2016

DECISION-MAKING PROCESSES, DRIVING PERFORMANCE, AND ACUTE RESPONSES TO ALCOHOL IN DUI OFFENDERS

Walter Roberts
University of Kentucky, walter.roberts86@gmail.com
Digital Object Identifier: http://dx.doi.org/10.13023/ETD.2016.257

STUDENT AGREEMENT:

I represent that my thesis or dissertation and abstract are my original work. Proper attribution has been given to all outside sources. I understand that I am solely responsible for obtaining any needed copyright permissions. I have obtained needed written permission statement(s) from the owner(s) of each third-party copyrighted matter to be included in my work, allowing electronic distribution (if such use is not permitted by the fair use doctrine) which will be submitted to UKnowledge as Additional File.

I hereby grant to The University of Kentucky and its agents the irrevocable, non-exclusive, and royalty-free license to archive and make accessible my work in whole or in part in all forms of media, now or hereafter known. I agree that the document mentioned above may be made available immediately for worldwide access unless an embargo applies.

I retain all other ownership rights to the copyright of my work. I also retain the right to use in future works (such as articles or books) all or part of my work. I understand that I am free to register the copyright to my work.

REVIEW, APPROVAL AND ACCEPTANCE

The document mentioned above has been reviewed and accepted by the student's advisor, on behalf of the advisory committee, and by the Director of Graduate Studies (DGS), on behalf of the program; we verify that this is the final, approved version of the student's thesis including all changes required by the advisory committee. The undersigned agree to abide by the statements above.

Walter Roberts, Student

Dr. Mark T. Fillmore, Major Professor

Dr. Mark T. Fillmore, Director of Graduate Studies

DECISION-MAKING PROCESSES, DRIVING PERFORMANCE, AND ACUTE RESPONSES TO ALCOHOL IN DUI OFFENDERS

DISSERTATION

A dissertation submitted in partial fulfillment of the
requirements for the degree of Doctor of Philosophy
in the College of Arts and Sciences at the University of Kentucky

By

Walter Roberts

Lexington, Kentucky

Co-Directors: Dr. Mark T. Fillmore, Professor of Psychology
and Dr. Richard Milich, Professor of Psychology

Lexington, Kentucky

ABSTRACT OF DISSERTATION

DECISION-MAKING PROCESSES, DRIVING PERFORMANCE, AND ACUTE RESPONSES TO ALCOHOL IN DUI OFFENDERS

Alcohol-impaired driving is a major cause of motor vehicle accident and death in the United States. People who are arrested for DUI (Driving under the Influence) are at high risk to reoffend; approximately one in three of these individuals will commit another DUI offense in the three years following their first conviction (Nochajski & Stasiewicz, 2006). This high risk for recidivism in these individuals suggests that cognitive characteristics may contribute to a pattern of pathological decision making leading to impaired driving. Indeed, individuals with a history of DUI report higher rates of impulsiveness and behavioral dysregulation compared to their nonoffending peers. Relatively little research, however, has used laboratory methods to identify the specific behavioral characteristics, such as poor inhibitory control or heightened sensitivity to immediate reward, which may differentiate DUI offenders from nonoffenders. Further, little is known about how individuals with a history of DUI respond following an acute dose of alcohol. Study 1 examined impulsivity in 20 adults with a recent DUI conviction and 20 adults with no history of DUI using self-report and behavioral measures of impulsivity. This study also used a novel decision-making paradigm to examine how different levels of risk and reward influenced the decision to drive after drinking in both groups. Results of this study found that DUI offenders did not differ from controls in their performance on behavioral measures of impulsivity. They did, however, report higher levels of impulsivity and demonstrated a greater willingness to tolerate higher levels of risk for more modest rewards. Study 2 examined the acute effects of alcohol and expectancy manipulation on driving performance and decision making in the same group of participants. Neither alcohol nor expectancy manipulation exerted a systematic effect on decision making in either group. Alcohol impaired driving performance equally in both groups, but the DUI group perceived themselves as less impaired by alcohol. Expectancy manipulation eliminated this group difference in perceived driving ability. Taken together, these findings identify processes that risk of impaired driving in DUI offenders. They may perceive themselves as less impaired by alcohol, leading to risky decision making when drinking. Expectancy manipulation may be a viable method of reducing risky decision making in DUI offenders.

KEYWORDS: acute alcohol effects, driving under the influence, decision making, cognitive performance, functional tolerance

Walter Roberts

June 8th, 2016

DECISION-MAKING PROCESSES, DRIVING PERFORMANCE, AND ACUTE RESPONSES TO ALCOHOL IN DUI OFFENDERS

By

Walter Roberts

Mark T. Fillmore, Ph.D.
Co-director of Dissertation

Richard Milich, Ph.D.
Co-director of Dissertation

Mark T. Fillmore, Ph.D.
Director of Graduate Studies

June 8, 2016
Date

ACKNOWLEDGEMENTS

I would like to thank all of the individuals in my life who gave me both material and emotional support through this process. Thank you to all of the faculty involved in my training, most notably Mark Fillmore and Richard Milich. You taught me much about the joys and frustrations of research. Likewise, I want to thank the other members of my committee, Drs. Craig Rush, Lon Hays, and Josh Lile. You have all been involved in my training to different extents and I appreciate your efforts and belief in my potential.

I am grateful for the guidance from all of my clinical supervisors. Drs. Marybeth McGavran, Linda Hellmich, and Charles Carlson deserve special recognition among this talented group. Even if I never again sit opposite a patient for psychotherapy, I will continue to benefit both personally and professionally from the wisdom that you shared with me through your supervision.

I would also like to thank my friends and family. There are a great many who deserve recognition. Chief among this is my wife Kelly. I am thankful for you every day. Thank you to Lyn McRainey and Wesley Roberts for loving me as a child, tolerating me as an adolescent, and giving me guidance as an adult. Finally, thank you to my siblings and best friend, Delaney Roberts, Hayes Roberts, and Chard Ransfard.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1: General Introduction

Driving under the influence of alcohol (DUI) is a significant and persistent societal problem. In 2014, alcohol-intoxicated drivers contributed to approximately 10,000 motor vehicle fatalities, accounting for approximately one third of all deaths that took place on United States roadways during that year (NHTSA, 2015). Also concerning is the financial burden of DUI in the United States. The National Highway Traffic Safety Association (2015) estimated that in 2014 the annual cost of medical services, lost productivity, quality-of-life services, public services used to address enforcement, and destruction of personal property resulting from DUI was $44 billion in the United States. Considering the tragic loss of life and economic damage caused by intoxicated drivers, it is not surprising that public opinion towards driving after drinking is largely negative. The majority of people in the United States (80%) believe that intoxicated driving is a threat to their personal safety (NHTSA, 2008). The significant societal cost of DUI and public support for deterrence measures have led lawmakers to adopt strict legal sanctions to reduce the rate of intoxicated driving in the general population (Cavaiola & Wuth, 2002).

Despite negative public attitudes towards DUI offenders and deterrence programs aimed at reducing rates of intoxicated driving, the practice is relatively commonplace among drivers in the United States. The National Highway Traffic Safety Administration (2012) estimated that approximately 120 million instances of impaired driving occurred in 2011, and the Federal Bureau of Investigation (2015) estimated that approximately 1.2 million DUI arrests were made in 2014. Unfortunately, people who are convicted of DUI are at high risk to reoffend: over one third of the drivers arrested for DUI will reoffend within three years (Nochajski & Stasiewicz, 2006). Researchers and clinicians have attempted to develop intervention programs to reduce recidivism in DUI offenders. Although early data have shown that these programs can reduce recidivism rates (Bakker, Hudson, & Ward, 2000), a significant proportion of DUI offenders referred to treatment programs will continue to drive while intoxicated. The treatment-resistant nature of DUI offenders has led researchers to examine neuropsychological and personality processes that may contribute to their decision to drive after drinking. Identifying traits of DUI offenders associated with recidivism may explain why some individuals repeatedly decide to drive while intoxicated, and this information may lead to more targeted intervention strategies.

Characteristics of the DUI Offender

Historically, alcohol-intoxicated driving was understood as being a direct result of alcohol dependence (Cavaiola & Wuth, 2002). Although it is true that DUI offenders are more likely to meet criteria for alcohol dependence (Cavaiola, Strohmetz, Wolf, & Lavender, 2003), many people who are arrested for DUI will not meet criteria (Lapham, de Baca, McMillan, & Hunt, 2004). A conceptual shift in recent years has led researchers to view DUI as a problem with different causes and maintaining factors than alcohol dependence. One possibility is that DUI offenders are characterized by patterns of dysregulated behavior, such that intoxicated driving is but one manifestation of their underlying impulsive personalities.

