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Does Disinhibition Mediate Alcohol Use And Risk Taking?

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DOES DISINHIBITION MEDIATE ALCOHOL USE AND RISK-TAKING?

by

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CHAPTER 1: INTRODUCTION

The association between alcohol use and risky personality traits such as sensation seeking and impulsivity is well-documented (Grekin, Sher, & Wood, 2006; Sher, Bartholow, & Wood, 2000; Sher & Trull, 1994) and has been observed in college students (Baker & Yardley, 2002; Carlson, Johnson & Jacobs, 2010), community volunteers (McGue, Slutske, & Iacono, 1999), and substance abusers (Fals-Stewart & Bates, 2003). The social and human cost exacted by this relationship is staggering, especially among college students who are considered an at-risk population for heavy alcohol consumption (Slutske, Hunt-Carter, Nabors-Oberg et al., 2004). Alcohol was a factor in an estimated 1,717 deaths, 696,000 physical assaults and 97,000 sexual assaults on college campuses between 1998 and 2001 (Hingson, Heeren, Winter, & Wechsler 2005). In a similar vein, the Commission on Substance Abuse at Colleges and Universities (1994) estimated that alcohol is a factor in two-thirds of college student suicides and 95% of on-campus violent incidents. Therefore, understanding the complex relationship between alcohol use and risk-taking is an absolutely essential matter for research, intervention, and social policy.

The literature shows that alcohol facilitates risk-taking both through its acute effects and through complex interactions between drinking, personality, and cognitive functioning. Although the literature establishing these links is large and convincing, there are gaps and shortcomings in this literature that the present study has attempted to address. One of these gaps is that, although alcohol use and risk-taking are related, they do not share a perfect relationship suggesting the existence of unexplored mediator and moderator variables. Executive functioning is one potential mediator or moderator of the alcohol/risk taking relationship, that was explored in the current study. Results were mixed, but suggest important directions for future research.

Acute Alcohol Intoxication and Risk Taking

Many experimental studies have found that acute alcohol intoxication is associated with increased riskiness. In many cases, acute alcohol intoxication and riskiness share a dose-response relationship, meaning that, as alcohol consumption increases, so does risk taking For example, using a double-blind, within subjects design Reynolds, Richards, and deWit (2006) found that individuals perform more impulsively on real-time laboratory measures when they consume alcohol than when they do not. Furthermore, they found that the highest amounts of alcohol tended to elicit more impulsive behavior from their participants. Other investigators, using a between subjects design, found that those participants who consumed alcohol performed more impulsively than those who had not (Abroms, Fillmore, & Marczinski, 2003). Lane, Yechiam, and Busemeyer (2006) found that participants who consumed the most alcohol in a laboratory study were more likely to make risky decisions on a computerized gambling task than those participants assigned to a placebo condition. Similarly, Curtin and Fairchild (2003) found that intoxicated individuals performed poorly on the Stroop task relative to a sober control group; this finding suggests that intoxicated individuals were less able than sober controls to inhibit their dominant response.

A number of theorists have attempted to explain the relationship between alcohol intoxication and risk taking. Steele and Josephs (1990) suggest that with increasing consumption of alcohol, one's ability to effectively process information is disrupted, an effect which they refer to as "alcohol myopia." According to this theory, intoxicated individuals remain able to focus on immediate and salient cues, but they are less able to notice more subtle aspects of their environment. This "myopia" effect is especially pronounced under conditions of "inhibition conflict," in which the pressure to act out a response conflicts with the pressure to inhibit it. The "alcohol myopia" hypothesis pertains to the risk taking literature in that intoxicated individuals

faced with arousing situations (e.g., gambling, sexual situations) may not be able to attend to subtle environmental cues (e.g., the possibility of losing money while gambling, or contracting an STD) that would prevent them from taking a risk.

Steele and Josephs' hypothesis has received a fair amount of empirical support. Experimentally, some investigators have found that acute alcohol intoxication increases the salience of potentially reinforcing stimuli while simultaneously decreasing the salience of potentially punishing stimuli (Lane, Yechiam, & Busemeyer, 2006). Similar findings have been reported among studies which seek to mimic real-world decision making. For example, MacDonald, MacDonald, Zanna, and Fong (2000) found a relationship between sexual arousal and favorable attitudes towards unprotected sex among intoxicated college students, but they found no such relationship among placebo and control conditions.

Sayette (1993) has given another account of the relationship between the acute effects of alcohol and risky behavior. According to his "appraisal-disruption" model, individuals who encounter ambiguous situations may label them in a variety of different ways (e.g., as irrelevant, positive, benign, stressful, etc.). This model suggests that alcohol pharmacologically constrains the activation of relevant information stored in long-term memory that may lead an individual to label a situation as stressful. According to Sayette, this disruption leads to a decrease in the individual's anxiety level, therefore increasing the likelihood of risky behavior. Although few studies have tested this theory, those that have provide empirical support (Sayette, 1999).

Alcohol Use and Risk Taking among Sober Individuals

Aside from increasing risk taking in intoxicated individuals, frequent, heavy alcohol use is also associated with risk taking behavior among sober individuals (Cloninger, Sigvardsson, & Bohman, 1988; Sher et al, 2000; Giancola & Moss, 1998). However, the temporal order of this

relationship is unclear. That is, it is an open question whether heavy and chronic drinking leads to impulsivity or whether impulsive personality traits lead to heavy and chronic drinking. It appears that both hypotheses have support and that alcohol misuse and personality traits share a complex causal relationship. For example, in a longitudinal study, Cloninger and others (1988) found that a high level of self-reported impulsivity in children was later predictive of alcohol use disorders in adulthood. Similarly, Sher and others (2000) found that impulsive personality traits prospectively predicted substance use disorders in a college student sample. Other research, however, has found that alcoholics are more likely to have deteriorated frontal lobes and reduced neuropsychological functioning when compared to normal controls; These observations suggest that chronic and heavy alcohol consumption can damage areas of the brain critical to planning and inhibition (Freund, 1982; Giancola & Moss, 1998; Parsons & Nixon, 1996).

Gaps in the Alcohol Use/Risk Taking Literature

Notably, the literature establishing a relationship between heavy alcohol use and risky personality traits contains some problems. First, some cross-sectional studies have reported mixed or null findings. For example, Magid, MacLean, and Colder (2007) found relationships between sensation seeking and problematic alcohol use, but they found no such relationship for impulsivity. Similarly, after controlling for drug use disorders study, McGue and colleagues (1999) found that negative emotionality, rather than impulsivity, accounted for differences between alcoholics and a non-alcoholic comparison group. Furthermore, Whiteside and Lynam (2003) found that impulsivity and alcohol misuse were unrelated, when levels of psychopathology were taken into account.

Another shortcoming in this literature is that many cross-sectional and prospective studies focusing on alcohol use and risky personality traits over-rely on retrospective self-

reports. Overuse of this method is problematic for a number of reasons (Lejuez et al. 2002). First, self-report data vary as a function of format, question wording, or changes in context (Schwartz, 1999). Second, individuals show a great variety of insight into their own behavior. Third, truthful reporting of risky behaviors may be limited because of social desirability (Aklin, Lejuez, Zvolensky, Kahler, & Gwadz, 2005).

Finally, "impulsivity" is a broad, multidimensional construct that has been operationalized in heterogeneous ways –e.g., as sensation-seeking, risk-taking, lack of perseveration, etc. Unfortunately, most empirical data fail to capture the complex, multidimensional nature of this construct. In addition, researchers are often unclear about what aspect of impulsivity they are assessing (i.e. a study may report findings of an impulsivity measure, when, in fact, they have only measured a certain facet of the broader construct). This problem has been exacerbated by a proliferation of "impulsivity" measures which vary widely in the traits and abilities they assess (Leshem & Glickson, 2007; Smith et al., 2007). Thus, despite a large literature, it is unclear which components of impulsivity are associated with heavy drinking and which are not.

In addition, some authors have argued that self-report and behavioral measures of impulsivity assess different constructs (Reynolds, Ortengren, Richards, & deWit, 2006). Self-report measures, for instance, may capture one's ability and willingness to present as a controlled or as an impulsive person while behavioral measures may capture one's ability to inhibit dominant responses or the preference for rewards that are delayed or immediate. Therefore, it seems quite likely that a literature which over-relies on self-report measures of impulsivity will capture only one aspect of what, in reality, is a broad multidimensional construct.

Potential Mediators and Moderators

It should also be noted that, whereas the relationship between alcohol use and risky behavior is strong, it is by no means perfect (i.e., there are many heavy alcohol users who do not engage in risky behavior). Few studies have examined factors that may mediate the relation between heavy alcohol use and risk-taking behavior. Cloninger (1987) addressed this issue by using personality and drinking pattern to distinguish between two types of alcoholics. Type I alcoholics start drinking relatively late in life and tend to exhibit high levels of negative affect. Drinkers in this group would be less likely to act in an impulsive and risky manner. In contrast, Type II alcoholics begin drinking early in life and tend to exhibit disinhibited personality traits, such as sensation-seeking and risk-taking. To date, however, few studies have examined this typology empirically and studies that have, have yielded null or mixed results (Howard, Kivlahan, & Walker, 1997).

One other potential mediator of the alcohol use/risk taking relationship is the neuropsychological construct of executive functioning, particularly as it relates to disinhibition. Executive functioning refers to higher-order cognitive abilities that are regulated by the frontal lobes such as cognitive flexibility, planning, and inhibition of impulsive responses –although it has also been expanded to include such constructs as working memory and attention (Giancola & Moss, 1998). Disinhibition refers to the extent to which an individual has control over his/her dominant response. An individual low in disinhibition would exhibit a high amount of control, and they would not be considered impulsive or risky while an individual high in disinhibition would exert a low amount of control over their thoughts and behavior, and they would be more likely to engage in risky and impulsive behavior.

Executive Functioning and Alcohol Use

The literature suggests that heavy and chronic alcohol use can be both a cause and an effect of poor executive functioning. Several studies have shown that heavy alcohol use over long periods of time can lead to residual brain dysfunction and executive functioning deficits, even while sober (Fals-Stewart & Bates, 2003; Parsons & Nixon, 1996; Schaeffer & Parsons, 1986). Moreover, alcoholic men who relapse recover their cognitive functioning much more slowly than do men who stay abstinent, further suggesting that long term exposure to alcohol has pathogenic effects on cognitive functioning (Sullivan, Rosenbloom, Lim, & Pfefferbaum, 2000). Similarly, post-mortem cell counts have revealed that chronic alcoholics have significantly fewer neurons –particularity in the frontal lobes– than healthy controls (Harper, Kril, & Daly, 1987; Kril & Harper, 1989).

On the other hand, executive functioning deficits are known to be a factor in the development of alcohol problems (Sher, Grekin, & Williams, 2005). For instance, below average executive functioning is widely known to be a common occurrence among children of alcoholics (Aytaclar, Tarter, Kirisci, & Lu, 1999; Corral, Rodreiguez-Holguin, & Cadaveria, 2003; Peterson, Flinn, & Phil, 1992) and longitudinal studies have shown that poor executive functioning in these children appears to prospectively predict both drinking onset (Tarter et al., 2003) and alcohol problems later in life (Deckel, Bauer, & Hesselbrock, 1995; Tarter, Kirisci, Habeych, Reynolds, & Vanyukov, 2004).

