.</td>
<td>T</td>
</tr>
<tr>
<td>61. I wish I were someone else.</td>
<td>T</td>
</tr>
<tr>
<td>62. I feel like my life is not interesting.</td>
<td>T</td>
</tr>
<tr>
<td>63. When I am angry, I sometimes hit objects and break them.</td>
<td>T</td>
</tr>
<tr>
<td>64. I often receive speeding tickets.</td>
<td>T</td>
</tr>
<tr>
<td>65. I often feel like I am on an emotional 'roller coaster'.</td>
<td>T</td>
</tr>
<tr>
<td>66. I feel like my family has deserted me.</td>
<td>T</td>
</tr>
<tr>
<td>67. I am very comfortable with who I am.</td>
<td>T</td>
</tr>
<tr>
<td>68. I often do things impulsively.</td>
<td>T</td>
</tr>
<tr>
<td>69. My life is without purpose.</td>
<td>T</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>70. I am not sure what I want to do in the future.</td>
<td>T F</td>
</tr>
<tr>
<td>71. At times I eat so much that I am in pain or have to force myself to throw up.</td>
<td>T F</td>
</tr>
<tr>
<td>72. People tell me that I am a moody person.</td>
<td>T F</td>
</tr>
<tr>
<td>73. The people I love often leave me.</td>
<td>T F</td>
</tr>
<tr>
<td>74. In social situations, I often feel that others will see through me and realize that I don't have much to offer.</td>
<td>T F</td>
</tr>
<tr>
<td>75. I have been in the hospital for trying to harm myself.</td>
<td>T F</td>
</tr>
<tr>
<td>76. I often feel empty inside.</td>
<td>T F</td>
</tr>
<tr>
<td>77. Others often make me angry.</td>
<td>T F</td>
</tr>
<tr>
<td>78. I often become frantic when I think that someone I care about will leave me.</td>
<td>T F</td>
</tr>
<tr>
<td>79. I am confused about my long-term goals.</td>
<td>T F</td>
</tr>
<tr>
<td>80. Others say I'm quick tempered.</td>
<td>T F</td>
</tr>
</tbody>
</table>

Thank you for your assistance

---

Permission to use given by Amir Poreh, Ph.D on August 3rd, 2009

Appendix B
Demographic Information for PSH 110

Demographic Information

Participant #_____

Age:_____

Gender (circle one): Male Female

Please indicate the hourly wage that you currently earn. If you do not currently work, indicate the hourly wage you earned at your most recent job: $_____/hour.

So that you can receive research credit in your Principles of Psychology course for your participation, please provide the following information:

PSH 110 (circle one) Section 01- Dr. Mulvaney, MWF 12:00 pm-1:00 pm

Section 02- Dr. Lipko, TR 1:15 pm-2:45 pm

Section 03- Dr. Hobson, MWF 8:15 am-9:15 am

Section 04- Dr. Mulvaney, MWF 1:15 pm-2:15 pm

Are you willing to be contacted by researchers for an additional study? Please note that your answer to this question will not affect your receiving 1 research credit for the study questionnaire you just completed. Also, if you are contacted about a future study, you will be free to choose, after hearing about the study, whether you would like to participate. In addition, if you participate in a future study you will receive an additional research credit.

_____ Yes

_____ No
Appendix C

Demographic Information for Other Psychology Courses

Demographic Information

Age: ___

Gender (circle one): Male Female

Please indicate the hourly wage that you currently earn. If you do not currently work, indicate the hourly wage you earned at your most recent job: $[_____] / hour.

So that you can receive extra credit in one of your psychology classes for your participation, please provide the following information:

<table>
<thead>
<tr>
<th>Course #</th>
<th>Course Title</th>
<th>Course Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>___</td>
<td>_____________</td>
<td>_________________</td>
</tr>
</tbody>
</table>

Are you willing to be contacted by researchers for an additional study? Please note that your answer to this question will not affect your receiving extra credit for the study questionnaire you just completed. Also, if you are contacted about a future study, you will be free to choose, after hearing about the study, whether you would like to participate. In addition, if you participate in a future study you will receive additional extra credit.