Along these lines, there is a sizeable literature examining personality traits in DUI offenders using self-report methods. These studies have used narrow (e.g., Zuckerman Sensation-Seeking Scale) and broadband (e.g., NEO-PI-R) measures of personality to identify how DUI offenders differ from their nonoffending peers. Donovan and Marlatt (1982) administered a battery of self-report inventories to a group of DUI offenders, finding elevated levels of hostility, aggression, sensation-seeking, and assaultiveness in this group. Donovan et al. (1983) concluded in a later review that DUI offenders are characterized by heightened impulsivity, irritability, low frustration tolerance, poor assertiveness, external locus of control, and emotional instability. Results of subsequent studies have supported the general conclusions of earlier work: DUI offenders are characterized by maladaptive personality traits that are associated with behavioral undercontrol and impulsivity (Donovan, Umlauf, & Salzberg, 1990; Hubicka, Kallmen, Hiltunen, & Bergman, 2010; Nolan, Johnson, & Pincus, 1994; Sutker, Brantley, & Allain, 1980).

In addition to personality-based assessment of DUI offenders, several studies have examined their performance on neuropsychological tasks. Glass et al. (2000) administered a battery of neuropsychological tests to a group of recidivist DUI offenders. The test battery included measures of immediate and delayed memory recall, word fluency, processing speed, and planning. Results of this study showed that 73% of the DUI offenders had clinically significant impairment in at least one cognitive domain, suggesting that cognitive impairment is common among recidivist DUI offenders. A similar study conducted by Fine and Steer (1979) found that 57% of DUI offenders produced test scores indicative of memory problems. Other studies have reported similar patterns of diffuse cognitive impairment in DUI offenders (Kasar, Gleichgerrcht, Keskinkilic, Tabo, & Manes, 2010; Ouimet et al., 2007), supporting the notion that dysfunctional cognitive processes may contribute to DUI risk.

Findings from the above studies suggest that DUI offenders are characteristically impulsive and show neurocognitive deficits; however, there is little research focused on identifying specific cognitive and personality mechanisms of increased risk for alcohol-impaired driving in these individuals. An important next step in this line of research is to apply theoretically based models of impulsivity to understand how such characteristics place DUI offenders at risk to offend.

Experiments in this Dissertation

This dissertation reports on a pair of experiments aimed at expanding our understanding of the characteristics of DUI offenders. It is clear from the literature that DUI offenders are more impulsive and show neurocognitive deficits compared to the general population; however, lacking from prior research is theory-based assessment of impulsive personality and model-based assessment of neurocognitive processes associated with impulsive action. Further, few studies have attempted to characterize how person by situation interactions influence the decision to drive after drinking. The first experiment in this dissertation attempted to characterize DUI offenders using a battery of behavioral tasks and personality-based assessments of impulsivity. This project also assessed how situational variables affect the decision to drive after drinking using a newly developed Risk versus Reward Driver Decision (RRDD) task. Finally, this experiment examined impulsivity and driving ability among DUI offenders in the context of a simulated driving task.

The second experiment in this dissertation built upon the first by examining the acute effects of alcohol on driving performance and decision making among DUI offenders. Because of their impulsivity, DUI offenders may not accurately perceive the degree to which alcohol impairs their driving ability. Modifying their expectation of impairment may be an effective way to reduce the risk of intoxicated driving in this group. This brief feedback intervention may make them less willing to drive after drinking as well as reduce the degree to which alcohol impairs their driving ability.

Chapter 2: Impulsivity and Decision-Making Processes in DUI Offenders

(Experiment 1)

Introduction

DUI offenders are known to show heightened levels of impulsivity (Donovan, Umlauf, & Salzberg, 1990; Hubicka, Kallmen, Hiltunen, & Bergman, 2010; Nolan, Johnson, & Pincus, 1994; Sutker, Brantley, & Allain, 1980; Van Dyke & Fillmore, 2014); however, little research has been conducted to clarify the specific personality and behavioral processes contributing to their impulsive actions. Further, little work has been done to examine how external factors, such as varying potential risk and reward outcomes, can influence decision making among individuals at risk for DUI. Experiment 1 sought to characterize DUI offenders using well-validated laboratory and self-report measures of impulsivity. Another goal was to develop a novel task that measured the influence of situational risk and reward factors on the decision to drive after drinking. This study also examined driving performance in DUI offenders.

Personality-Based Models of Impulsivity

In the personality literature, impulsivity refers to several different personality processes that lead to rash or unplanned acts (Dick et al., 2010). A shift towards a heterogeneous view of impulsivity has occurred in recent years. Much of this shift is based upon foundational work on the UPPS model of impulsivity conducted by Whiteside and Lynam (2001). Recognizing that different personality traits can predispose individuals to act impulsively, these researchers conducted a factor analysis of existing impulsivity and personality questionnaires and identified four distinct traits associated with a tendency towards impulsive action. These traits included urgency (i.e., tendency to experience strong impulses under negative affect), (lack of) premeditation (i.e., tendency to act on the spur of the moment without regard to the consequences), (lack of) perseverance (i.e., difficulty with focusing on a task that may be boring or difficult), and sensation seeking (i.e., tendency to enjoy activities that are exciting or novel). Measurement of impulsivity using this model is useful because it recognizes that the same impulsive behavior can result from different personality processes. For example, a person may impulsively drive after drinking because they enjoy the sensation of doing so (i.e., sensation seeking) or because he or she does not consider the negative consequences associated with this behavior (i.e., [lack of] premeditation).

Behavioral Models of Impulsivity

Another approach to understanding impulsivity is to use laboratory tasks that assess the integrity of behavioral and cognitive processes used to stymie impulsive actions (Dick et al., 2010; Dougherty, Mathias, Marsh, & Jagar, 2005). Such tasks have been instrumental in showing how dysfunction in a specific cognitive mechanism can lead an individual to behave in an impulsive fashion. For example, researchers have used behavioral measures of response inhibition (e.g., stop-signal task; Logan, Cowan, & Davis, 1984) to identify dysfunctional inhibitory control as a contributing factor in the symptomatology of individuals with attention-deficit/hyperactivity disorder (ADHD; Roberts, Fillmore, & Milich, 2011).

As previously discussed, several studies have examined DUI offenders in terms of their performance on neuropsychological tasks (Kasar et al., 2010; Ouimet et al., 2007), generally finding that DUI offenders show impairment on these tasks. Those studies have been instrumental in showing that DUI offenders differ from the general population in terms of general neurocognitive functioning; however, these studies lack of cohesive theoretical framework that explains how these traits contribute to DUI risk. For experiment 1, I identified a series of behavioral tasks measuring cognitive processes hypothesized to be of direct relevance to an individual deciding whether to drive after drinking.

Immediate reward salience. The decision to engage in risky behaviors may result from a heightened sensitivity to immediate gain (Nigg, 2000). Humans are generally able to inhibit reward-seeking behavior if such behavior is inconsistent with internally represented goals. This ability is highly relevant to the DUI offender. For example, an intoxicated individual may wish to drive because doing so would result in the reward of convenience for the drinker. Presumably, most drinkers will forgo this opportunity for reward because intoxicated driving is incompatible with their internal goal of avoiding arrest and personal injury. For the highly reward-sensitive individual, however, the prospect of reward may lead to disadvantageous decision making regardless of compatibility with internal goals (Bechara, 2005).

Working memory. Impairments of working memory can lead to impulsive behavior. Human decision making is guided in part by memory of previous events and perceptions of current contingencies (Weber & Johnson, 2009), and this information is combined and evaluated in working memory. Individuals with poor working memory capacity may become overloaded as they weigh relevant information, encouraging quick decision making based on incomplete evaluation of the pertinent circumstances. Supporting this notion, Hinson et al. (2003) showed that experimentally increasing working memory load caused participants to respond more impulsively on a decision-making task. Other studies have found that people with low working memory capacity respond more impulsively than do those with high working memory capacity (Finn, Justus, Mazas, & Steinmetz, 1999; Finn, Mazas, Justus, & Steinmetz, 2002). For the DUI offender, impaired working memory may limit their ability to evaluate simultaneously the risk factors associated with driving after drinking. When working memory capacity is limited, heuristic attentional processes select the most salient information in the environment (e.g., prospect of immediate reward) at the expense of less salient contingencies (e.g., possibility of arrest; Weber & Johnson, 2009).