Executive Functioning and Risky Behavior

Executive functioning –and disinhibition, specifically –is also associated with risky behavior. In fact, some authors have argued that poor disinhibition is a central component in both externalizing behavior among alcoholics (Nigg, 2001) and delinquency in adolescents (Nigg et al., 2004). These results converge with findings from laboratory studies. For example,

patients with frontal lobe damage are known to make riskier decisions on laboratory tasks, especially under conditions of uncertainty or when a tangible reward is possible (Bechara, Damasio, Tranel, & Anderson, 1998; Rogers et al., 1999). Moreover, poor executive functioning has been cross-sectionally related to questionnaire measures of impulsivity among community-dwelling, substance-abusing individuals (Dolan, Bechara, & Nathan, 2008), and impulsive responses to a series of hypothetical vignettes (Magar, Phillips, & Hosie, 2008). Clinical observations have also long hypothesized a link between executive functioning deficits and impulsive behavior (Antonucci et al., 2006; Stuss, Gow, & Hetherington, 1992).

Alcohol Use, Executive Functioning and Risk-Taking: Integrative Theories

A number of theories have attempted to explain the complex relationship between alcohol use, executive functioning, and risky behavior. Moffit (1993) hypothesized that neurologically compromised children become trapped in a cycle of negative social interactions that ultimately lead to externalizing-type behavior problems. Specifically, she stated that children with executive functioning deficits tend to be disinhibited, irritable, inattentive, and emotionally reactive. Offspring with these characteristics are often difficult to care for and may elicit negative affectivity and poor caretaking behavior. In addition, child temperament tends to be correlated with parent temperament (Plomin, Chipuer, & Loehlin, 1990). Thus, impulsive, irritable, inattentive children often have impulsive, irritable, inattentive parents. These negative parent/child interactions may increase stress and ultimately lead to conflictual family environments that are conducive to the development of offspring behavior problems, such as substance abuse and other externalizing behaviors.

Another relevant theory to this investigation is Stern's (2002) "cognitive reserve" hypothesis. Stern refers to an individual's "cognitive reserve" as their baseline cognitive

processing capacity. Individuals with a high level of cognitive functioning are protected, to some extent, from various insults such as trauma, degenerative brain disease, and the harmful effects of psychotropic substance abuse. According to Stern, a given insult's effects should be moderated by the individual's level of cognitive reserve. For example, an individual with low cognitive reserve would be greatly affected by heavy and chronic alcohol use while an individual with high cognitive reserve would be less affected. Researchers have found some empirical support for Stern's hypotheses. For example, Giancola (2004) found that (1) men with low executive functioning were more aggressive against a fictitious opponent than those with high executive functioning and (2) alcohol increased aggression for men with low, but not high, executive functioning. Others have found that, when intoxicated, those with low cognitive reserves make riskier decisions in a sexual situation than those with high cognitive reserve (Abbey, Saenz, Buck, Parkhill, & Hayman, 2006).

Hypotheses

Despite a large theoretical literature, few studies to date have empirically examined the degree to which executive functioning mediates or moderates the relationship between alcohol consumption and risky personality traits and behavior. This study addressed this shortcoming in the literature by examining the following five hypotheses:

1. Self-reported alcohol use will be positively associated with laboratory and questionnaire measures of impulsive behavior. When alcohol use is high, individuals are expected to be more impulsive –both in terms of stable personality traits as well as behavior. This prediction is made on the basis of literature reviewed previously that indicated a positive cross-sectional and prospective relationship.

2. Self-reported alcohol use will be associated with poor performance on executive functioning tasks that measure disinhibition. It is predicted that individuals who use more alcohol will have higher amounts of disinhibition. Evidence for a negative relationship between alcohol use and neurocognitive functioning has been reported previously in the literature (Parsons, 1998; Sher et al., 1997)
3. Poor performance on executive functioning/disinhibition tasks will be associated with higher rates self-reported impulsivity and impulsive behavior on laboratory tasks. This positive relationship between disinhibition and impulsivity has been reported in literature previously (Dolan et al., 2008; Magar et al., 2008).
4. Executive functioning/disinhibition measures will mediate the relationship between alcohol consumption and both self-reported and laboratory impulsivity. That is, the relationship between alcohol use and impulsivity will be significantly reduced once disinhibition is statistically controlled. This prediction is made on the basis of the previously reviewed life-course-persistent antisocial behavior theory (Moffit, 1993) that posits complex relationships between a child's executive functioning and risky-behavior (i.e. alcohol use) and personality traits (i.e. impulsivity and sensation seeking).
5. Executive functioning/disinhibition measures will moderate the relationship between alcohol consumption and both self-reported and laboratory impulsivity. That is, the degree to which alcohol consumption and impulsivity are related will depend on the level of disinhibition. A non-significant relationship between alcohol use and risk-taking is expected for those with low disinhibition while a significant relationship is expected for those with high disinhibition.

CHAPTER 2: METHOD

Participants

A total of 71 university students (18 males, 53 females) participated in this study (mean age = 24.03, SD=7.21). The ethnic breakdown of the sample was as follows; 35% Caucasian, 22.9% African-American, 12.7% Asian, 11.3% Arab American, 2.8% American Indian, 1.4% Hispanic, and 12.8% identified as "Other." Eighty-six percent of participants were full time students. Fifty two percent lived at home with their parents, 15.5% lived alone off-campus, 12.7% lived with a spouse or children, 11.3% lived in an on-campus dormitory and 8.5% lived off campus with friends.

To be eligible for the study, participants needed to have consumed at least five alcoholic drinks in the past year. All participants were recruited through the Wayne State University psychology department's online subject pool. Information about the study such as open times and dates, rationale, expected duration as well as a brief summary of the topic area were available to all participants before they chose to enroll. The Wayne State University human investigations committee approved all study procedures.

Measures

Alcohol Use

National Institute of Alcohol Abuse and Alcoholism's Recommended Alcohol Questions. Alcohol use was measured through a set of six questions created by the National Council of Alcohol Abuse and Alcoholism's Task Force on Recommended Alcohol Questions (NIAAA, 2003). These questions assessed quantity and frequency of drinking behavior, as well as highest amount of alcohol consumed in a 24 hour period. In the current study, drinking quantity and drinking frequency were multiplied to create a standard "quantity/frequency" variable for both the past week and the past year. Please see appendix A for a copy of this measure.

Alcohol Use Disorders and Associated Disabilities Interview (AUDADIS). Alcohol abuse and dependence were assessed through 24 questions from the AUDADIS. This measure contains questions based on the DSM-IV diagnostic criteria for alcohol abuse and dependence (Grant, Harford, Dawson, Chou, & Pickering, 1995). Grant and colleagues confirmed that the AUDADIS has demonstrated good to excellent reliability as a measure of alcohol abuse and dependence (kappa =.76) in the general population. Subsequent findings support construct validation for this instrument to evaluate alcohol abuse and dependence among community samples (Grant et al, 2003). In the current sample, the number of alcohol abuse symptoms was winsorized in order to reduce skew. Please see appendix B for a copy of this measure.

Impulsivity

Balloon Analogue Risk Taking Task. The Balloon Analogue Risk Taking Task, or BART, is a computer-based risk-taking task in which participants blow up a balloon by pressing a simulated balloon pump (Lejuez, et al., 2002). On the screen, there is a balloon, a pump, two displays showing how much a participant has earned on the current trial and how much they have earned overall, and a button labeled "Collect $$$." Each time a participant successfully pumps the balloon, the balloon grows larger and one cent is deposited in the display showing the current total for that trial. Once a balloon has gotten too big and has past its randomly determined explosion point, the balloon explodes and the display showing the total earned for that trial returns to zero. At any point during balloon pumping, the participant may terminate the trial by pressing the "Collect $$$" button and transferring earnings for that trial into a permanent display. The average number of pumps per trial was the dependent measure. White, Lejuez and deWit (2008) have shown evidence of adequate test-retest reliability ($r = .77$, $p < .001$), and others have provided evidence of construct validation of the BART as a measure of risk-taking behavior

and impulsive decision making among adolescents (Leujez, Aklin, Zvolensky, & Pedulla, 2003) and college students (Hunt, Hopko, Bare, Lejuez, & Robinson, 2005). Please see appendix E for a screen shot of this measure.

Urgency, Premeditation, Perseverance, and Sensation Seeking Scale (UPPS) The UPPS is a 45 question, Likert-type, impulsivity measure that produces four different factors, derived from a principle components analysis of a number of established impulsivity scales: (1) lack of premeditation, which is defined as a preference for action instead of careful deliberation and planning; (2) urgency, which is defined as the tendency to act impulsively because of negative affect; (3) sensation seeking, which reflects a desire to seek exciting experiences; and (4) lack of perseveration, which is the inability to tolerate boredom (Whiteside & Lynam, 2001). Among large samples of college students, as well as clinical samples, the UPPS has been found to show good discriminant validity and reliability with all four factors (Whiteside, Lynam, Miller, & Reynolds, 2005; Miller, Flory, Lynam, & Leukefled, 2003; Whiteside & Lynam, 2003). In the current study, alphas were as follows; UPPS Total (.88), lack of premeditation (.87), urgency (.87), sensation seeking (.87) and lack of premeditation (.84). The total score, derived from adding all four subscales together, was the dependent measure. In addition, each of the four subscales was analyzed separately. Please see appendix D for a copy of this measure.

Executive Functioning

Stroop Color Word Task. The Stroop Color Word Task is an executive functioning measure that assesses the ability to inhibit a dominant response (Golden & Freshwater, 2002). In the Stroop, participants read aloud from a list of color names printed in colored ink different from their name. For example, they might encounter the word “blue” printed in red ink. The participant’s goal is to name the color ink in which each word is printed, ignoring what the word

actually says (i.e., they must inhibit their dominant response to read the text of the word and instead name the color of ink). The Stroop Task has a long history of use in the alcohol and substance abuse literature because of its strong psychometric properties and ease of use (e. g., Morgenstern & Bates, 1999). Golden (1975) has reported adequate reliability (between .73-.86) for individual administration of the Stroop test among the general population. The individual's interference score, calculated from the equation provided by Golden and Freshwater (2002) was the dependent measure in the current study.

Reading with Distraction Task. The Reading with Distraction Task is an executive functioning measure that assesses attention regulation ability, or the ability to inhibit the processing of irrelevant or distracting information (Darowski, Helder, Zacks, Hasher, & Hambrick, 2008). In this task, participants read aloud from a series of four, paragraph-length stories containing words in regular font and italics. Participants are instructed to ignore randomly positioned distracter words printed in normal font and to read aloud only the words printed in italics. Thus, in order to successfully complete this task, participants must simultaneously ignore one set of words while attending to another set. After completing each paragraph, participants were given four multiple choice questions to test comprehension of the passage. Darowski and colleagues reported that reliability for the comprehension questions among the general population is low (coefficient alpha of .41), but that reliability for reading time is excellent (alpha of .95). In the current sample, reading time between the four paragraphs was found to correlate between .77 - .91 suggesting acceptable reliability while errors did not show adequate reliability, as errors made for each paragraph correlated between .49 -.55. Dependent measures included reading time and errors. Reading comprehension was not considered as a dependent

measure because of the unacceptable reliability. Please see appendix C for a copy of this measure.

The Tower of Hanoi. The Tower of Hanoi is a computerized task in which participants are presented with a simulated board containing three vertical pegs. Participants must move a series of rings onto these pegs while conforming to a set of three rules: first, they must only move one ring at a time; second, only smaller rings may be placed on top of larger rings; third, no ring can be removed from a peg, unless the participant is moving it to another peg. Researchers have found no difference between computerized and non-computerized administrations of the Tower of Hanoi among college students (Mataix-Cols & Bartres-Faz, 2002). An individual's performance on the Tower of Hanoi reflects executive and frontal lobe functioning, specifically functioning of the orbito prefrontal cortex (Damasio & Anderson, 2003; Dagher, Owen, Boecker, Brooks, 1999). Dependent measures in the current study included time to completion and number of moves per trial. In the current sample, the number of moves per trial was winsorized in order to reduce skew.