____ Yes

____ No
Appendix D

Contact Information

If you responded ‘yes’ to being contacted for a further study, please provide the follow information so that researchers can contact you:

Name (Please print clearly): ________________________________

Phone # where you prefer to be reached ____________________________
Appendix E

BIS-11

Participant #

Directions: People differ in the ways they act and think in different situations. This is a test to measure some of the ways in which you act and think. Read each statement and put an X on the appropriate circle on the right side of this page. Do not spend too much time on any statement. Answer quickly and honestly.

1. I plan tasks carefully.
2. I do things without thinking.
3. I make-up my mind quickly.
4. I am happy-go-lucky.
5. I don’t “pay attention.”
6. I have “racing” thoughts.
7. I plan trips well ahead of time.
8. I am self controlled.
9. I concentrate easily.
10. I save regularly.
11. I “squirm” at plays or lectures.
12. I am a careful thinker.
13. I plan for job security.
15. I like to think about complex problems.
16. I change jobs.
17. I act “on impulse.”
18. I get easily bored when solving thought problems.
19. I act on the spur of the moment.
20. I am a steady thinker.
21. I change residences.
22. I buy things on impulse.
23. I can only think about one thing at a time.
24. I change hobbies.
25. I spend or charge more than I earn.
26. I often have extraneous thoughts when thinking.
27. I am more interested in the present than the future.
28. I am restless at the theater or lectures.
29. I like puzzles.
30. I am future oriented.

Permission to use given by Matthew S. Stanford, Ph.D on July 27th, 2009.

Appendix F

GoStop Impulsivity Paradigm Instructions

54935

For this task, you need to pay attention and remember numbers. This card shows you what the computer screen will look like during your session. Like you see on the card here, the numbers will be black against a white background. The five digit numbers appear on the screen...

54935

...one right after another. If the numbers match, like this one matches the number you just saw...then you should click the left mouse button, but only when the number you see is exactly the same as the one just before it.

63897

If the numbers do not match...like this one doesn't match the last one...then do not click the mouse button.
Okay, this is the important part...

Whenever you respond (or “click”) to a number, you must click while that number is still on the screen. Clicking after the number disappears from the screen does not count.

Another important part is that this task can be a little tricky...sometimes a number that matches the one you just saw will change from black ...

...to red...

You do NOT click for any number that changes to red.

So, in other words, you click the left mouse button when you see a matching number...but...only if that number does NOT turn red.

Finally, remember to respond to a number while it is still on the screen.

During your session you will have a short rest break.

The screen will show you a message, similar to what you see on this card that says “Please Rest”...do not leave the computer monitor during this time.
Just before the end of the break, a message will tell you to “Get Ready”.

When you see this message, watch the screen for the next part of the session to start.

You will do the same thing during all parts of the session...clicking on the matching numbers while they are still on the screen, as long as they don’t turn red.

It’s important to be as accurate as possible during this task...clicking the mouse when you are supposed to, and NOT clicking the mouse when you are not supposed to.

This message will appear on the screen to tell you when your session is over.

Do you have any questions?

Appendix G

Screening Session Consent Form for PSH 110

STATEMENT OF INFORMED CONSENT
The purpose of this research project is to examine different personality traits among college students. Four areas will be studied including emotions, thoughts, relationships and behaviors. This research project is also being conducted in order for Rachel D’Agostino to complete a Master’s Thesis for the Department of Psychology at the College at Brockport State University of New York.

In order to participate in this study, your informed consent is required. You are being asked to make a decision whether or not to participate in the project. If you want to participate in the project, and agree with the statements below, please sign your name in the space provided at the end. You may change your mind at any time and leave the study without penalty, even after the study has begun.

I understand that:

1. My participation is voluntary, I have the right to refuse to answer any questions, and I may choose to end my participation at any time. Nonparticipation or discontinuation of participation will have no impact on my grades in PSH 110.

2. My confidentiality is guaranteed. The consent form and contact information sheet containing my name will be kept separate from the questionnaires containing my participant number and will be locked in a secure place. Only the researcher will be able to connect my name to my questionnaires, which will only occur if I am chosen and agree to participate in future research. If any publication results from this research, I would not be identified by name.

3. There will be no anticipated personal risks or benefits because of my participation in this project, except the time to complete the survey and perhaps a heightened awareness/sensitivity to specific emotions, thoughts or behaviors. The benefit of my participation is that I will receive 1 research credit in the PSH 110 course.