Time estimation. Impulsive individuals show distortions in time estimation that cause them to overestimate the speed of the passage of time (Gerbing, Ahadi, & Patton, 1987). For example, an individual with poor time estimation ability may perceive that 4 hours have elapsed when only 3 hours have actually passed (Glicksohn, Leshem, & Aharoni, 2006). This temporal underestimation in impulsive individuals may result from increased arousal or a faster “internal clock” (Wittmann & Paulus, 2008), leading to impulsive action via an accelerated internal tempo.

Inhibition to alcohol cues. The inability to inhibit prepotent actions is a central trait of individuals with dysfunctional impulse control. Prior research has shown that substance-related cues can increase behavioral disinhibition among impulsive individuals, such as heavy drinkers (Weafer & Fillmore, 2015) and cocaine users (Pike, Stoops, Fillmore, & Rush, 2013). These studies show that when presented with cues for their preferred substances, these individuals become less able to inhibit inappropriate action. Some DUI offenders show heightened attention towards and cognitive preoccupation alcohol-related cues in the environment (Miller & Fillmore, 2014). As such, it is possible that DUI offenders will have greater difficulty inhibiting inappropriate responses in the presence of alcohol-related cues.

Sober-State Driving Performance in DUI Offenders

Although DUI offenders are riskier drivers overall by virtue of their willingness to drive after drinking, some studies have shown that these individuals are poorer drivers than their nonoffending peers even when they are sober. McMillen and colleagues (1992) reported that multiple DUI offenders were involved in more traffic accidents and received more moving violations compared to first time offenders. A similar study reported that repeat DUI offenders were more likely to be involved in traffic accidents and have a conviction for reckless and careless driving (Cavaiola, Strohmetz, & Abreo, 2007).

These studies use examinations of driving records to quantify driving skill in DUI offenders. Although this technique provides the advantage of external validity, it is difficult to isolate the specific driving circumstances in which DUI offenders are expected to drive poorly. Another strategy for measuring driving competence is to use simulated driving tasks. An advantage to using a driving simulator in this context is that it provides better control over the driving situations that participants must navigate. Considering the range of competencies involved in driving (Groeger, 2000), it is important to employ several styles of drive to ensure that performance can be evaluated across a range of driving situations. In some driving scenarios, such as navigating a long and uneventful commute (i.e., precision driving), drivers are required to be attentive to operating the vehicle and make minor course corrections to remain in their lane. This type of driving scenarios places demands on the sustained attention and fine motor skills of the driver. In contrast, other driving scenarios are challenging due to the motivational conflict inherent to the situation. For example, to a driver who is running late for an appointment, the incentives of speeding (i.e., avoiding punishment for being late) may outweigh the disincentives of being involved in an accident or receiving a traffic citation. Motivational conflict requires drivers to balance the potential risks and rewards associated with driving quickly. Impulsive drivers, such as DUI offenders, may tend to drive unsafely in order to pursue the incentive.

Situational Influence on the Decision to Drive after Drinking

Most attempts to understand the decision to drive after drinking focus on characteristics that exist within the DUI offender (e.g., impulsivity). However, the decision to drive after drinking, like most other behaviors, is influenced by characteristics of a person as well as situational variables (Mischel & Shoda, 1995). When deciding whether or not to drive after drinking, potential offenders likely consider situational variables (e.g., number of drinks consumed, time since last drink, distance to next destination) to determine whether or not they are willing to risk driving (Gustin & Simons, 2008; Lewis, Merz, Hays, & Nicholas, 1995). Previous studies using vignette methods have identified situational factors that influence people's willingness to drive after drinking (Thurman, 1986; Turrisi & Jaccard, 1991). These studies are valuable because they provide insight into the situational cues that can influence this decision. Thurman (1986) found that participants' willingness to drive after drinking was inversely related to perceived risk in that situation. For example, participants were more willing to drive after drinking if the drinking location was in a rural setting relative to a bar on a busy downtown street.

Although these studies have provided valuable insight into the effects of situational factors on the decision to drive after drinking, there are significant limitations to using traditional vignette-based methods. In these vignette-based studies, participants are asked to read a scenario and rate their willingness to drive on a Likert scale. The scenario is standardized aside from manipulations that changes the perceived amount of risk associated with choosing to drive. An example of a vignette used by Thurman (1986) is as follows:

> It is 10:00 P.M. on a Friday and you are at a downtown bar. You decide to leave and 3 friends ask to go with you. Your destination is 45 miles away over roads you have seldom driven and the weather is snowy. You notice that you have trouble standing without help and are reminded that you could take the bus instead of driving. Considering that the police set up 27 roadblocks in the county last month and use Breathalyzer tests to detect drinking drivers, reporting the names of those arrested in the local newspaper, what are the chances that you would drive? (p. 449)

This type of vignette does an excellent job of illustrating how levels of risk influence the decision to drink and drive. In the above vignette, the researchers manipulated certain factors (e.g., 1 mile rather than 45 miles) to assess how these changes in perceived risk influenced the likelihood of participants choosing to drive, finding that this decision was most strongly influenced by factors such as the participants' hypothetical level of intoxication, police presence, and distance to be travelled. However, factors other than risk level likely contribute to decision making. People decide to drive after drinking because this behavior leads to desirable outcomes (e.g., convenience of driving to the next destination). It is possible that DUI offenders accurately perceive the levels of risk associated with driving after drinking but are more willing to discount this risk when given the opportunity for reward. No studies to date have examined how situational changes in perceived gain influence the decision to drive after drinking.

To better understand the influence of situational risk and reward on the decision to drive after drinking, I developed a decision-making paradigm that was used to assess how participants' willingness to drive changes as a function of changing risk and opportunity for reward. The Risk versus Reward Driver Decision (RRDD) task is similar to the previously described vignette studies; however, in addition to varying levels of risk, the scenarios offered participants a reward associated with deciding to drive while intoxicated (see Table 1). Participants were presented with multiple variations of this basic scenario and tasked with deciding whether they drive after drinking if they would be compensated for various amounts of money for doing so. As seen in Table 1, this task separately measured four different risk factors, including time since drinking, perceived probability of arrest, BAC, and distance to be travelled. These factors were chosen based on findings of previous research (i.e., Thurman, 1986) and because these common factors are present any time an individual decides whether to drive after drinking.

Experiment 1

Experiment 1 compared impulsivity and driving ability in DUI offenders and similar individuals with no history of DUI using behavioral and self-report measures. Specifically, I used a battery of empirically validated behavioral tasks to assess specific cognitive processes implicated in impulsive actions, including discounting of delayed rewards, working memory capacity, time estimation, and inhibition to alcohol-related cues. Self-reported impulsivity was measured using a battery of questionnaires. The primary questionnaire assessed impulsivity according to the UPPS model (Whiteside & Lynam, 2000). I also used the Barrett Impulsiveness Questionnaire (BIS; Patton, Stanford, & Barratt, 1995) in order to replicate previous research demonstrating heightened levels of impulsiveness among DUI offenders (Van Dyke & Fillmore, 2014a). I measured symptoms of ADHD—a clinical condition characterized by heightened levels of impulsivity-- using the Barkley Adult ADHD Self-Report Scale (Barkley, 2011).

To examine different aspects of driving performance, participants completed two simulated driving tasks. The first was a precision drive in which participants guided a vehicle along a curvy and unpopulated country road. The second was a motivational conflict drive where participants were rewarded for driving quickly but punished if they failed to obey traffic laws (i.e., running a red light).

Another goal of study 1 was to develop a decision to drive task to assess the effects of perceived risk and reward on the decision to drive after drinking. The specifics of this task are described above and in Table 1. The task was used to compare DUI offenders and nonoffending controls in terms of their overall willingness to drive after drinking, as well as compare group differences in the effects of changing levels of risk.

I predicted that DUI offenders would have poorer performance on the behavioral measures of impulsiveness and simulated driving tasks, and they would self-report higher levels of impulsiveness compared to their nonoffending peers. On the RRDD task, I predicted that DUI offenders would be willing to drive for less money overall compared to controls, and that both groups would tolerate more risk as level of reward increased. I also predicted that DUI offenders would require less of an increase in reward to tolerate higher levels of risk compared to controls.