Control Measures

Wechsler Test of Adult Reading. The Wechsler Test of Adult Reading (WTAR) is a standardized test used to assess intelligence, reading ability and memory (The Psychological Corporation, 2001). Participants are shown a laminated card with 50 words that are pronounced irregularly (e.g., "homily" or "xenophobia"). The dependent measure is the number of words pronounced correctly. The overall score from the WTAR was used to control for general intelligence when the neuropsychological measures were analyzed.

Because of a researcher oversight, WTAR data from thirty-four individuals was collected while the measure was not approved for use. The IRB later informed the researchers that any

data they collected while the measure was waiting approval should be destroyed. In order to impute missing WTAR scores, regression analyses using other variables in the dataset were used to predicted a substantial amount of variance in the available WTAR data. Results from analyses using "filled" and "unfilled" WTAR data did not differ.

Procedure

Participants were greeted by a research assistant who introduced them to the study, reviewed the information sheet, and obtained verbal consent. All participants then completed (1) the alcohol use questionnaires, (2) the Stroop, (3) the Reading with Distraction Task, (4) the Tower of Hanoi and (5) the BART. Order was consistent across individuals Please see appendix E for the protocol scripts used by the researchers. After participants completed the tasks, they were paid the amount of money they had earned on the BART, de-briefed and awarded course credit for their participation.

CHAPTER 3: RESULTS

Table 1 displays the means, standard deviations, and normality statistics for all outcome variables while table 2 shows product-moment correlations between all outcome variables. All UPPS subscales were strongly related to UPPS total score and most were positively correlated with one another. As an exception, the UPPS sensation seeking subscale was not significantly correlated with either the lack of premeditation subscale or the urgency subscale. Notably, correlations between UPPS scores –both total and subscale– and BART scores were non-significant and, therefore, self-reported and behavioral impulsivity were treated separately in all analyses. In addition, neuropsychological measures of disinhibition were largely uncorrelated. While Stroop interference scores were significantly related to completion time on the Reading

with Distraction Task, there were no other significant associations between neuropsychological measures. Therefore, these measures were treated separately in all analyses as well.

Hypothesis #1: Association between Alcohol Consumption/Symptomatology and Impulsivity

UPPS Total Scores

Tables 3-6 show the regression models used to examine the relationship between alcohol consumption, alcohol symptomatology, and impulsivity. After controlling for age, gender, and ethnicity. UPPS total scores were significantly associated with (1) DSM-IV alcohol abuse symptom count, β=.281, $p<.05$, (2) DSM-IV alcohol dependence symptom count, β=.378, $p<.01$, (3) amount of alcohol consumed over the past thirty days, β=.298, $p<.01$ and (4) amount of alcohol consumed over the past year, β=.298, $p<.01$.

UPPS Subscale Scores

UPPS subscales were differentially associated with the various measures of alcohol consumption. Specifically, (1) urgency related to both DSM-IV abuse and dependence symptom count (β=.282. $p<.05$ and β=.266, $p<.05$, respectively), (2) lack of perseveration was related to DSM-IV dependence symptom count (β=.301, $p<.05$) and (3) lack of premeditation associated with past 30 day (β=.348, $p<.01$),and past year (β=.407, $p<.01$) alcohol consumption. No other UPPS subscales were related to drinking pathology or quantity/frequency of drinking after demographic variables were controlled.

BART Scores

Adjusted average number of pumps per trial was not associated with DSM-IV alcohol symptomatology, past 30-day alcohol consumption or past-year alcohol consumption.

Hypothesis #2: Association between alcohol consumption and neuropsychological measures of disinhibition

Tables 7-10 display the regression models employed to examine the relationship between alcohol consumption, DSM symptoms and disinhibition. DSM-IV alcohol abuse symptom count was negatively related to both time (β=-.363, $p<.05$) and errors (β=-.369, $p<.01$) on the Reading with Distraction task, while DSM-IV dependence symptom count was positively related to moves on the Tower of Hanoi, β=.275, $p<.05$. In addition, past 30 day alcohol consumption was associated with time on the Reading with Distraction task (β=-.338, $p<.05$) while past year consumption related to number of moves on the Tower of Hanoi, β=.264, $p<.05$.

Hypothesis #3: Association between neuropsychological measures of disinhibition and impulsivity

Tables 11-16 show the regression analyses conducted to examine relationships between neuropsychological measures of disinhibition and both self-report and laboratory measures of impulsivity. Demographic variables and general intelligence (represented by raw WTAR scores) were entered into the analyses as control variables. The total score on the UPPS was negatively related to time on the Reading with Distraction task (β=-.283, $p<.05$), as was lack of premeditation, β=-.401, $p<.01$). Lack of premeditation was also significantly related to the number of moves on the Tower of Hanoi, β=.322, $p<.05$.

Hypothesis #4 and #5: Moderation and Mediation

Although alcohol and impulsivity measures were related, mediation analyses could not be performed because (1) alcohol measures were largely unrelated to neuropsychological measures of disinhibition; and (2) neuropsychological measures largely were unrelated to self-report and behavioral measures of impulsivity (Baron & Kenny, 1986). Although such an analysis could have been performed between alcohol consumption over the past year and lack of perseveration with moves on the Tower of Hanoi as a mediator, this relationship was the only one to span

alcohol use, disinhibition, and impulsivity, so this finding suggested that a more conservative approach be adopted to avoid type I error. Regression analyses were conducted with centered interaction terms to determine whether any of the alcohol consumption measures interacted with any neuropsychological variables to predict outcomes from the UPPS or the BART. No interactions were significant.

CHAPTER 4: DISCUSSION

Hypothesis #1 –alcohol use and impulsivity

Results showed that self-reported impulsivity predicted multiple indices of alcohol use, including measures of quantity/frequency and DSM-IV alcohol dependence and abuse. This finding is consistent with previous literature that has found both cross-sectional (McGue, Slutske, Taylor, & Iacono, 1997) and prospective (Cloninger, et al., 1998; Grekin, Sher & Wood, 2006; Skeel, Pilarski, Pytalk & Neudecker, 2008) relationships between self-reported impulsivity and alcohol use.

However, this study is one of very few to examine relationships between alcohol use and individual components of impulsivity. Results revealed significant associations between heavy alcohol use and (1) lack of premeditation (i.e., a preference for action over careful deliberation), (2) lack of perseverance (i.e., an inability to tolerate boredom) and (3) urgency (i.e., the tendency to act without thinking to relieve negative affect). While preliminary, these data suggest that impulsivity may lead to problematic alcohol use through two separate pathways; (1) drinking spontaneously without thinking or considering consequences, which has more to do with the amount one drinks or (2) drinking to alleviate negative emotions, such as boredom or negative affect which appears to be more strongly related to DSM-IV symptomatology. While preliminary, these data suggest that specific types of impulsivity deserve careful consideration as

problem drinking risk factors, alongside the more established pathways including: family history of alcohol use disorders, child temperament, biological liabilities, peer influences, comorbid psychopathology, and stress (Sher, et al., 2005).

Surprisingly, sensation seeking was not associated with any of the alcohol use indices, despite strong relationships reported in the literature among a number of different populations, ranging from alcoholics to the general population to college students (e.g., Sher & Trull, 1994). This observation may have been a function of the current sample, which contained older and more diverse participants than those found in more traditional college samples. Using meta-analytic techniques, Hittner and Swickert (2006) found that the percentage of male and Caucasian participants correlated positively with the effect size between alcohol use and sensation seeking (i.e., the more male and Caucasian participants a study has, the stronger the effect size between alcohol use and sensation seeking). Alcohol use, especially heavy alcohol use, may have different meanings for different populations. While alcohol use may be associated with exciting and thrilling experiences for Caucasian males, it may be experienced differently by women or other ethnic groups. In fact, plausible sociocultural differences such as socialization, lack of economic opportunity, and differential amounts of stress have been hypothesized to underlie observed gender, racial and ethnic differences in time of onset, natural course, and quantity of alcohol consumption (Blume & Zilberman, 2005; Fraklin & Markarian, 2005).

Behavioral impulsivity –as measured by the BART –was unrelated to every measure of alcohol consumption. Notably, most previous BART studies have examined the impulsivity/alcohol use relationship using high-risk, adolescent samples (e.g. Lejuez et al., 2003). It is likely, however, that alcohol use has a different meaning in adolescent populations, (where it is illegal and viewed as deviant) than in college populations (where it is common and

often normative). In fact, a growing body of literature suggests that undergraduates who use alcohol may actually be more involved in college life than those who abstain (Neal, Sugarman, Hustad, Caska, & Carey, 2005). Thus, the BART may be tapping into a type of deviant or antisocial impulsivity that is most associated with alcohol use in underage or high-risk populations. Indeed, there is some evidence to indicate that the BART and antisociality are related among college students (Hunt et al., 2005). To test this hypothesis among college students, a future study might examine associations between performance on the BART and a number of behaviors that remain antisocial and deviant even among college students (such as stealing, or drinking and driving).

In the current study, self-reported (total UPPS score and subscales) and behavioral (BART scores) impulsivity were uncorrelated. Notably, other authors have also found null relationships between BART scores and self-report measures of impulsivity (e.g. Lejuez, et al., 2003; Reynolds, et al., 2006; Skeel et al., 2008). In fact, depending on the definition of impulsivity and the sample, authors have reported moderate ($r = .47$, $p < .01$; Vigil-Colet, 2007) to no correlation (Lejuez et al., 2003) between these two types of impulsivity measures.

There are a number of potential explanations for this puzzling finding. Some have argued that self-report and behavioral impulsivity measures assess different constructs (Reynolds et al., 2006; Vigil-Colet, 2007). In particular, questionnaire measures of impulsivity focus more on internal states or preferences (e.g., “I often feel bored,” “I would like skydiving”) than do behavioral tasks that only assess overt action. It should also be noted that questionnaire measures tend to assess aggregated behavior (i.e., behavior averaged over time), whereas laboratory measures assess behavior at a single time point. Aggregated behavior tends to be

more reliable than single "snapshots" of behavior (Epstein, 1979) and the two types of assessments are often uncorrelated.

Hypotheses #2 & #3 –alcohol use and disinhibition/ disinhibition and impulsivity

In the current study, alcohol use was largely unrelated to performance on neuropsychological tests. Some exceptions were observed: DSM-IV abuse symptoms and the amount of alcohol consumed in the past thirty days were negatively related to time on the Reading with Distraction task, and DSM-IV dependence symptoms as well as the amount of alcohol consumed in the past year were positively related to moves on the Tower of Hanoi. For the Tower of Hanoi, individuals with higher levels of abuse symptoms may complete the task less efficiently.

For the Reading with Distraction task, however, the relationships were in the opposite direction from what was predicted –that is, individuals with more abuse symptoms and higher amounts of alcohol consumption in the past 30 days tended to complete the task faster and with fewer errors than others who consumed less alcohol and those with fewer abuse symptoms. Impulsive individuals typically complete tasks more quickly than those who are not impulsive (Pietrzak, Sprague, & Synder, 2008), and the Reading with Distraction task seems to be no exception. As errors on the Reading with Distraction task were determined to show inadequate reliability, the finding that abuse symptoms negatively relate to errors cannot be meaningfully interpreted.