4. My participation involves completing an 80-item questionnaire and answering those items by circling either true or false. It is estimated that the survey will take less than 1 hour.

5. Approximately 400 people will take part in this study. The results will be used for the completion of a Master’s Thesis by the primary researcher.

6. Data will be kept in a secure location in the faculty advisor’s laboratory where only the investigator and advisor will have access to it. Data, consent forms, and contact information will be separated before they are stored and will be destroyed by shredding when the research has been accepted and approved.
I am 18 years of age or older. I have read and understand the above statements. All my questions about my participation in this study have been answered to my satisfaction. I agree to participate in the study realizing I may withdraw without penalty at any time during the survey process. Signing and returning the consent form and questionnaire indicates my consent to participate.

If you have any questions you may contact:

Primary researcher
Rachel D'Agostino, MA candidate
Psychology Department

Faculty Advisor
Lori-Ann B. Forzano, Ph.D
Psychology Department

IRB Administrator
Colleen Donaldson
6th Floor Allen Administration Building

PRINT name: _____________________________________________________________
Signature: ______________________________________________________________
Date: ___________________________________________________________________
Appendix H

Screening Session Consent Form for Other Psychology Courses

STATEMENT OF INFORMED CONSENT

The purpose of this research project is to examine different personality traits among college students. Four areas will be studied including emotions, thoughts, relationships and behaviors. This research project is also being conducted in order for Rachel D’Agostino to complete a Master’s Thesis for the Department of Psychology at the College at Brockport State University of New York.

In order to participate in this study, your informed consent is required. You are being asked to make a decision whether or not to participate in the project. If you want to participate in the project, and agree with the statements below, please sign your name in the space provided at the end. You may change your mind at any time and leave the study without penalty, even after the study has begun.

I understand that:

1. My participation is voluntary, I have the right to refuse to answer any questions, and I may choose to end my participation at any time. Nonparticipation or discontinuation of participation will have no impact on my grades in the psychology course for which I am completing this study.

2. My confidentiality is guaranteed. The consent form and contact information sheet containing my name will be kept separate from the questionnaires containing my participant number and will be locked in a secure place. Only the researcher will be able to connect my name to my questionnaires, which will only occur if I am chosen and agree to participate in future research. If any publication results from this research, I would not be identified by name.

3. There will be no anticipated personal risks or benefits because of my participation in this project, except the time to complete the survey and perhaps a heightened awareness/sensitivity to specific emotions, thoughts or behaviors. The benefit of my participation is that I will receive extra credit in my psychology course.

4. My participation involves completing an 80-item questionnaire and answering those items by circling either true or false. It is estimated that the survey will take less than 1 hour.

5. Approximately 400 people will take part in this study. The results will be used for the completion of a Master’s Thesis by the primary researcher.

6. Data will be kept in a secure location in the faculty advisor’s laboratory where only the investigator and advisor will have access to it. Data, consent forms, and contact information will be separated before they are stored and will be destroyed by shredding when the research has been accepted and approved.
I am 18 years of age or older. I have read and understand the above statements. All my questions about my participation in this study have been answered to my satisfaction. I agree to participate in the study realizing I may withdraw without penalty at any time during the survey process. Signing and returning the consent form and questionnaire indicates my consent to participate.

If you have any questions you may contact:

Primary researcher

Rachel D’Agostino, MA candidate
Psychology Department

Faculty Advisor

Lori-Ann B. Forzano, Ph.D
Psychology Department

IRB Administrator

Colleen Donaldson
6th Floor Allen Administration Building

PRINT name:________________________________________________________________________

Signature:________________________________________________________________________

Date:____________________________________________________________________________
Appendix I

Screening Debriefing to be Handed out

This study was designed to examine different personality traits among college students. Some items asked you about personal characteristics, others asked you about your experience of emotions, interactions with others or behaviors you engage in.

Though your individual results on the questionnaire cannot be disclosed, please feel free to contact the following people or services if you have concerns about your answers to any items on the questionnaire you just completed.