Method

Participants

Participants were 20 DUI offenders and 20 adult drivers with no prior DUI convictions. Participants in the DUI group were convicted of a DUI offense within the past five years. Screening measures were used to determine medical history and past and current drug and alcohol use. Individuals who reported severe psychiatric diagnoses (e.g., bipolar disorder, schizophrenia) were not included in the study. Volunteers were recruited via notices placed on community bulletin boards and by university newspaper advertisements. The research was approved by the University of Kentucky Medical Institutional Review Board. Participants received $30 for participating in this study.

Materials and Measures

Risk versus Reward Driver Decision Task (RRDD). This task examined the role of situational risk and reward factors on participants' decisions to drive after drinking. Participants viewed a series of vignettes briefly describing a drinking scenario. They were then asked whether they would be willing to drive for various amounts of money. Each scenario described one situational factor that varies between scenarios in terms of risk level. Situational factors that were examined included "distance to be travelled", "blood alcohol concentration", "time since last drink", and "probability of being arrested." Each risk factor was examined with a series of 100 questions presented on a PC. Different levels of risk and reward are described in Table 1. Each level of potential monetary gain was combined with each level of risk for each factor. Trials were randomized and participants were informed that their responses would be deidentified to encourage honest responding. The task was completed separately for each scenario and each task required approximately 5 minutes to complete.

The main criterion variable of this task was the least amount of money required to drive under each level of risk. Each situational factor yielded 10 values: the least money required to drive under each level of risk. Additional criterion variables include *average money required to drive* and the *risk slope* of money required to drive (i.e., risk slope). Average money required to drive was calculated as the mean amount of money required to drive across all risk levels of a single situational factor. This variable was calculated to provide an overall measure of willingness to drive independent of risk level. Risk slope was calculated by plotting each participant's data using risk level as the independent variable and money required to drive as the dependent variable. Least squares regression lines were fit to these data and the slope of these lines represent how much of an increase in money is required for a single unit increase in risk.

Money choice task. Temporal discounting was measured using a money choice task described in Richards et al (2004). This task required participants to make a series of choices between a small reward delivered immediately and a large reward delivered after a variable time delay (1, 2, 30, 180, or 365 days). For example, a participant would be asked to decide between receiving $10 today or $5 two days in the future. For each time delay, an indifference point was calculated that represented the point at which the participant had no preference between the smaller immediate reward and the larger delayed reward. Each participant produced an indifference point for each monetary delay. Area under the curve (AUC) analyses were used to quantify discounting of delayed reward, as recommended by Myerson and colleagues (2001), and AUC was the criterion variable on this task. Lower AUC values indicate a preference for immediate smaller rewards over larger but delayed rewards.

To reduce reliance on hypothetical rewards, participants were informed that they would receive real money according to their response on one trial chosen at random. If they chose an immediate amount, they were told that the money would be given to them immediately at the end of the session. If they chose a delayed amount, they were told that the money would be placed in an envelope with their name and address and be sent to them after the specified delay.

Time estimation and production tasks. Time estimation and production tasks were used to measure accuracy of timing perceptions (Barkley, Murphy, & Bush, 2001). The time production task assessed participants' ability to produce various brief intervals of time. The experimenter sat in front of the participant with a stop watch and presented them with various time intervals, including 2, 4, 8, 16, 24, 32, and 64 seconds. The experimenter began each trial by stating an interval and saying "begin." The participant was instructed to produce each time interval by saying "stop" after they believed the specified amount of time had passed. The experimenter recorded elapsed time for each trial using a stopwatch. Participants were instructed not to use verbal counting methods to estimate time. The criterion measure for this task is the length of the estimated time interval for each trial.

The time estimation task required participants to verbally estimate a time period that the experimenter produced using a stopwatch. The experimenter produced six different time intervals (4, 12, 15, 45, 60, and 90 seconds). The experimenter verbally began and ended each trial and then elicited an estimation of the time interval from the participant. The criterion measure from this task is the estimated time interval for each interval.

Letter memory task. The letter memory task was used to measure working memory functioning (Morris & Jones, 1990). In this task, participants are presented serially with a list of letters. Participants were instructed that upon presentation of the final letter, they would be required to reproduce the final four letters in the list. The number of letters presented in each list was varied randomly across trials (i.e., 5, 7, 9, and 11 items) to ensure that participants cannot anticipate the critical items. They were instructed to rehearse out loud the last 4 letters by mentally adding the most recent letter and dropping the 5th letter back and then saying the new string of 4 letters out loud. The task began with two practice trials and then complete 24 trials for a total of 96 letters recalled. The criterion variable of interest was the proportion of letters recalled correctly (Miyake et al., 2000).

Attentional-bias behavioral activation (ABBA) task. The ABBA task is a modified cued go/no-go task used to measure inhibition to alcohol-related cues. Trials consist of the following series of events: (a) presentation of a fixation point (+) for 800 ms; (b) a blank white screen for 500 ms; (c) a cue image (alcohol or neutral), displayed for one of five stimulus onset asynchronies (SOAs = 100, 200, 300, 400, and 500 ms); (d) a go or no-go target, which remained visible until a response occurred or 1,000 ms had elapsed; and (e) an intertrial interval of 700 ms.

The cues consisted of alcohol-related images (e.g., beer can, six-pack of beer bottles) or neutral images (e.g., stapler, paper towel roll). These were 15 cm X 11.5 cm images presented in the center of the computer monitor against a white background. The alcohol beverage type was always beer. After an SOA the cue image turned either solid green (go target) or solid blue (no-go target). Participants were instructed to press the forward slash (/) key on the keyboard as soon as a green (go) target appeared and to suppress the response when a blue (no-go) target was presented. Key presses were made with the right index finger.

The task consisted of two conditions: *alcohol go* condition and *alcohol no-go* condition. In the *alcohol go* condition, alcohol images turned into the go target on 80% of trials and turned into the no-go target on only 20% of trials. Therefore, alcohol images operated as go cues based on the high probability that they would signal go targets most of the time. As such, these images should have sped reaction time (RT) to the go targets, but also increased failures to inhibit the response when the no-go target was occasionally presented. By contrast, in the *alcohol no-go* condition the opposite cue image-target pairings were presented. Therefore, in this condition neutral images serve as go cues, producing faster RT to go targets, but more inhibitory failures to the occasional presentation of no-go targets. By comparing the *alcohol go* condition and *alcohol no-go* condition, the task measured the degree to which alcohol-related go cues elicit greater response activation, but poorer inhibitory control, compared to alcohol no-go cues. Participants were evenly split between conditions such that 10 DUI offenders and 10 control participants completed the alcohol go condition and the remainder of the sample completed the alcohol no-go condition.

A test consisted of 250 trials, split into 5 blocks of 50 trials each. Each block required approximately 2.5 min to complete and blocks were separated by 30 sec breaks, for a total test time of approximately 15 min. For each trial, the computer recorded whether a response occurred and, if so, the RT in milliseconds was measured from the onset of the target until the key was pressed. To encourage quick and accurate responding, the computer presented feedback to the participant during the intertrial interval by displaying the words *correct* or *incorrect* along with the RT in milliseconds.

Criterion variables on this task included proportion of go cue/no-go targets trials in which participants pressed the response key (i.e., *p*-fails) and mean response time on no-go cue/go target trials (i.e., RT).

Driving simulation. A simulated driving task was used to measure driving ability (STISIM Drive, Systems Technology Inc., Hawthorne, CA). This apparatus has been used in prior studies on alcohol-impaired driving (Harrison & Fillmore, 2005). The driving simulator emulated driving a vehicle by providing the participant with the view of a roadway from a driver's perspective. It includes foot-controlled accelerator and brake pedals and a circular steering wheel. Participants were required to maintain a constant speed and maintain their vehicle position in the middle of the right lane. Criterion measures for the driving simulator were standard indicators of driving performance, including standard deviation lane position (LPSD), average speed, standard deviation of speed (speed SD), number of collisions, and number of times crossing the center line. Two drive scenarios were used that place demands on different aspects of driving performance. These scenarios are described below:

Precision driving scenario. This driving scenario assessed participants' ability to maintain a constant speed and lane position during an 8 kilometer drive on a meandering country road. They were instructed to maintain a constant speed of 55 miles per hour

(MPH) while remaining in the center lane of the road. The drive took place in a rural setting with trees and buildings. Other vehicles appeared in the opposite lane, but the participant was not required to pass or brake in response to other vehicles.