Although some significant effects were observed, the general paucity of findings was surprising, given that other investigators have shown a negative association between heavy alcohol use and measures of cognitive performance among college students (e.g. Goudriaan et

al., 2007; Kokavec & Crowe, 1999; Sher, Martin, Wood, & Rutledge, 1997; Townshend & Duka, 2005). Even so, there are three potential explanations for the lack of expected findings.

First, rates of drinking in the current sample may not have been high enough to interfere with cognitive performance. For example, Parsons (1998) found a threshold effect for the executive functioning/alcohol use relationship such that individuals must drink in excess of 21 standard drinks per week in order for executive functioning deficits to appear. Individuals drinking less than 21 drinks per week, tend not to exhibit measurable cognitive impairment (Bates & Tracy, 1990). However, among individuals who consume more than 21 drinks per week, alcohol and executive functioning share a dose-response relationship (i.e., the more alcohol consumed, the greater the executive functioning deficits (Parsons & Nixon, 1996). The majority of participants in this study consumed less than 21 drinks per week and exhibited relatively low rates of binge drinking when compared to other college student samples. For example, 38% (n = 27) of the current sample could be classified as binge drinkers as compared to 44% in nationally representative samples (Wechsler, Dowdall, Maenner, Gledhill-Hoyt, & Lee. 1998).

Second, it may be that college student populations are less susceptible to alcohol-induced cognitive impairment than are other populations because they are more likely to have above average baseline cognitive functioning. According to Stern's (2002) cognitive reserve hypothesis, these individuals are protected against various types of cognitive insult, including the deleterious effects of substance abuse. Indeed, some investigators have argued that college populations are "cognitively resilient" based on their failure to show expected neuropsychological deficits related to post-traumatic stress disorder and substance use (Twamley, Hami, & Stein, 2004).

Third, the lack of expected findings may be due to statistical issues, such as restriction of range or ceiling effects as college students tend to do quite well on tests of executive functioning (Lezak, Howieson, & Loring, 2004). It should also be noted that participating in the current study required a certain degree of executive functioning in that students needed to register for the study online, locate the laboratory, show up on time, etc. and these requirements may have decreased our ability to obtain a sample in which executive functioning was normally distributed.

Data from the current study showed that certain types of self-reported impulsivity were related to executive functioning measures. In particular, lack of premeditation, or the preference for action over deliberation, was significantly related to time on the Reading with Distraction task, such that those with a high preference for action took less time to read the stories. Lack of premeditation was also positively related to the number of moves on the Tower of Hanoi, such that individuals high in this trait tended to complete the task using more moves than necessary (i.e., they failed to use the optimal task strategy). Overall, these findings suggest that, for a subgroup of participants, acting without thinking can interfere with the ability to plan and execute tasks effectively.

Notably, however, there were no other relationships between executive functioning measures and self-reported or behavioral impulsivity. This finding may have been due to restricted range on the executive functioning variables (as discussed above). However, it is important to note that the literature in this area has been mixed with a number of authors reporting null relationships between executive functioning and impulsivity (Kelip, Sackeim, & Mann, 2005; Pietrzak et al., 2008). Thus, more research is needed to clarify the complex associations between the broad constructs of executive functioning and impulsivity.

Study Limitations

Although this thesis was a laboratory study that used many well-validated measures, there are some limitations that must be considered. First, because these data are correlational, this study cannot make causal claims regarding relationships between alcohol consumption and impulsivity. Second, several of our findings were non-significant, but in the expected direction, suggesting that we may have lacked statistical power needed to detect relationships. It should be noted, however, that studies similar to this obtained significant effects with fewer subjects. In addition, in most cases, effect sizes for non-significant relationships were small. Third, due to time constraints, only three neuropsychological measures of disinhibition were used. Thus, we were unable to assess certain executive functioning abilities that may have been associated with heavy alcohol use such as attention and working memory (Kokavec & Crowe, 1999; Townshend & Duka, 2005). Fourth, although impulsivity was assessed both through self-report and behavioral measures, a more comprehensive assessment of impulsivity may have been warranted. Factor analytic work has empirically identified between three and four facets of impulsivity (Gerbing, Ahadi, & Patton, 1987; Helmer, Young, & Pihl, 1995; Miller, Joseph, & Tudway, 2004). Typically, these facets tend to fall along self-report and behavioral lines, but including more measures of impulsivity may have been beneficial (Reynolds et al., 2006).

Future Directions

Exploring the relationship between alcohol use and risky behavior remains an important issue, especially among college students. Epidemiological research shows that the problem is both severe (Commission on Substance Abuse at Colleges and Universities, 1994; Hingson et al., 2005) and pervasive (Wechsler et al., 1998). Therefore, more work is needed to identify the mechanisms by which alcohol consumption leads to risky behavior (mediators), and what factors

determine the strength of the relationship (moderators). More specifically, data from the current study highlight a number of important, yet understudied research areas.

First, data from the current study were collected at an urban research university with a large number of non-traditional students. Relatively little is known about non-traditional students (i.e., those who attend part-time, work more than 35 hours per week, have children, etc), and it is unclear whether current knowledge about college student drinking will generalize to this population (e.g. Sheffield, Darkes, DelBoca, & Goldman, 2005). The number of non-traditional students at American colleges and universities has rapidly increased over the past two decades, and this trend is projected to continue (National Center on Education Statistics, 2002). Despite this trend, the vast majority of college student research continues to rely on full-time, 18-22 year old "traditional" students and an expansion of the research literature is clearly needed. Future research will also need to address the various challenges that increasing numbers of culturally diverse students pose to the current knowledge base. For example, although sensation seeking has been identified as a key variable in understanding and predicting alcohol use among Caucasians, it may be a less useful predictor in other ethnic groups where different facets of impulsivity may be more meaningful (Hittner & Swickert, 2006).

Third, it remains unclear how laboratory measures of impulsivity (like the BART) are related to heavy alcohol use in college students. Despite clear evidence that such measures are useful among adolescents and the general population (Bornovalova, et al., 2005; Hopko, et al., 2006; Leujez, et al., 2003), the evidence remains mixed for college students, but it is unclear why. The BART may tap an antisocial style of alcohol use that future research should investigate in samples of college students. A better understanding of how self-report and

behaviorally-based measures of impulsivity best complement each other may further illuminate how various facets of impulsivity predict heavy alcohol use in college samples.

Fourth, the relationship between the broad constructs of executive functioning/ disinhibition and impulsivity needs to be explored with greater levels of clarification and precision (e.g. Smith et al., 2007). Instead of focusing on specific relationships between various measures of each construct, the field might benefit from a greater focus on constructing latent variables. Furthermore, a fully comprehensive assessment of each construct was outside the scope of this study, precluding a more thorough exploration of our hypotheses. Gaining a greater understanding of these relationships will be important in effectively targeting and intervening to prevent excessively risky behavior.

Finally, future work in this area should focus on contextual variables. Traditionally, riskiness and impulsivity have been assumed to be stable and global traits, however, there is growing evidence that these traits may be domain-specific (Hanoch, Johnson, & White, 2006; Nicholson, Soane, Fenton-O'Creevy, & Willman, 2005). For example, it is possible for an individual to be quite rash in one area of his or her life (i.e. with financial decisions), but quite conservative in another (i.e. relationships or health). It may well be that heavy alcohol use is associated with risk in one area, but not another.

Like many other complex social issues, the connection between alcohol use and risky behavior merits study on many different levels. There are many individual factors which contribute to the association between alcohol use and risk-taking such as personality (Sher & Trull, 1994), motivations for drinking (Cooper, Frone, Russell, & Mudar, 1995), and executive functioning (Giancola, 2000), but to further advance our understanding of this complex relationship, more work needs to be done on the interaction between individual variables and

environmental determinants such as residential status (Wechsler et al., 1995), and price and availability of alcohol (Wechsler, Kuo, Lee, & Dowdall, 2000). Only with greater integration can researchers and policy-makers gain a holistic understanding of this important problem.

APPENDIX A

Alcohol use measure (NIAAA, 2003).

THE FOLLOWING QUESTIONS ASK ABOUT HOW MUCH YOU DRINK. A "DRINK" MEANS ANY OF THE FOLLOWING:

A 12-ounce can or bottle of beer

A 12-ounce can or bottle of wine cooler

A 4-ounce glass of wine

A shot of liquor

How often have you had some kind of beverage containing alcohol in the PAST YEAR?

I didn't drink in the past year

Less than once a month

About once a month

2 to 3 times a month

Once or twice a week

3 to 4 times a week

5 to 6 times a week

Once a day

Twice a day or more

In the PAST YEAR, when you drank alcohol, how many drinks did you usually have on one occasion?

I didn't drink in the past year

1 drink

2 drink

3 drinks

4 drinks

5 drinks

6 drinks

7 drinks

8 to 11 drinks

12 or more drinks

How often have you had some kind of beverage containing alcohol in the PAST 30 DAYS?

I didn't drink in the past 30 days

Once during the past 30 days

2 to 3 times during the past 30 days

Once or twice a week

3 to 4 times a week

5 to 6 times a week

Everyday

In the 30 DAYS, when you drank alcohol, how many drinks did you usually have on one occasion?

I didn't drink in the past 30 days	5 drinks
1 drink	6 drinks
2 drinks	7 drinks
3 drinks	8 to 11 drinks
4 drinks	12 or more drinks

How many times in the PAST 30 DAYS did you get a little high or light-headed from alcohol?

Didn't get high or light-headed in the past 30 days	3 to 4 times a week
Once	5 to 6 times a week
2 to 3 times	Everyday
Once or twice a week	

How many times in the PAST 30 DAYS did you get drunk from alcohol (e.g., speech was slurred or unsteady on your feet)?

Didn't get drunk in the past 30 days	3 to 4 times a week
Once	5 to 6 times a week
2 to 3 times	Everyday
Once or twice a week	

In the PAST 30 DAYS, how many times have you had <u>five or more</u> drinks at a single sitting?

Didn't drink 5 or more drinks at a single setting in the past 30 days	3 to 4 times a week
Once	5 to 6 times a week
2 to 3 times	Everyday
Once or twice a week	

In the PAST 30 DAYS, how many times have you had twelve or more drinks at a single sitting?

Didn't drink 12 or more drinks at a single setting in the past 30 days	3 to 4 times a week
Once	5 to 6 times a week
2 to 3 times	Everyday
Once or twice a week	

APPENDIX B

Alcohol abuse and dependence measure (Grant et al., 1995).

Have you ever felt that you needed larger amounts of alcohol than you used to in order to get any effect?

Yes, in the past year Yes, but not in the past year No

Have you ever felt that you could no longer get high or drunk on the amount that used to get you high or drunk?

Yes, in the past year Yes, but not in the past year No

In the first few days AFTER stopping or cutting down on drinking did you ever experience any negative after-effects of drinking, such as insomnia, shaking, feeling anxious, nauseous or restless, sweating or having your heart beat fast, seeing or hearing things that weren't really there or having seizures?:

Yes, in the past year Yes, but not in the past year No

Did you ever take a drink or use any drug, other than aspirin, Advil or Tylenol, to GET OVER any of the bad aftereffects of drinking?

Yes, in the past year Yes, but not in the past year No

Did you ever take a drink or use any drug, other than aspirin, Advil or Tylenol, to KEEP FROM having any of these bad aftereffects of drinking?

Yes, in the past year Yes, but not in the past year No

Have you had a period when you ended up drinking more than you meant to?

Yes, in the past year Yes, but not in the past year No

Have you had a period when you kept on drinking for longer than you had intended to?

Yes, in the past year Yes, but not in the past year No

Did you ever, more than once, want to stop or cut down on your drinking?