Primary Researcher
Rachel D’Agostino, MA candidate
Email: Rdago1@brockport.edu
Phone:

Faculty Advisor
Lori-Ann B. Forzano, Ph.D
Psychology Department

Brockport Counseling Center
Location: Hazen Hall
Email: askacounselor@brockport.edu
Phone: (585) 395-2207
Website: www.brockport.edu/cc/
Hours: Mon-Fri 8am-5pm

Life Line
24 hours/day at 275-5151
Appendix J
Phone Script for PSH 110

Hello, is (Full Name) available? Hello (first name), this is Rachel D’Agostino, the primary researcher for the study on personality traits that you completed a few weeks ago for research credit for PSH 110. You indicated then that you were interested in being contacted for future research in which you would earn an additional 1 research credit for psych 110. I am calling to give you more information to see if you are still interested in participating in another study that is part of my Master’s Thesis.

The current study is examining personality traits, perception of stimuli, and decision making. It will require you to come to Holmes Hall room 112 for a session lasting no more than one hour. You will be required to fill out a questionnaire and complete three short tasks on the computer. Are you interested in signing up to participate?
Appendix K

Phone Script for Other Psychology Course

Hello, is (Full Name)__________ available? Hello (first name)______, this is Rachel D’Agostino, the primary researcher for the study on personality traits that you completed a few weeks ago for extra credit for your (specific course) _______ psychology course. You indicated then that you were interested in being contacted for future research in which you would earn additional extra credit for your psychology course. I am calling to give you more information to see if you are still interested in participating in another study that is part of my Master’s Thesis.

The current study is examining personality traits, perception of stimuli, and decision making. It will require you to come to Holmes Hall room 112 for a session lasting no more than one hour. You will be required to fill out a questionnaire and complete three short tasks on the computer. Are you interested in signing up to participate?
Appendix I

Laboratory Session Consent Form for PSH 110

STATEMENT OF INFORMED CONSENT

The purpose of this research project is to examine personality traits and decision making among college students. Four areas will be studied including personality characteristics, perception of stimuli, decisions regarding money and decisions regarding social situations. This research project is also being conducted in order for Rachel D’Agostino to complete a Master’s Thesis for the Department of Psychology at the College at Brockport State University of New York.

In order to participate in this study, your informed consent is required. You are being asked to make a decision whether or not to participate in the project. If you want to participate in the project, and agree with the statements below, please sign your name in the space provided at the end. You may change your mind at any time and leave the study without penalty, even after the study has begun.

I understand that:

1. My participation is voluntary, I have the right to refuse to answer any questions, and I may choose to end my participation at any time. Nonparticipation or discontinuation of participation will have no impact on my grades in PSH 110.

2. My confidentiality is guaranteed. The consent form containing my name will be kept separate from the questionnaire. My name will not be connected to my data. If any publication results from this research, I would not be identified by name.

3. There will be no anticipated personal risks or benefits because of my participation in this project, except the time it takes to complete all tasks and perhaps a heightened awareness/sensitivity to specific emotions, thoughts or behaviors. The benefit of my participation is that I will receive 1 research credit in the PSH 110 course.

4. My participation involves completing a 30-item questionnaire and answering those items by shading in the circle that indicates the response that best describes me. It is estimated that the questionnaire will take no more than 15 minutes. I will also be asked to complete 3 different tasks on the computer which involve using a keyboard to indicate my decision regarding different stimuli or scenarios. It is estimated that all 3 tasks will take no more than 40 minutes to complete.

5. Approximately 40 people will take part in this study. The results will be used for the completion of a Master’s Thesis by the primary research.

6. Data will be kept in a secure location in the faculty advisor’s office where only the investigator and advisor will have access to it. Data and consent forms will be separated before they are stored. Consent forms will be shredded once the study is complete, while data without identifying information will be stored for up to 7 years.
I am 18 years of age or older. I have read and understand the above statements. All my questions about my participation in this study have been answered to my satisfaction. I agree to participate in the study realizing I may withdraw without penalty at any time during the survey process. Signing and returning the consent form and questionnaire indicates my consent to participate.