Motivational conflict driving scenario. This drive scenario assessed how opportunity for reward loss and gain affects participants' driving performance. It required participants to drive approximately 6 miles in a busy metropolitan setting. They drove through twenty intersections equipped with traffic lights, and they were signaled to stop at five of the intersections. Although participants were instructed to observe traffic laws, there were no overt penalties for speeding. Other vehicles were presented in the opposite lane, but the participant was not required to pass or brake in response to other vehicles. Before the drive, the experimenter informed participants that they would receive monetary reward for completing the drive in a certain timeframe (e.g., $5 for less than 5 min, $4 for 5-6 min). Participants were also informed that they would lose money each time they fail to stop at a red light, creating motivational conflict between the possibility of gaining money for driving quickly and losing money for driving too fast to brake effectively at a red light. In addition to criterion variables listed above, outcome variables for this drive included distance in feet from a red light that the participant begins to apply the brakes (i.e., breaking distance) and the number of red lights run (i.e., traffic tickets).

Kaufman Brief Intelligence Scale—2nd Edition (K-BIT; Kaufman & Kaufman, 2004). The K-BIT is a standardized brief measure of general intelligence. It provided an estimate of verbal, nonverbal, and full scale intelligence quotient (IQ).

UPPS Impulsive Behavior Questionnaire. (UPPS; Whiteside & Lynam, 2001). The 45-item UPPS measured four personality traits associated with impulsive behavior, including urgency, (lack of) premeditation, (lack of) perseverance, and sensation seeking. Participants indicated to what degree each statement applies to them on a 4-point Likert scale and higher scores indicate higher levels of impulsiveness.

Barrett Impulsivity Scale (BIS; Patton et al., 1995). This 30-item questionnaire measured impulsiveness through items such as “I act on impulse” and “I consider myself always careful”. Participants indicated how frequently each statement applies to them on a 4-point Likert scale (*never*, *occasionally, often, almost always*). Possible score totals ranged from 30 to 120, with higher scores indicating greater total levels of impulsiveness.

Barkley Adult ADHD Self Report Scale (BAARS; Barkley, 2011). The BAARS is an 18-item self-report measure of ADHD symptoms according to DSM-5 criteria often used for diagnostic purposes. Participants marked how often they experience problems related to symptoms of inattention and hyperactivity/impulsivity. The BAARS quantifies the number of symptoms which the participant experienced “*often*” or “*very often*.” Within each symptom cluster, possible scores range from 0 to 9, with higher scores indicating the presence of more symptoms.

Driving History Questionnaire. Participants provided information about their experiences operating a motor vehicle (e.g., miles driven per day, number of citations) using a driving history questionnaire. This questionnaire also gathered information about past behavior related to driving after drinking alcohol.

Personal Drinking Habits Questionnaire (PDHQ; Vogel-Sprott, 1992). The PDHQ provided a quantity/frequency measure of typical alcohol use and an estimate of how long participants have used alcohol in months.

Structured Clinical Interview for DSM-IV—Alcohol Use Module (SCID-IV; First, Spitzer, Gibbon, & Williams, 2002). Participants completed the SCID-IV Alcohol Use Module to measure symptoms of alcohol abuse and alcohol dependence.

Timeline Follow-back (TLFB; Sobell & Sobell, 1992). The TLFB procedure was used to assess daily patterns of alcohol consumption. This procedure uses structured calendar anchored with holidays and other notable dates to assist participants in recording their drinking behavior over the past 90 days. Participants reported several drinking-related variables for each day, including (1) number of standard drinks consumed, (2) amount of time spent drinking, and (3) whether or not the participant felt “drunk”. This information, along with gender and body weight, was used to estimate the resultant BAC obtained for each drinking using the anthropometric-based BAC estimation formulae that assume an average clearance rate of 15 mg/100 ml per hour (Watson, Watson, & Batt, 1981). These formulae have been used in previous studies and have been shown to yield high correlations with actual BACs obtain under laboratory conditions (Fillmore, 2001). This procedure is considered the gold standard for retrospective reconstruction of alcohol consumption and other risk behaviors (Shakeshaft, Bowman, & Sanson-Fisher, 1998). The TLFB provided four measures of drinking habits: (a) total drinks (total number of drinks consumed), (b) drunk days (total number of days that participants reported feeling drunk), (c) drinking days (total number of days that alcohol was consumed, and (d) binge days (total number of days characterized by days in which the reported alcohol use of a participant was estimated to yield a BAC of 80 mg/100 ml or higher (National Institute on Alcohol Abuse and Alcoholism, 2004).

Procedure

Participants completed the measures and tasks included in Study 1 during a single laboratory session. They first provided informed consent and completed questionnaires regarding their health status to ensure that they were eligible to participate. They then completed the questionnaires and behavioral tasks. They were provided with breaks as needed to avoid fatigue effects.

Results

Demographics, Drinking Habits, and Driving History

Group differences on demographics, drinking habits, and driving history were analyzed using independent samples *t* tests. Descriptive data on these measures are presented in Table 2. There were no significant group differences in age, t (38) = 1.5, p = .151, years of education, t (38) = 0.4, p = .719, or estimated IQ, t (38) = 0.2, p = .855. There were no significant differences in drinking habits according to the TLFB or the PDHQ, $ts < 1.6$, $ps > .114$. However, participants in the DUI group reported significantly more alcohol-related problems on the abuse, t (38) = 8.3, p <.001, and dependence, t (38) = 4.0, p <.001, modules of the SCID-IV. DUI offenders also had higher scores on the AUDIT relative to controls, t (38) = 3.9, p <.001. The gender composition of the DUI group (14 male, 6 female) was not significantly different from that of the control group (13 male, 7 female), χ^2 (1, N = 40) = 0.1, p = .736.

There were no significant difference between groups in number of months driving, t (38) = 1.1, p = .279 or number of miles driven each day t (38) = 0.3, p = .739.

Participants in the DUI group reported receiving more moving vehicle citations than did the control group, t (38) = 2.4, p = .020. There was no significant difference in the reported number of collisions t (38) = 1.6, p = .127. The majority of participants in the DUI group had one past DUI conviction (n = 17), although some participants in this group had a history of two DUI convictions (n = 3). The mean amount of time between their most recent DUI and their participation in the study was 19 months (SD = 15.1 months).

Covariate Analysis

No covariates were included in these analyses because the groups did not differ on demographic variables that were expected to be related to the outcome measures of interest (e.g., age, IQ, gender composition).

Self-Reported Impulsivity

Participants' scores on self-report impulsivity inventories were analyzed using independent samples t tests. Descriptive statistics for these measures are presented in Table 3. This table shows that participants in the DUI group reported higher levels of impulsiveness compared to those in the control group. On the UPPS, DUI offenders reported significantly higher levels of (lack of) premeditation, t (38) = 2.5, p = .017, and urgency, t (38) = 2.2, p = .034. There was no significant difference in their self-reported levels of sensation seeking, t (38) = 1.8, p = .086, and (lack of) perseverence, t (38) = 1.2, p = .241. Participants in the DUI group reported higher levels of impulsivity on the BIS, t (38) = 3.2, p = .003. On the BAARS, DUI offenders reported significantly more ADHD symptoms compared to controls, in both the hyperactive/impulsive, t (38) = 2.2, p = .036, and inattentive, t (38) = 2.4, p = .021, symptom clusters.

Behavioral Measures of Impulsivity

Money choice task. Responses on the money choice task were analyzed using *t* tests to compare AUC values. The control group (*M* = 0.51, *SD* = 0.29) and the DUI group (*M* = 0.46, *SD* = 0.25) were not significantly different, *t* (38) = 0.6, *p* = .563.

Time estimation and production task. Time interval productions and estimations are listed in Table 4. Data from one participant in the DUI group was lost due to experimenter error.

Production. Time production values were analyzed using a 2 (group) X 7 (duration) mixed-design ANOVA. Neither the main effect of group, *F* (1, 37) = 0.4, *p* = .532, nor the group X duration interaction, *F* (6, 222) = 0.7, *p* = .650, was significant.