Yes, in the past year Yes, but not in the past year No

Did you ever, more than once, TRY to stop or cut down on your drinking but found you couldn't do it?

Yes, in the past year Yes, but not in the past year No

Did you ever have a period when you spent a lot of time drinking?

Yes, in the past year Yes, but not in the past year No

Did you ever have a period when you spent a lot of time being sick or getting over the bad aftereffects of drinking?

Yes, in the past year Yes, but not in the past year No

Did you ever give up or cut down on activities that were important to you in order to drink – like work, school, or associating with friends or relatives?

Yes, in the past year Yes, but not in the past year No

Did you ever give up or cut down on activities that you were interested in or that gave you pleasure in order to drink?

Yes, in the past year Yes, but not in the past year No

Did you ever continue to drink even though you knew it was making you feel depressed, uninterested in things, or suspicious or distrustful of other people?

Yes, in the past year Yes, but not in the past year No

Did you ever continue to drink even though you knew it was causing you a health problem or making a health problem worse?

Yes, in the past year Yes, but not in the past year No

Did you ever continue to drink even though you had experienced a blackout, that is, awakened the next day not being able to remember some of the things you did while drinking or after drinking?

Yes, in the past year Yes, but not in the past year No

Did you ever have a period when your drinking or being sick from drinking often interfered with taking care of your home or family?

Yes, in the past year Yes, but not in the past year No

Did you ever have a job or school troubles because of your drinking or being sick from drinking – like missing too much school, not doing your work well, being demoted or losing a job or being suspended, expelled or dropping out of school?

Yes, in the past year Yes, but not in the past year No

Did you, more than once, drive a car or other vehicle WHILE you were drinking?

Yes, in the past year Yes, but not in the past year No

Did you, more than once drive a car, motorcycle, truck, boat, or other vehicle after having too much to drink?

Yes, in the past year Yes, but not in the past year No

Did you ever get into situations while drinking or after drinking that increased your chances of getting hurt – like swimming, using machinery or walking in a dangerous area or around heavy traffic?

Yes, in the past year Yes, but not in the past year No

Did you ever get arrested, held at a police station, or have any other legal problems because of your drinking?

Yes, in the past year Yes, but not in the past year No

Did you ever continue to drink even though you knew it was causing you trouble with your family or friends?

Yes, in the past year Yes, but not in the past year No

APPENDIX C

Reading with Distraction Task (Darowski, et al., 2008)

At The Eye Doctor's

Betsy Robson a cigarette *walked into* odor *the optometrist's office* medicine *and told the* odor *young secretary* odor *that she* a cigarette *had arrived* medicine *for her* the receptionist *appointment. Betsy* a cigarette *suspected* the receptionist *that* medicine *it was* the receptionist *about* odor *time* a cigarette *for her first* medicine *pair of* odor *glasses. A* a cigarette *sweet* the receptionist *aroma began* medicine *to filter* medicine *into the* a cigarette *waiting* odor *room. Betsy* the receptionist *looked* medicine *about* a cigarette *wondering what it* the receptionist *could be when* medicine *the doctor* odor *walked* medicine *in with a pipe* the receptionist *clenched between* medicine *his smiling* odor *teeth. "Won't* odor *you* a cigarette *come back and* the receptionist *we'll take a look* medicine *at your eyes" the* odor *doctor* a cigarette *said in a friendly* the receptionist *manner. He led Betsy* medicine *to the* a cigarette *examining* the receptionist *room in the back* medicine *and examined her* a cigarette *eyes thoroughly. She* odor *watched* a cigarette *as he* odor *wrote her* the receptionist *prescription* odor *on* a cigarette *a pad of yellow* the receptionist *paper. The doctor* odor a cigarette *told her* medicine *not to* the receptionist *worry since she* a cigarette *would now* the receptionist *be enjoying* odor medicine *normal* the receptionist *vision again.*

The Bus Ride

Sharon Brown's unreasonable *car had fallen* train pass *apart* the park *to the point of* train pass *being a total write-off. She* auto *needed* the park *to get around* unreasonable *town so* auto *she applied to* the park *get a monthly discount* unreasonable *bus pass. She didn't* auto *relish* train pass *the idea* train pass *of riding*

the the park unreasonable *bus but the* unreasonable *passes* the park *were not expensive,* auto *they fit* auto *well* the park *into her* unreasonable *budget. The* train pass *transit service* unreasonable *also* train pass *allowed* the park *her to do all* unreasonable *of the* auto *activities* train pass *she needed her* unreasonable *car for, such as* auto *shopping,* train pass *visiting friends* train pass *and going to* train pass *the zoo. The* auto *zoo trips* unreasonable *were* train pass *especially nice* the park *since* the park *she liked* train pass *to go* auto *there* the park *at least* unreasonable *once* the park *a month. With the bus* auto *she would not have* unreasonable *to worry* the park *about* auto *paying the five* unreasonable *dollar parking fee* train pass *which she had* the park *always perceived* auto *as unfair. The more* unreasonable *she thought about* train pass *it, the more* auto *that Sharon* the park *realized that* auto *the idea* unreasonable *of taking* the park *the bus* train pass *was a good* auto *one.*

The Volunteer

Bertha McKee in a carton *was working* college Van Dyck *as a volunteer* gallery *at the information* in a carton *booth* Van Dyck *at the* in a carton *museum. She* Van Dyck *brushed off* gallery *the* gallery *snow which had* college Van Dyck *fallen on her* in a carton *as she* Van Dyck *came from her* gallery *high* Van Dyck *school. She took* college *her seat in* gallery *the round* Van Dyck *booth and* Van Dyck *waited for* in a carton *the evening's* gallery *art viewers* Van Dyck *to arrive. She* college *liked* in a carton *her job* gallery *because* in a carton *it* Van Dyck *allowed her* in a carton *to see all of* college *the different* gallery *types of art* college *that* in a carton *moved through* Van Dyck *the* in a carton *displays. Bertha* college *picked up* Van Dyck *a box* college *full of new* gallery *pamphlets* college *that told* in a carton *of* college gallery *upcoming displays. When she* Van Dyck in a carton *looked* college *through one* in a carton *of them* Van Dyck *she became* college *very* in a carton *excited. One* college *of her* gallery *favorite* gallery *painters, Van Gogh, was* gallery *being* college *highlighted* in a carton *in an* gallery *exhibition* Van Dyck *soon. She* college *couldn't* gallery *wait.*

Time to Lose Weight

Howard Smith was eating habits bookstore looking workout routine at bookstore his body eating habits in the full-length health mirror and could see bookstore that his body workout routine was definitely bookstore changing health as it got older. Now health that he workout routine was 24 bookstore he could see eating habits that he must health take some workout routine sort of action workout routine to eating habits maintain his bookstore fitness. First of all he bookstore health would have bookstore to change health his diet. He began health workout routine to think eating habits of all the fat health little bellies bookstore down at workout routine the plant. He did not eating

habits bookstore want to end up workout routine like that. He eating habits thought that he health should also eating habits check his bookstore exercise schedule eating habits to see if workout routine that health should be workout routine modified. He health made a bookstore workout routine note in his datebook to eating habits stop at the workout routine library health around lunch workout routine to see if there were eating habits any books health he could check eating habits out that would bookstore help him. Howard health eating habits was indeed the bookstore type health of person workout routine who wanted eating habits to keep workout routine his body fit and trim bookstore eating habits his whole life.

APPENDIX D

Impulsivity scale (Whiteside & Lynam, 2001).

UPPS

Below are a number of statements that describe ways in which people act and think. For each statement, please indicate how much you agree or disagree with the statement. If you **Agree Strongly** circle **1**, if you **Agree Somewhat** circle **2**, if you **Disagree somewhat** circle **3**, and if you **Disagree Strongly** circle **4**. Be sure to indicate your agreement or disagreement for every statement below. Also, there are a few more questions on the next page.

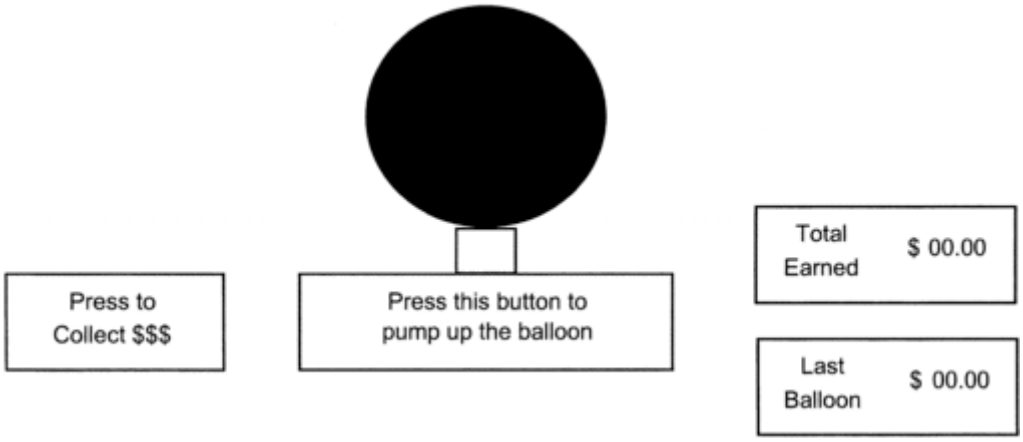
	Agree Strongly	Agree Some	Disagree Some	Disagree Strongly
1. I have a reserved and cautious attitude toward life.	1	2	3	4
2. I have trouble controlling my impulses	1	2	3	4
3. I generally seek new and exciting experiences and sensations.	1	2	3	4
4. I generally like to see things through to the end.	1	2	3	4
5. My thinking is usually careful and purposeful.	1	2	3	4
6. I have trouble resisting my cravings (for food, cigarettes, etc.).	1	2	3	4
7. I'll try anything once.	1	2	3	4
8. I tend to give up easily	1	2	3	4
9. I am not one of those people who blurt out things without thinking.	1	2	3	4
10. I often get involved in things I later wish I could get out of.	1	2	3	4

11. I like sports and game in which you have to choose your next move very quickly.	1	2	3	4
12. Unfinished tasks really bother me.	1	2	3	4
13. I like to stop and think things over before I do them.	1	2	3	4
14. When I feel bad, I often do things I later regret in order to make myself feel better now.	1	2	3	4
15. I would enjoy water skiing.	1	2	3	4
16. Once I get going on something, I hate to stop.	1	2	3	4
17. I don't like to start a project until I know exactly how to proceed.	1	2	3	4
18. Sometimes when I feel bad, I can't seem to stop what I'm doing even though it is making me feel worse.	1	2	3	4
19. I quite enjoy taking risks.	1	2	3	4
20. I concentrate easily.	1	2	3	4
21. I would enjoy parachute jumping.	1	2	3	4
22. I finish what I start.	1	2	3	4
23. I tend to value a rational, "sensible" approach to things.	1	2	3	4
24. When I am upset, I often act without thinking.	1	2	3	4
25. I welcome new and exciting experiences and sensations, even if they are a little frightening and unconventional.	1	2	3	4
26. I am able to pace myself so as to get things done on time.	1	2	3	4
27. I usually make up my mind through careful reasoning.	1	2	3	4
28. When I feel rejected, I often say things that I later will regret.	1	2	3	4
29. I would like to learn to fly an airplane.	1	2	3	4