If you have any questions you may contact:

Primary researcher
Rachel D’Agostino, MA candidate
Psychology Department

Faculty Advisor
Lori-Ann B. Forzano, Ph.D
Psychology Department

IRB Administrator
Colleen Donaldson
6th Floor Allen Administration Building

PRINT name: __________________________________________________________

Signature: __________________________________________________________

Date: __________________________________________________________
Appendix M

Laboratory Session Consent Form for Other Psychology courses

STATEMENT OF INFORMED CONSENT

The purpose of this research project is to examine personality traits and decision making among college students. Four areas will be studied including personality characteristics, perception of stimuli, decisions regarding money and decisions regarding social situations. This research project is also being conducted in order for Rachel D’Agostino to complete a Master’s Thesis for the Department of Psychology at the College at Brockport State University of New York.

In order to participate in this study, your informed consent is required. You are being asked to make a decision whether or not to participate in the project. If you want to participate in the project, and agree with the statements below, please sign your name in the space provided at the end. You may change your mind at any time and leave the study without penalty, even after the study has begun.

I understand that:

1. My participation is voluntary. I have the right to refuse to answer any questions, and I may choose to end my participation at any time. Nonparticipation or discontinuation of participation will have no impact on my grades in the psychology course for which I am completing this study.

2. My confidentiality is guaranteed. The consent form containing my name will be kept separate from the questionnaire. My name will not be connected to my data. If any publication results from this research, I would not be identified by name.

3. There will be no anticipated personal risks or benefits because of my participation in this project, except the time it takes to complete all tasks and perhaps a heightened awareness/sensitivity to specific emotions, thoughts or behaviors. The benefit of my participation is that I will receive extra credit in my psychology course.

4. My participation involves completing a 30-item questionnaire and answering those items by shading in the circle that indicates the response that best describes me. It is estimated that the questionnaire will take no more than 15 minutes. I will also be asked to complete 3 different tasks on the computer which involve using a keyboard to indicate my decision regarding different stimuli or scenarios. It is estimated that all 3 tasks will take no more than 40 minutes to complete.

5. Approximately 40 people will take part in this study. The results will be used for the completion of a Master’s Thesis by the primary research.

6. Data will be kept in a secure location in the faculty advisor’s office where only the investigator and advisor will have access to it. Data and consent forms will be separated.
before they are stored. Consent forms will be shredded once the study is complete, while data without identifying information will be stored for up to 7 years.

I am 18 years of age or older. I have read and understand the above statements. All my questions about my participation in this study have been answered to my satisfaction. I agree to participate in the study realizing I may withdraw without penalty at any time during the survey process. Signing and returning the consent form and questionnaire indicates my consent to participate.

If you have any questions you may contact:

Primary researcher
Rachel D'Agostino, MA candidate
Psychology Department

Faculty Advisor
Lori-Ann B. Forzano, Ph.D
Psychology Department

IRB Administrator
Colleen Donaldson
6th Floor Allen Administration Building

PRINT name: ____________________________________________

Signature: ______________________________________________

Date: ___________________________________________________
Appendix N

Indication of Person for Social Delay Discounting

Think of all the important people in your life. Out of all of those people, who do you most enjoy spending your free time with? Though this may be a difficult question, choose one person, think of this person’s name, and picture them in your head. On the lines below, please write this person’s relationship to you (e.g. best friend, girlfriend, boyfriend, mother, father etc.), as well as why you enjoy spending your free time with this person. Please do not indicate their name on this sheet.

I most like spending time with my: ________________________________________________________
because: ___________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________

Throughout the following computer task, please answer the questions while thinking of the one person who you’ve indicated above.
Appendix O

Verbal Laboratory Debriefing

This study was designed to examine personality traits and risk taking behavior among college students. We examined your ability to inhibit responses when shown specific stimuli, as well as your decision making in the context of monetary and social rewards. We also assessed your self-reported levels of risk taking. Your individual results to any questionnaires or computer tasks included in this study cannot be disclosed.
Appendix P

Laboratory Debriefing to be Handed out

If you have any concerns about your responses or behaviors during this study, please feel free to contact the following people or services.

Primary Researcher
Rachel D’Agostino, MA candidate
Email: Rdagol@brockport.edu
Phone:

Faculty Advisor
Lori-Ann B. Forzano, Ph.D
Psychology Department

Brockport Counseling Center
Location: Hazen Hall
Email: askacounselor@brockport.edu
Phone: (585) 395-2207
Website: www.brockport.edu/cc/
Hours: Mon-Fri 8am-5pm

Life Line
24 hours/day at 275-5151