Estimation. Time estimation values were analyzed using a 2 (group) X 6 (duration) mixed-design ANOVA. Neither the main effect of group, *F* (1, 37) = 0.3, *p* = .532, nor the group X duration interaction, *F* (6, 185) = 0.2, *p* = .956, was significant.

Letter memory task. LMT performance was analyzed using an independent samples *t*-test. Participants in the control group recalled 72.3% (*SD* = 13.7%) of target letters, and the DUI group recalled 71.6% (*SD* = 18.7%) of target letters. Performance did not differ significantly between groups, *t* (38) = 0.2, *p* = .881.

Attentional-bias behavioral activation task. Performance on the ABBA task was analyzed using 2 (group: DUI versus control) X 2 (condition: alcohol go versus alcohol no-go) between subjects ANOVA.

***p* - fails.** *p*-fail rates are graphed in Figure 1. There was no significant main effect of group, *F* (1, 36) < 0.1, *p* = .720, or condition, *F* (1, 36) = 1.9, *p* = .181. The group X condition interaction approached significance, *F* (1, 36) = 3.8, *p* = .059. As seen in Figure 1, this interaction suggests that control participants made more inhibitory failures in the alcohol go condition, whereas the effect of condition was less pronounced in the DUI group. *Post-hoc t* tests confirmed that effect of condition was significant for controls, t (18) = 2.1, p = .028, but not among DUI offenders, t (18) = 0.5, p = .623.

RT. RTs are graphed in Figure 1. There was no significant main effect of DUI group, F (1, 36) < 0.1, p = .836. The main effect of condition was significant, F (1,36) = 7.2, p = .011. As seen in Figure 1, this main effect indicates that participants in the alcohol go condition responded more quickly than those in the alcohol no-go condition. There was no significant group X condition interaction, F (1,36) < 0.1, p = .961.

Simulated Driving Performance

Precision driving task. Performance on the driving task was analyzed using independent samples *t* tests. Descriptive data as well as between-group comparisons are reported in Table 5. These comparisons found that participants in the DUI group had poorer performance on several driving measures as compared to the control group, including standard deviation of lane position, standard deviation of speed, and line crossings.

Motivational conflict driving task. Performance on the motivational conflict task was analyzed using independent samples *t* tests. These data are also presented in Table 5. These comparisons found a significant difference between groups in braking distance; however, the direction of this difference was not as expected. Participants in the DUI group had significantly longer braking distances compared to the control group. There was no other significant difference in performance.

Risk versus Reward Driver Decision Task

Data from the RRDD task were analyzed using a 2 (DUI versus control) X 10 (risk level) mixed-design analysis of variance. One participant in the control group was removed from all analyses involving the RRDD task due to quick and invariant responding (i.e., responding yes to all scenarios.) Bar graphs charting the amount of money required to drive under each level of risk are presented in Figure 2.

Distance to be traveled. There was a significant main effect of risk level, F (9, 333) = 15.5, $p < .001$, confirming that participants required more money to drive as distance to be traveled increased. There was no significant main effect of group, F (1, 37) = 1.1, $p = .302$. The group X risk level interaction was not significant, F (9, 333) = 0.6, $p = .816$.

Blood alcohol concentration. There was a significant main effect of risk level, F (9, 342) = 42.8, $p < .001$, confirming that participants required more money to drive as blood alcohol concentration increased. There was no significant main effect of group, F (1, 38) = 1.8, $p = .190$. The group X risk level interaction was not significant, F (9, 342) = 0.6, $p = .836$.

Time since drinking. There was a significant main effect of risk level, F (9, 333) = 27.1, $p < .001$, confirming that participants required more money to drive when less time had passed since drinking. There also was a significant main effect of group, F (1, 37) = 4.7, $p = .036$. An examination of Figure 2 shows that participants in the DUI were generally willing to drive for less money under most levels of risk. The group X risk level interaction also was significant, F (9, 333) = 2.1, $p = .032$. This interaction was probed by examining risk slopes for each group. The control group (*M* slope = 17,968;

SD slope = 9,537) had a steeper slope than the DUI group (*M* slope = 12,508; *SD* slope = 11,385), although this difference was not statistically significant, t (37) = 1.6, p = .120.

Probability of arrest. There was a significant main effect of risk level, F (9, 333) = 47.2, p < .001, confirming that participants required more money to drive as the likelihood of being arrested increased. There was no significant main effect of group, F (1, 37) = 3.4, p = .074. There was no significant group X risk level interaction, F (9, 333) = 0.3, p = .981.

Discussion

Study 1 examined impulsivity in DUI offenders using performance-based tasks and self-report measures. It also examined their driving performance using two simulated driving scenarios. In terms of performance on the behavioral measures of impulsivity, there were few differences between groups. There were no group differences in performance on the money choice task, letter memory task, or the time estimation task. On the ABBA task, participants in the control group made more inhibitory failures when alcohol cues were paired with go targets. In the DUI group, there was no difference in performance between conditions, suggesting that alcohol cues did not increase disinhibited responding among these individuals. This finding runs counter to my prediction that DUI offenders would be particularly vulnerable to the disinhibiting effects of alcohol cues in this context; however, previous research has shown that non-recidivist DUI offenders show attentional avoidance away from alcohol cues (Miller & Fillmore, 2014). Given that most participants in the DUI group (n = 17) had a single DUI offense, it is possible that these individuals lack the strong association between alcohol cues and approach behavior thought to produce this disinhibiting effect (Fleming & Bartholow, 2014).

Results of the simulated driving tasks identified several differences in performance between the groups. On the precision driving task, participants in the DUI group showed large LPSD and made more line crossings, indicating that these individuals tended to drift within their lanes more than did participants in the control group. Likewise, DUI offenders showed higher speed SD compared to control, another indication of risky driving performance (Groeger, 2000). Participants' driving histories also supported this conclusion. DUI participants reported more moving violations than did controls, despite driving similar lengths each day and being licensed for a similar amount of time. On the motivational conflict drive, however, driving performance was no-more risky in the DUI group compared to the control group. In fact, contrary to my prediction, those in the DUI group initiated braking farther away from red lights than did control participants, suggesting greater caution while driving in the DUI offenders.

Increased brake distance can sometimes occur because a driver is travelling at a high rate of speed. In order to brake effectively at a red light, a driver travelling quickly must initiate braking earlier than would a driver traveling at a more moderate speed. One possible explanation for longer braking distance in the DUI group is that they drove more quickly than did control participants. The motivational conflict drive requires rapid shifts in speed according to proximity to stoplights. It is possible that DUI offenders were less effective in reducing their speed appropriately when approaching a stoplight, resulting in approaching stoplights at a higher rate of speed. As they approached red lights at this higher rate of speed, they would need to begin braking earlier in order to stop.

Results of the self-report questionnaires provided new information about the subtypes of impulsivity that may contribute to risk for alcohol-impaired driving. On the UPPS, participants in the DUI group reported significantly higher levels of urgency and (lack of) premeditation. There was a smaller group difference in sensation seeking that approached significance and no difference between groups in (lack of) perseverance. Consistent with prior research, participants in the DUI group also had higher levels of impulsiveness on the BIS (Van Dyke & Fillmore, 2014a). Responses on the BAARS showed that DUI offenders report higher rates of ADHD symptoms than did controls, suggesting the presence of clinically relevant symptoms of inattention and impulsivity in this group.

Results from the RRDD task provided mixed support for my predictions. As expected, participants required more money to drive as the level of risk associated with that decision increased. Increased risk led participants to require more money to drive in all of the presented situational factors. This finding is important because it demonstrates that these factors influence decision making for drinkers when they are deciding whether to drive. In general, participants in the DUI group were willing to drive for less money than were controls. Although this difference was only statistically significant in for one situational factor (i.e., time since drinking), similar nonsignificant trends were observed in each scenario. A closer examination of responses to the time since drinking situational factor suggest important group differences in response to increasing levels of risk. In the DUI group, there was little difference in money required to drive between low (i.e., 4.5-4.0 hours) and moderate (3.5-2.5 hours) levels of risk, suggesting that DUI offenders are relatively insensitive to shifts from mild to moderate risk. Conversely, control participants were sensitive to changes across all levels of risk. This suggests that DUI offenders may be less influenced by variations in this risk factor, particularly when these variations occur at the lower ends of the risk spectrum.

The group differences reported here cannot be attributed to group differences in variables such as age, education, or IQ, because there were no significant differences between groups on these measures. Likewise, the groups were relatively similar in terms of drinking habits according to the TLFB and PDHQ, suggesting that differences in prior alcohol use are unlikely to explain these findings.