30. I am a person who always get the job done.	1	2	3	4
31. I am a cautious person.	1	2	3	4
32. It is hard for me to resist acting on my feelings.	1	2	3	4
33. I sometimes like doing things that are a bit frightening.	1	2	3	4
34. I almost always finish projects that I start.	1	2	3	4
35. Before I get into a new situation, I like to find out what to expect from it.	1	2	3	4
36. I often make matters worse because I act without thinking when I am upset.	1	2	3	4
37. I would enjoy the sensation of skiing very fast down a mountain slope.	1	2	3	4
38. Sometimes there are so many little things to be done that I just ignore them all.	1	2	3	4
39. I usually think before doing anything.	1	2	3	4
40. Before making up my mind, I consider all the advantages and disadvantages.	1	2	3	4
41. In the heat of an argument, I say things that I later regret.	1	2	3	4
42. I would like to go scuba diving.	1	2	3	4
43. I always keep my feelings under control.	1	2	3	4
44. I would enjoy fast driving.	1	2	3	4
45. Sometimes I do impulsive things that I later regret.	1	2	3	4

APPENDIX E

Screenshot of the Balloon Risk Analogue Task (BART) taken from Leujez and others (2002)



APPENDIX F

Protocol Scripts

The Stroop Color Word Task

Introducing the Stroop
[hand the participant a copy of the test booklet] "**This is a test of how fast you can read the words on this page. After I say begin, you are to read down the columns starting with the first one** [point to the left-most column] **until you complete it** [run finger down the left-most column] **and then continue without stopping down the remaining columns in order** [run your finger down the other columns]. **If you finish all the columns before I say "stop", then return to the first column and begin again** [point to the first column]. **Remember, do not stop reading until I tell you to "stop" and read out loud as quickly as you can. If you make a mistake, I will say "No" to you. Correct your error and continue without stopping. Are there any questions?**

Starting the Word Page:
[answer any questions or paraphrase directions as necessary. If there are no more questions, say] **Ready?...Then begin.**
[as soon as the participant starts to say the first word, begin timing. After 45 seconds, say] **Stop. Circle the item you are on.**

Starting the Color Page:
[Turn to the next page, then say] **This is a test of how fast you can name the colors on this page.**

[if the subject understands the directions, say] **You will complete this page just as you did the previous page, starting with this first column. Remember to name the colors out loud as quickly as you can.**
[administration of this test is identical to the previous test –after 45 seconds, say] **Stop. Circle the item you are on.** [if the participant made it through the list once, ask them to put a mark next to the circle].

Starting the Color-Word Page:
[Turn to the next page and say] **This word page is like the page you just finished. I want you to name the color of ink the words are printed in, ignoring the word that is printed for each item. For example** [point to the first item of the first column], **this is the first item: what would you say?**

[if the participant is incorrect, say] **No. That is the word that is spelled there. I want you to name the color of the ink the word is printed in.** Now [point to the word] **what would you say to this item?**

[if the participant is correct, say] **Good. You will do this page just like the others, starting with the first column** [point] **and then going on to as many columns as you can. Remember, if you make a mistake, just correct it and go on. Are there any questions?** [check and see if the participant has questions, if not, then say] **Then begin.**
[after 45 seconds, say] **Stop. Circle the item you are on.**

<u>Tower of Hanoi</u>

Introducing the Tower of Hanoi
[Invite the participant to sit in front of the computer] **Now we're going to do something different. On the screen in front of you are three pegs, and one of those pegs is holding four discs. Have you ever performed this task before?** [write down their response to include with the data] **I want to see how well you can move all the disks from the rightmost side of the screen to the leftmost side. To move each disc, use the mouse to click on the disc and move it to another peg. In completing this task there are two simple rules that you must follow. First is that you may only move one disc at a time. Second, is that you may not place a larger disc on top of a smaller one. Do you have any questions?** [pause and make sure they understand the task]. **Okay, you may begin now.**

[while the participant is completing this task, be sure to remain out of their line of sight. We don't want our presence to influence them to make moves they otherwise wouldn't. After the task is over, however, make note of how many moves and the amount of time it took them to complete the puzzle.]

<u>Reading with Distraction Task</u>

Introducing the Task:
These pieces of paper each have a different story on them. I'd like you to read these four stories out loud. Read them clearly and accurately. Also, please read them so that you

understand their content because I have some questions for you to answer after each story. While reading this story out loud, please do your best only read the words printed in normal font while ignoring the words in italics. If you make a mistake, that's okay. Just correct it and keep reading. Also, do not use your finger as a place marker. Any questions?

[if the participant doesn't have any questions, flip over the first story and say] **Okay, begin.**

[when the participant is finished reading say] **Okay. Here are four multiple choice questions about the story. Please choose the best answer. If you do not know the answer, just give your best guess.**

Balloon Risk Analogue Task (BART)

Introducing the BART
[invite the participant to take a break while you switch to the BART –enter in the appropriate information. Be sure that they money and counter option are set correctly]. **Now we have one more task for you to complete.** [first, you will see a screen shot of the BART] **In this task, you will click on the pump** [point] **to make the balloon bigger. Each time you pump the balloon, you earn money which you may see in this box** [point], **but if you pump it too much, the balloon will explode and you will lose your money earned for that trial. You may click this box** [point] **to end the trial. Ending a trial will return the balloon to its original size and it will allow you to keep what you've earned which you may see here** [point]. **Your goal in this task is to earn as much money as possible. Do you have any questions?** [click the continue button]. **These are some directions which you may read silently to yourself. Please tell me when you have finished**. [wait for their response] **Okay, you may begin now.**

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Table 1

Descriptives for Outcome Variables

Outcome Variable	N	Mean	SD	Skewness	Kurtosis
DSM-IV Abuse Symptom Count*	71	0.35	0.63	1.19	1.11
DSM-IV Dependence Symptom Count	71	1.56	1.74	1.62	7.5
Drinking, Past 30 Days	71	13.11	9.36	1.2	1.34
Drinking, Past Year	71	20.75	13.13	1.04	0.57
WTAR, Raw Score^	64	38.21	6.33	-0.4	-0.09
Stroop Interference Score	71	4.16	9.43	1.52	6.96
Tower of Hanoi, Time	68	125.21	91	1.7	2.81
Tower of Hanoi, Moves*	68	26.95	8.5	0.13	9.83
Reading with Distraction, Time	69	339.23	79.84	1.05	2.09
Reading with Distraction, Errors	69	8.72	5.78	1.07	0.84
BART, Adjusted Number of Pumps	68	35.04	12.06	0.15	0.72
UPPS, Total Score	71	95.24	16.21	-0.06	-0.83
(Lack of) Premeditation	71	19.87	5.51	0.37	-0.45
Urgency	71	25.37	7.34	0.3	-0.23
Sensation Seeking	71	32.62	8.15	-0.09	-0.82
(Lack of) Perseveration	71	17.38	5.09	0.78	-1.12

* Variable was windsorized because skew was > 2.00

^ Missing data was filled according to a protocol described in the Measures section

DSM-IV = Diagnostic and Statistical Manual -4th edition; WTAR =Wechsler Test of Adult Reading; BART = Balloon Analogue Risk Taking Task; UPPS=Urgency, Premeditation, Perseverance, and Sensation Seeking Scale

Table 2

Product-Moment Correlations Between Outcome Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Abuse*		.54**	.45**	.52**	-.06	.02	.02	.20	-.23	-.18	.08	.31**	.15	.32**	.16	.11
2. Dependence			.44**	.60**	-.16	-.16	.07	.21	.09	.01	-.14	.37**	.17	.29*	.20	.25*
3. Q*F, 30 days				.71**	-.09	-.12	.08	.17	-.17	-.11	-.05	.27*	.28*	.12	.16	.12
4. Q*F, Year					.07	-.07	.03	.26*	-.22	-.08	.00	.32**	.40**	.17	.19	.05
5. WTAR						.16	.28*	.23	-.45**	-.33**	.25	-.29*	.14	-.12	-.54**	-.02
6. Stroop							-.04	-.14	-.25*	-.19	-.01	.17	.10	.14	.11	.06
7. ToH, Time								.67**	.00	.03	-.11	-.02	.13	.08	-.26*	.11
8. ToH, Moves*									-.01	-.05	.02	.09	.29*	.12	-.17	.08
9. RwD, Time										.41**	-.15	-.12	-.34**	-.13	.13	-.03
10. RwD, Errors											-.16	.02	-.09	.03	.11	.06
11. BART												-.08	.05	-.20	.04	-.08
12. UPPS													.66**	.78**	.45**	.62**
13. LofPre														.34**	.02	.49**
14. Urgency															.04	.60**
15. SS																-.25*
16. LofPers																

* p<.05 ** p<.01

Abuse =DSM-IV alcohol abuse symptom count; Dependence =DSM-IV alcohol dependence symptom count; Q*F, 30 days =alcohol comsumed in the past 30 days; Q*F, Year =alcohol comsumed in the past year; WTAR =raw score on the WTAR; Stroop =Stroop interference score; ToH, time =Time on the Tower of Hanoi; ToH ,moves = moves on the Tower of Hanoi; RwD, Time =Time on the Reading with Distraction Task RwD, Errors =Errors on the Reading with Distraction task; BART =Adjusted average number of pumps per trail on the BART; UPPS =total score on the UPPS; LofPre =(Lack of) Premeditation; SS =Sensation Seeking; LofPers =(Lack of) Perseveration

Table 3*

Hierarchical Regressions Between Impulsivity Measures and Alcohol Abuse Symptom Count

Step in Model	*F*	df	R^2	sig.	Step 1 β	Step 1 sig.	Step 2 β	Step 2 sig.
Step 1	.536	3,64	.024	.660				
Age					-.131	.292	-.088	.474
Gender					-.003	.982	.049	.692
Ethnicity					.077	.540	.035	.780
Step 2	1.66	4,63	.096	.170				
UPPS total							**.281**	**.030**
Step 1								
Age							-.143	.251
Gender							.009	.940
Ethnicity							.041	.752
Step 2	.855	4,63	.051	.496				
Lack of Premeditation							.165	.185
Step 1								
Age							-.101	.406
Gender							.005	.964
Ethnicity							.077	.526
Step 2	1.81	3,64	.103	.139				
Urgency							**.282**	**.022**
Step 1								
Age							-.133	.391
Gender							.025	.861
Ethnicity							.059	.660
Step 2	.449	4,63	.028	.773				
Sensation Seeking							.070	.650
Step 1								
Age							-.133	.284
Gender							-.030	.816
Ethnicity							.107	.402
Step 2	.849	4,63	.051	.500				
Lack of Perseveration							.169	.188
Step 1	.614	3,64	.029	.609				
Age							-.152	.234
Gender							.010	.939
Ethnicity							.643	.523
Step 2	.763	4,63	.048	.554				
Adjusted number of pumps							.140	.277

* Redundant information that two or more models share (i.e. betas, F-vales, degrees of freedom, R-squared, and significance-values) has been omitted from the following tables.

Table 4

Hierarchical Regressions Between Impulsivity Measures and Alcohol Dependence Symptom Count

Step in Model	*F*	df	R^2	sig.	Step 1 β	Step 1 sig.	Step 2 β	Step 2 sig.
Step 1	.938	3,64	.042	.426				
Age					-.098	.428	-.039	.739
Gender					-.150	.235	-.079	.508
Ethnicity					-.130	.302	-.187	.118
Step 2	**3.24**	**4,63**	**.171**	**.017**				
UPPS Scale total							**.378**	**.003**
Step 1								
Age							-.113	.355
Gender							-.134	.281
Ethnicity							-.178	.162
Step 2	1.52	4,64	.088	.207				
Lack of Premeditation							.221	.080
Step 1								
Age							-.069	.567
Gender							-.142	.246
Ethnicity							-.130	.288
Step 2	1.99	4,64	.112	.108				
Urgency							**.266**	**.030**
Step 1								
Age							-.048	.709
Gender							-.075	.587
Ethnicity							-.180	.172
Step 2	1.11	4,64	.066	.361				
Sensation Seeking							.190	.212
Step 1								
Age							-.101	.398
Gender							-.197	.109
Ethnicity							-.077	.531
Step 2	2.29	4,64	.127	.070				
Lack of Perseveration							**.301**	**.016**
Step 1	1.07	3,61	.050	.367				
Age					-.118	.348	-.114	.367
Gender					-.160	.210	-.180	.163
Ethnicity					-.125	.325	-.131	.275
Step 2	1.11	4,60	.069	.359				
Adjusted number of pumps							-.139	.275

Table 5

Hierarchical Regressions Between Impulsivity Measures and Drinking in the Past 30 Days

Step in Regression Model	*F*	df	R^2	sig.	Step 1 β	Step 1 sig.	Step 2 β	Step 2 sig.
Step 1	.236	3,64	.011	.871				
Age					.016	.899	.062	.612
Gender					-.013	.920	.043	.733
Ethnicity					.101	.427	.056	.654
Step 2	1.58	4,63	.091	.191				
UPPS total							**.298**	**.022**
Step 1								
Age							-.008	.949
Gender							.012	.919
Ethnicity							.026	.834
Step 2	2.25	4,64	.125	.074				
Lack of Premeditation							**.348**	**.006**
Step 1								
Age							.029	.816
Gender							-.009	.942
Ethnicity							.101	.427
Step 2	.420	4,64	.026	.793				
Urgency							.123	.328
Step 1								
Age							.041	.755
Gender							.025	.859
Ethnicity							.076	.574
Step 2	.273	4,64	.017	.894				
Sensation Seeking							.097	.534
Step 1								
Age							.014	.911
Gender							-.051	.687
Ethnicity							.143	.260
Step 2	1.09	4,64	.064	.371				
Lack of Perseveration							.240	.062
Step 1	.096	3,61	.005	.962				
Age					.009	.942	.011	.931
Gender					.024	.853	.016	.904
Ethnicity					.067	.604	.065	.618
Step 2	.119	4,60	.008	.975				
Adjusted number of pumps							-.057	.663

Table 6

Hierarchical Regressions Between Impulsivity Measures and Drinking in the Past Year

Step in Regression Model	*F*	df	R^2	sig.	Step 1 β	Step 1 sig.	Step 2 β	Step 2 sig.
Step 1	2.70	3,64	.112	.053				
Age					-.088	.459	-.046	.691
Gender					-.174	.153	-.124	.300
Ethnicity					.235	.054	.194	.104
Step 2	**3.39**	**4,63**	**.177**	**.014**				
UPPS total							**.267**	**.030**
Step 1								
Age							-.115	.291
Gender							-.144	.195
Ethnicity							.147	.196
Step 2	**5.77**	**4,63**	**.268**	**.001**				
Lack of Premeditation							**.407**	**.001**
Step 1								
Age							-.071	.552
Gender							-.169	.161
Ethnicity							.235	.053
Step 2	2.51	4,63	.137	.051				
Urgency							.159	.182
Step 1								
Age							-.101	.423
Gender							-.193	.155
Ethnicity							.248	.055
Step 2	2.03	4,63	.114	.101				
Sensation Seeking							-.049	.740
Step 1								
Age							-.090	.446
Gender							-.204	.095
Ethnicity							**.268**	**.029**
Step 2	**2.69**	**4,63**	**.146**	**.039**				
Lack of Perseveration							.190	.121
Step 1	2.03	3,61	.091	.120				
Age					-.100	.416	-.100	.421
Gender					-.150	.230	-.151	.237
Ethnicity					.211	.092	.211	.095
Step 2	1.50	4,60	.091	.215				
Adjusted number of pumps							-.006	.965

Table 7

Hierarchical Regressions Between Disinhibition Measures and Alcohol Abuse Symptom Count

Step in Model	*F*	df	R^2	sig.	Step 1 β	Step 1 sig.	Step 2 β	Step 2 sig.
Step 1	.357	4,58	.024	.838				
Age					-.120	.370	-.112	.411
Gender					.027	.847	.031	.824
Ethnicity					.091	.502	.082	.552
Wechsler Test of Adult Reading					-.010	.940	-.023	.871
Step 2	.330	5,57	.028	.893				
Stroop							.066	.627
Step 1	.325	4,56	.023	.860				
Age					-.100	.464	-.113	.419
Gender					-.025	.858	-.036	.805
Ethnicity					.099	.472	.103	.460
Wechsler Test of Adult Reading					.030	.831	.017	.909
Step 2	.302	5,55	.027	.910				
Time, Tower of Hanoi							.068	.636
Step 1								
Age							-.088	.508
Gender							-.027	.845
Ethnicity							.105	.434
Wechsler Test of Adult Reading							-.035	.805
Step 2	1.05	5,55	.087	.396				
Moves, Tower of Hanoi							.262	.053
Step 1	.442	4,56	.031	.778				
Age					-.116	.391	-.137	.293
Gender					-.024	.862	-.051	.706
Ethnicity					.113	.410	.019	.887
Wechsler Test of Adult Reading					.035	.804	-.111	.449
Step 2	1.62	5,55	.128	.172				
Time, Reading with Distraction							**-.363**	**.016**
Step 1								
Age							-.162	.211
Gender							-.056	.672
Ethnicity							.081	.535
Wechsler Test of Adult Reading							.071	.606
Step 2	1.91	5,55	.148	.107				
Errors, Reading with Distraction							**-.369**	**.008**

Table 8

Hierarchical Regressions Between Disinhibition Measures and Alcohol Dependence Symptom Count

Step in model	*F*	df	R^2	sig.	Step 1 β	Step 1 sig.	Step 2 β	Step 2 sig.
Step 1	.608	4,58	.04	.659				
Age					-.057	.668	-.070	.603
Gender					-.100	.465	-.107	.440
Ethnicity					-.118	.381	-.104	.445
Wechsler Test of Adult Reading					-.097	.483	-.078	.581
Step 2	.594	5,57	.05	.704				
Stroop							-.100	.458
Step 1	.671	4,56	.046	.615				
Age					-.035	.796	-.063	.647
Gender					-.134	.341	-.156	.274
Ethnicity					-.133	.329	-.125	.359
Wechsler Test of Adult Reading					-.089	.526	-.117	.412
Step 2	.748	5,55	.064	.591				
Time, Tower of Hanoi							.144	.310
Step 1								
Age							-.022	.864
Gender							-.135	.321
Ethnicity							-.127	.338
Wechsler Test of Adult Reading							-.157	.263
Step 2	1.46	5,55	.117	.219				
Moves, Tower of Hanoi							**.275**	**.040**
Step 1	.253	4,56	.018	.907				
Age					-.046	.737	-.043	.753
Gender					-.077	.587	-.074	.607
Ethnicity					-.083	.550	-.072	.622
Wechsler Test of Adult Reading					-.053	.708	-.036	.818
Step 2	.214	5,55	.019	.955				
Time, Reading with Distraction							.042	.787
Step 1								
Age							-.058	.672
Gender							-.086	.548
Ethnicity							-.092	.512
Wechsler Test of Adult Reading							-.082	.578
Step 2	.303	5,55	.027	.909				
Errors, Reading with Distraction							-.102	.477

Table 9

Hierarchical Regressions Between Disinhibition Measures and Drinking in the Past 30 Days

Step in Model	*F*	df	R^2	sig.	Step 1 β	Step 1 sig.	Step 2 β	Step 2 sig.
Step 1	.476	4,58	.031	.760				
Age					.086	.518	.082	.545
Gender					.068	.625	.065	.639
Ethnicity					.156	.248	.161	.243
Wechsler Test of Adult Reading					-.099	.475	-.093	.513
Step 2	.379	5,57	.032	.861				
Stroop							-.032	.815
Step 1	.427	4,56	.030	.789				
Age					.105	.440	.086	.538
Gender					.050	.725	.035	.808
Ethnicity					.132	.337	.137	.321
Wechsler Test of Adult Reading					-.107	.446	-.127	.382
Step 2	.432	5,55	.038	.825				
Time, Tower of Hanoi							.098	.497
Step 1								
Age							.114	.393
Gender							.048	.728
Ethnicity							.137	.312
Wechsler Test of Adult Reading							-.161	.262
Step 2	.870	5,55	.073	.508				
Moves, Tower of Hanoi							.216	.113
Step 1	.447	4,56	.031	.774				
Age					.087	.520	.068	.603
Gender					.061	.664	.036	.789
Ethnicity					.156	.256	.069	.617
Wechsler Test of Adult Reading					-.093	.507	-.228	.125
Step 2	1.44	5,55	.116	.225				
Time, Reading with Distraction							**-.338**	**.026**
Step 1								
Age							.066	.627
Gender							.046	.741
Ethnicity							.142	.304
Wechsler Test of Adult Reading							-.141	.332
Step 2	.646	5,55	.056	.665				
Errors, Reading with Distraction							-.169	.237

Table 10

Hierarchical Regressions Between Disinhibition Measures and Drinking in the Past Year

Step in Model	*F*	df	R^2	sig.	Step 1 β	Step 1 sig.	Step 2 β	Step 2 sig.
Step 1	2.03	4,58	.123	.103				
Age					-.120	.344	-.129	.316
Gender					-.190	.152	-.194	.145
Ethnicity					.210	.104	.220	.094
Wechsler Test of Adult Reading					.146	.270	.160	.239
Step 2	1.67	5,57	.127	.158				
Stroop							-.072	.577
Step 1	1.75	4,56	.111	.151				
Age					-.099	.446	-.115	.389
Gender					-.216	.113	-.228	.100
Ethnicity					.181	.170	.185	.163
Wechsler Test of Adult Reading					.135	.318	.119	.391
Step 2	1.46	5,55	.117	.219				
Time, Tower of Hanoi							.082	.553
Step 1								
Age							-.087	.490
Gender							-.218	.101
Ethnicity							.187	.145
Wechsler Test of Adult Reading							.070	.605
Step 2	2.36	5,55	.177	.052				
Moves, Tower of Hanoi							**.264**	**.041**
Step 1	1.98	4,56	.124	.110				
Age					-.117	.362	-.131	.302
Gender					-.183	.173	-.201	.130
Ethnicity					.215	.104	.151	.206
Wechsler Test of Adult Reading					.150	.259	.052	.714
Step 2	2.23	5,55	.168	.065				
Time, Reading with Distraction							-.245	.092
Step 1								
Age							-.130	.321
Gender							-.192	.157
Ethnicity							.206	.121
Wechsler Test of Adult Reading							.122	.379
Step 2	1.68	5,55	.132	.156				
Errors, Reading with Distraction							-.098	.472

Table 11

Hierarchical Regressions Between Disinhibition Measures and Urgency, Premeditation, Perseverance, Sensation Seeking Scale Total Score