Table 1. Risk versus Reward Driver Decision task: Risk factor levels and potential monetary rewards

General Prompt
We are interested in understanding how much monetary incentive you would need to drive after drinking. Imagine that you have had five drinks while at a bar with a group of friends. The bar is closing for the evening. Your car is parked at the bar and you have the option of driving to your next destination… Monetary incentive conditions: $1; $10; $50; $100; $500; $1,000; $5,000; $20,000; $100,000; $200,000
Factor 1: Distance
Your next destination is [5 miles] away. Would you be willing to drive for [$500]? Distance scenarios: 1/10 mile, 1 mile, 2 miles, 5 miles, 10 miles, 15 miles, 20 miles, 25 miles, 30 miles, 50 miles
Factor 2: Blood alcohol concentration
The bar provides a free breathalyzer service to its customers. You use the breathalyzer and you register a [0.04%] BAC. Would you be willing to drive for [$20,000]? Blood alcohol concentration scenarios: 0.00%, 0.01%, 0.03%, 0.04%, 0.05%, 0.07%, 0.09%, 0.11%, 0.15%, 0.20%
Factor 3: Time since last drink
It has been [1 hour] since you finished your last drink. Would you be willing to drive for [$5,000]? Time since drinking scenarios: 5 minutes, 30 minutes, 1 hour, 1 hour and 30 minutes, 2 hours, 2 hours and 30 minutes, 3 hours, 3 hours and 30 minutes, 4 hours, 4 hours and 30 minutes
Factor 4: Perceived probability of arrest
It this part of town, [1] out of every [100] intoxicated drivers will be arrested. Would you be willing to drive for [$10]? Perceived probability of arrest scenarios: 1/500; 1/100; 1/50; 1/20; 1/10; 1/5; 1/2; 2/3; 3/4; 9/10.

Table 2. Demographics, drinking habits, and driving history

	Group			
	Control (*n* = 20)		DUI (*n* = 20)	
	Mean	SD	Mean	SD
Demographic				
Age	24.9	3.7	23.4	2.7
Gender (% male)	65.0		70.0	
Education	15.9	1.9	15.7	1.6
IQ: Verbal	103.4	11.3	101.3	10.3
IQ: Nonverbal	102.8	11.3	103.8	13.2
IQ: Composite	103.9	10.8	103.3	11.6
Drinking Habits				
TLFB				
Drinking Days	29.4	12.7	34.2	14.5
Total Drinks	111.7	92.6	152.2	63.1
Drunk Days	8.1	10.2	12.3	7.8
Binge Days	7.0	8.8	10.2	8.9
PDHQ				
Frequency	2.2	0.9	2.6	1.5
Quantity	3.5	2.0	4.4	1.9
Months	87.6	47.0	81.2	37.4
SCID				
Abuse	0.8	1.1	3.5	0.9
Dependence	1.1	1.4	2.8	1.3
Driving History				
Drive Months	94.0	48.6	78.8	38.0
Distance	14.8	10.3	13.8	8.5
Tickets	0.9	1.1	2.4	1.2
Collision	0.7	0.8	1.2	1.2

Note. Age is reported in years. TLFB = Timeline follow-back. PDHQ = Personal Drinking Habits Questionnaire. SCID = Structured Clinical Interview for the DSM-IV. Drive months = number of months since first operating a motor vehicle. Distance = number of miles driven daily. Tickets = number of moving violations received. Collisions = number of motor vehicle collisions in which the participant has been involved.

Table 3. Self-reported impulsivity by group

	Group				
	Control (n = 20)		DUI (n = 20)		
	Mean	SD	Mean	SD	t
UPPS					
Premeditation	1.8	0.4	2.2	0.6	2.5*
Urgency	1.9	0.4	2.2	0.5	2.2*
Sens Seeking	3.1	0.6	3.4	0.5	1.8
Perseverance	1.7	0.3	1.9	0.5	1.2
BAARS					
IA	0.3	0.8	1.3	1.8	2.1*
HI	0.8	1.2	2.0	2.0	2.2*
TOT	1.1	1.6	3.2	3.3	2.5*
BIS	57.4	9.1	68.2	12.2	3.2*

Note. UPPS = UPPS Impulsive Behavior Scale, BAARS = Barkley Adults ADHD Self-Report Scale, IA = Inattentive symptom count, HI = Hyperactive/Impulsive symptom count, TOT = Total symptom count, BIS = Barratt Impulsiveness Scale

Comparisons are independent sample t tests. *$p < .05$.

Table 4. Time estimation and production task performance by group

Duration (sec)	Group: Control *M*	*SD*	DUI *M*	*SD*
Production				
2	1.67	0.39	1.81	0.46
4	3.25	1.06	3.67	0.99
8	6.83	1.63	7.34	1.96
16	12.48	3.33	14.15	4.09
24	21.91	5.03	20.35	5.97
32	26.38	7.53	30.14	9.26
64	54.73	6.98	56.43	16.82
Estimation				
4	4.40	1.31	5.26	3.75
12	15.50	6.69	16.53	11.91
15	16.30	5.02	19.32	11.31
45	43.20	8.42	49.47	22.45
60	62.70	13.64	63.84	26.88
90	91.20	34.57	93.90	32.61

Note. Values are produced and estimated time intervals in seconds.

Table 5. Simulated driving performance by group

	Group					
	Control		DUI			
	M	*SD*	*M*	*SD*	*t*	*p*
Precision Drive						
LPSD	1.31	0.23	1.68	0.48	3.1*	.004
Steer Rate	10.09	2.71	11.30	17.52	0.3	.761
Average Speed	54.46	0.87	54.56	1.22	0.3	.775
Speed SD	4.76	1.40	6.08	1.69	2.7*	.010
Collisions	0.30	0.57	0.35	0.59	0.3	.786
Line Crossings	16.00	11.88	40.4	31.45	3.2*	.002
Conflict Drive						
LPSD	0.96	0.29	1.04	0.37	0.8	.445
Steer Rate	9.27	3.21	7.96	10.59	0.5	.601
Average Speed	55.79	7.18	54.93	6.34	0.4	.692
Speed SD	26.29	2.78	26.06	2.72	0.3	.799
Collisions	0.05	0.22	0.00	0.00	**	**
Line Crossings	2.95	3.40	3.80	5.0	0.6	.534
Brake Distance	407.91	79.43	473.968	119.12	2.1*	.047
Traffic Tickets	0.85	0.88	1.15	1.31	0.9	.400

Note. LPSD = Lane position standard deviation. For all comparisons, $n = 40$, $df = 38$.
* $p < .05$, ** Unable to conduct *t* test due to invariance in DUI group.