Step in model	*F*	df	R^2	sig.	Step 1 β	Step 1 sig.	Step 2 β	Step 2 sig.
Step 1	**2.88**	**4,58**	**.166**	**.030**				
Age					-.109	.376	-.104	.407
Gender					-.130	.311	-.128	.326
Ethnicity					.203	.108	.197	.125
Wechsler Test of Adult Reading					-.249	.057	-.256	.055
Step 2	2.29	5,57	.167	.052				
Stroop							.042	.741
Step 1	**2.90**	**4,56**	**.171**	**.030**				
Age					-.085	.498	-.120	.345
Gender					-.165	.210	-.192	.145
Ethnicity					.178	.162	.188	.138
Wechsler Test of Adult Reading					-.253	.055	**-.289**	**.032**
Step 2	**2.74**	**5,55**	**.200**	**.028**				
Time, Tower of Hanoi							.181	.170
Step 1								
Age							-.075	.542
Gender							-.166	.197
Ethnicity							.183	.142
Wechsler Test of Adult Reading							**-.309**	**.022**
Step 2	**3.08**	**5,55**	**.219**	**.016**				
Moves, Tower of Hanoi							.224	.074
Step 1	**2.86**	**4,56**	**.170**	**.032**				
Age					-.107	.392	-.123	.314
Gender					-.150	.249	-.171	.180
Ethnicity					.203	.113	.130	.313
Wechsler Test of Adult Reading					-.234	.074	**-.348**	**.014**
Step 2	3.26	5,55	.229	.012				
Time, Reading with Distraction							**-.283**	**.045**
Step 1								
Age							-.120	.344
Gender							-.159	.226
Ethnicity							.194	.133
Wechsler Test of Adult Reading							-.264	.054
Step 2	**2.40**	**5,55**	**.179**	**.049**				
Errors, Reading with Distraction							-.104	.432

Table 12

Hierarchical Regressions Between Disinhibition Measures and Lack of Premeditation

Step in model	*F*	df	R^2	sig.	Step 1 β	Step 1 sig.	Step 2 β	Step 2 sig.
Step 1	1.18	4,58	.075	.331				
Age					-.018	.887	-.023	.864
Gender					-.135	.320	-.137	.317
Ethnicity					.168	.204	.173	.200
Wechsler Test of Adult Reading					.162	.234	.168	.228
Step 2	.938	5,57	.076	.464				
Stroop							-.033	.804
Step 1	.951	4,56	.064	.442				
Age					-.009	.944	-.042	.755
Gender					-.140	.314	-.166	.237
Ethnicity					.148	.273	-.157	.243
Wechsler Test of Adult Reading					.147	.289	.114	.418
Step 2	1.06	5,55	.088	.390				
Time, Tower of Hanoi							.169	.228
Step 1								
Age							.005	.968
Gender							-.142	.285
Ethnicity							.156	.228
Wechsler Test of Adult Reading							.067	.620
Step 2	2.12	5,55	.161	.077				
Moves, Tower of Hanoi							**.322**	**.014**
Step 1	1.03	4,56	.069	.400				
Age					-.025	.848	-.048	.701
Gender					-.159	.252	-.188	.152
Ethnicity					.147	.276	.043	.744
Wechsler Test of Adult Reading					.139	.312	-.022	.877
Step 2	2.55	5,55	.188	.038				
Time, Reading with Distraction							**-.402**	**.006**
Step 1								
Age							-.035	.795
Gender							-.165	.237
Ethnicity							.140	.303
Wechsler Test of Adult Reading							.117	.416
Step 2	.875	5,55	.074	.504				
Errors, Reading with Distraction							-.077	.584

Table 13

Hierarchical Regressions With Disinhibition Measures and Urgency

Step in model	*F*	df	R^2	sig.	Step 1 β	Step 1 sig.	Step 2 β	Step 2 sig.
Step 1	.327	4,58	.022	.859				
Age					-.083	.533	-.085	.534
Gender					.003	.981	.003	.985
Ethnicity					.049	.717	.050	.714
Wechsler Test of Adult Reading					-.100	.472	-.098	.492
Step 2	.258	5,57	.022	.934				
Stroop							-.010	.943
Step 1	.257	4,56	.018	.904				
Age					-.061	.657	-.102	.461
Gender					-.035	.803	-.068	.635
Ethnicity					.039	.778	.050	.712
Wechsler Test of Adult Reading					-.085	.549	-.126	.377
Step 2	.657	5,55	.056	.658				
Time, Tower of Hanoi							.211	.141
Step 1								
Age							-.050	.710
Gender							-.037	.791
Ethnicity							.044	.743
Wechsler Test of Adult Reading							-.144	.317
Step 2	.834	5,55	.070	.531				
Moves, Tower of Hanoi							.236	.084
Step 1	.277	4,56	.019	.892				
Age					-.077	.569	-.092	.495
Gender					-.023	.872	-.041	.768
Ethnicity					.063	.648	-.002	.988
Wechsler Test of Adult Reading					-.071	.612	-.172	.238
Step 2	.779	5,55	.066	.569				
Time, Reading with Distraction							-.251	.103
Step 1								
Age							-.079	.566
Gender							-.024	.866
Ethnicity							.062	.660
Wechsler Test of Adult Reading							-.076	.607
Step 2	.220	5,55	.020	.952				
Errors, Reading with Distraction							-.016	.910

Table 14

Hierarchical Regressions Between Disinhibition Measures and Sensation Seeking

Step in Model	*F*	df	R^2	sig.	Step 1 β	Step 1 sig.	Step 2 β	Step 2 sig.
Step 1	**17.97**	**4,58**	**.553**	**.000**				
Age					**-.131**	**.150**	**-.120**	**.191**
Gender					**-.286**	**.003**	**-.280**	**.044**
Ethnicity					**.352**	**.000**	**.340**	**.000**
Wechsler Test of Adult Reading					**-.466**	**.000**	**-.482**	**.000**
Step 2	**14.51**	**5,57**	**.560**	**.000**				
Stroop							.085	.355
Step 1	**18.42**	**4,58**	**.568**	**.000**				
Age							-.112	.219
Gender							**-.308**	**.002**
Ethnicity							**.325**	**.001**
Wechsler Test of Adult Reading							**-.473**	**.000**
Step 2	**14.47**	**5,57**	**.568**	**.000**				
Time, Tower of Hanoi							.000	.997
Step 1								
Age								
Gender								
Ethnicity								
Wechsler Test of Adult Reading								
Step 2	**14.80**	**5,55**	**.574**	**.000**				
Moves, Tower of Hanoi							-.076	.405
Step 1	**16.76**	**4,56**	**.545**	**.000**				
Age					-.129	.169	-.128	.174
Gender					**-.275**	**.006**	**-.274**	**.006**
Ethnicity					**.368**	**.000**	**.369**	**.000**
Wechsler Test of Adult Reading					**-.449**	**.000**	**-.447**	**.000**
Step 2	**13.17**	**5,55**	**.545**	**.000**				
Time, Reading with Distraction							.006	.956
Step 1								
Age							-.136	.150
Gender							**-.280**	**.005**
Ethnicity							**.362**	**.000**
Wechsler Test of Adult Reading							**-.467**	**.000**
Step 2	**13.35**	**5,55**	**.548**	**.000**				
Errors, Reading with Distraction							-.063	.519

Table 15

Hierarchical Regressions Between Disinibition Measures and Lack of Perseveration

Step in Model	*F*	df	R^2	sig.	Step 1 β	Step 1 sig.	Step 2 β	Step 2 sig.
Step 1	1.31	4,58	.083	.279				
Age					.003	.980	.009	.947
Gender					.192	.157	.195	.155
Ethnicity					-.179	.174	-.185	.167
Wechsler Test of Adult Reading					-.063	.639	-.071	.605
Step 2	1.05	5,57	.084	.398				
Stroop							.043	.746
Step 1	1.23	5,56	.081	.309				
Age					.003	.946	-.009	.949
Gender					.184	.183	.170	.225
Ethnicity					-.182	.175	-.177	.190
Wechsler Test of Adult Reading					-.063	.647	-.081	.566
Step 2	1.06	5,55	.088	.393				
Time, Tower of Hanoi							.091	.514
Step 1								
Age							.016	.905
Gender							.183	.184
Ethnicity							-.178	.183
Wechsler Test of Adult Reading							-.100	.479
Step 2	1.24	5,55	.101	.302				
Moves, Tower of Hanoi							.149	.264
Step 1	1.20	4,56	.079	.323				
Age					.001	.995	-.006	.962
Gender					.166	.228	.157	.258
Ethnicity					-.191	.157	-.224	.113
Wechsler Test of Adult Reading					-.070	.608	-.121	.420
Step 2	1.10	5,55	.091	.373				
Time, Reading with Distraction							-.127	.400
Step 1								
Age							-.014	.914
Gender							.155	.262
Ethnicity							-.202	.138
Wechsler Test of Adult Reading							-.105	.462
Step 2	1.11	5,55	.092	.366				
Errors, Reading with Distraction							-.122	.382

Table 16

Hierarchical Regressions Between Dishibition Measures and Adjusted Average Number of Pumps

Step in Model	*F*	df	R^2	sig.	Step 1 β	Step 1 sig.	Step 2 β	Step 2 sig.
Step 1	2.39	4,57	.144	.061				
Age					-.109	.390	-.117	.360
Gender					**-.275**	**.038**	**-.278**	**.037**
Ethnicity					-.120	.346	-.112	.385
Wechsler Test of Adult Reading					**.350**	**.009**	**.364**	**.009**
Step 2	1.95	5,56	.148	.100				
Stroop							-.070	.582
Step 1	**2.57**	**4,55**	**.157**	**.048**				
Age					-.107	.399	-.077	.551
Gender					**-.286**	**.033**	-.262	.052
Ethnicity					-.102	.424	-.111	.385
Wechsler Test of Adult Reading					**.370**	**.007**	**.400**	**.004**
Step 2	2.34	5,54	.178	.054				
Time, Tower of Hanoi							-.156	.247
Step 1								
Age							-.111	.389
Gender							**-.285**	**.035**
Ethnicity							-.105	.417
Wechsler Test of Adult Reading							**.388**	**.006**
Step 2	2.10	5,54	.162	.080				
Moves, Tower of Hanoi							-0.74	.570
Step 1	**2.59**	**4,55**	**.159**	**.046**				
Age					-.106	.404	-.116	.364
Gender					**-.298**	**.026**	**-.313**	**.020**
Ethnicity					-.119	.356	-.155	.247
Wechsler Test of Adult Reading					**.356**	**.008**	**.295**	**.044**
Step 2	2.30	5,54	.175	.058				
Time, Reading with Distraction							-.151	.301
Step 1								
Age							-.117	.363
Gender							**-.304**	**.024**
Ethnicity							-.127	.327
Wechsler Test of Adult Reading							**.330**	**.019**
Step 2	2.15	5,54	.166	.074				
Errors, Reading with Distraction							-.091	.498

ABSTRACT

DOES EXECUTIVE FUNCTIONING MEDIATE ALCOHOL USE AND RISK-TAKING?

by

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Advisor: Dr. Emily R. Grekin

Major: Psychology (Clinical)

Degree: Master of Arts

The relationship between alcohol use and risk-taking is well-documented in the psychological literature. Although this area has attracted an enormous amount of research and interest, the mechanisms that underlie this relationship are not well understood. A model whereby executive functioning (disinhibition, specifically) mediated the relationship between alcohol use and risk-taking/impulsivity was proposed and tested. Although alcohol use and self-reported impulsivity were related on a number of different measures, alcohol use was largely not related to disinhibition, nor was disinhibition related to impulsivity/risk-taking. Therefore, full-fledged tests of mediation could not be performed. Study limitations and directions for future research were also discussed.

AUTOBIOGRAPHICAL STATEMENT

I came to the doctoral program in clinical psychology at Wayne State University in 2007 after completing a bachelor's of arts in psychology, with honors, at Calvin College in Grand Rapids, Michigan. I maintain an interest in the predictors and correlates of heavy episodic drinking (i.e. "binge drinking") during the college years because of the persistence, severity, and cost of this problem. Hopefully, a robust basic literature which addresses individual (i.e. personality, cognitive) variables as well as contextual variables (i.e. the meaning of alcohol in the university's culture) will aid more effective interventions in the future.