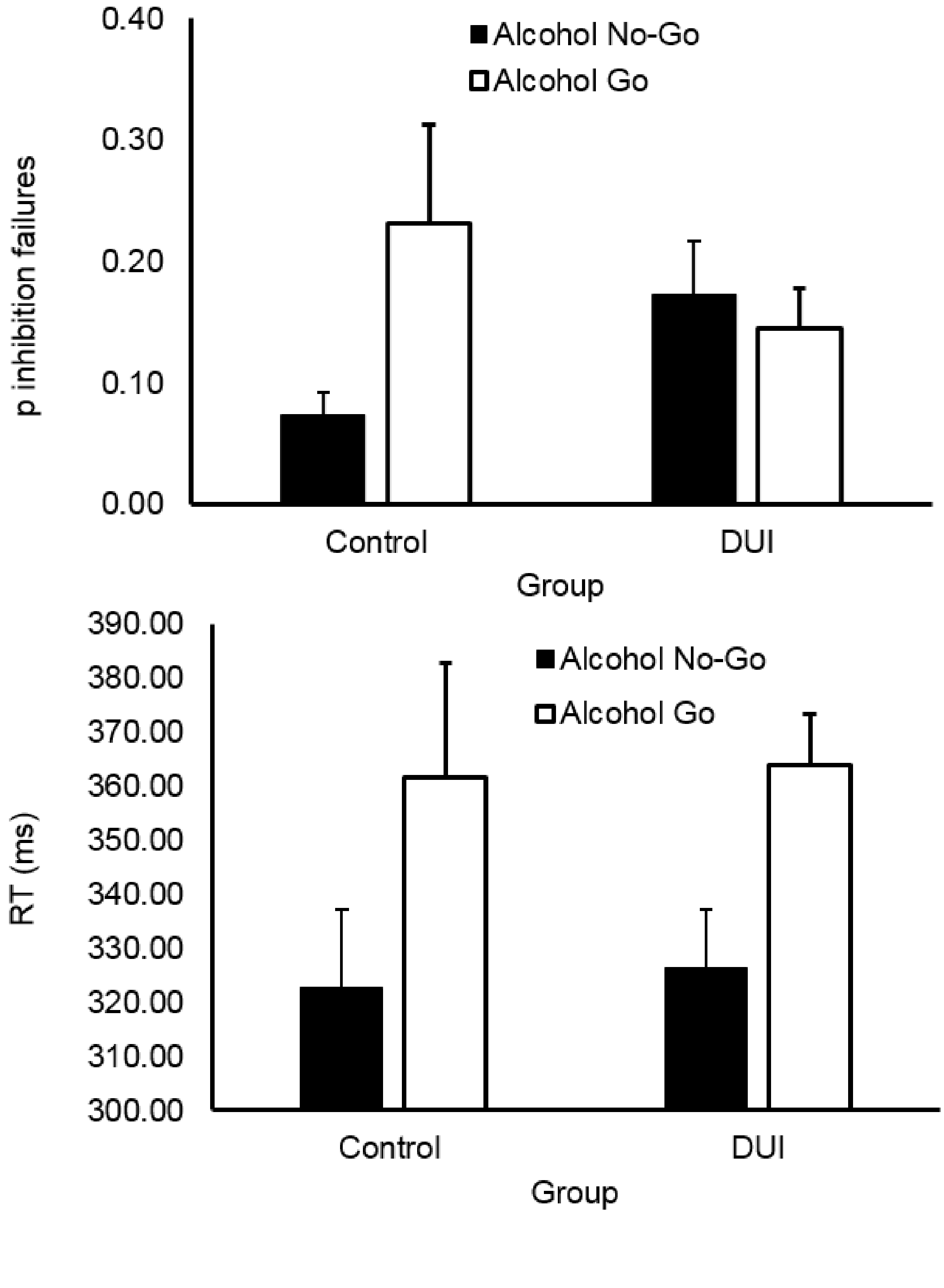


Figure 1. Mean (+ SE) RT and *p*-fail on the ABBA task by group

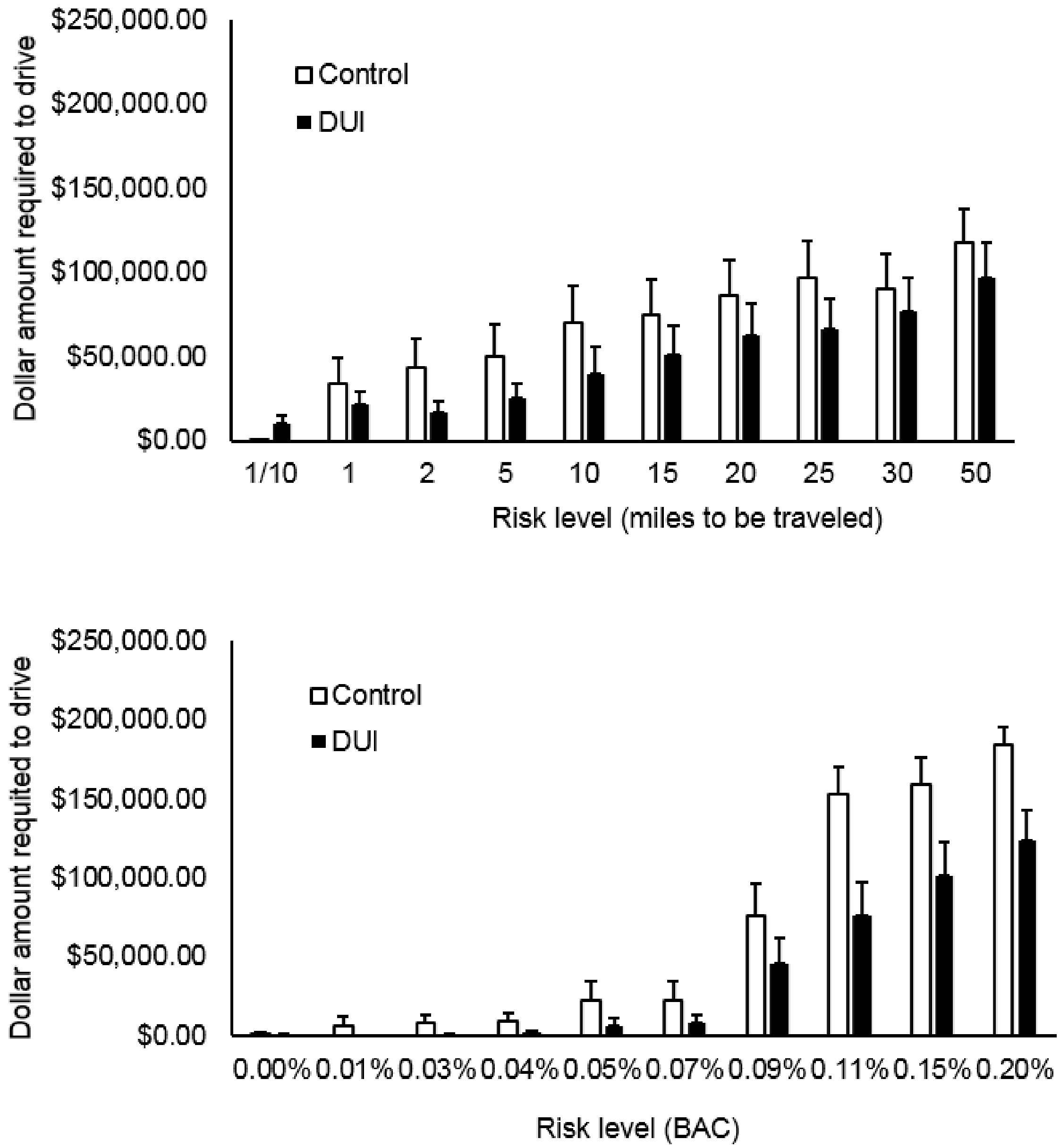
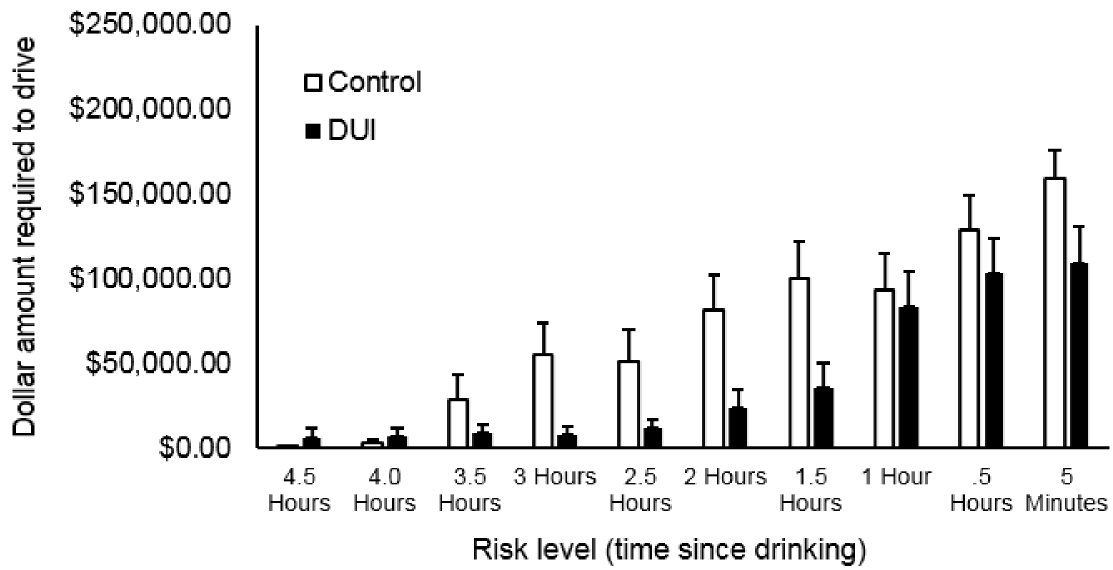


Figure 2. Money required to drive on the Risk versus Reward Driver Decision task.



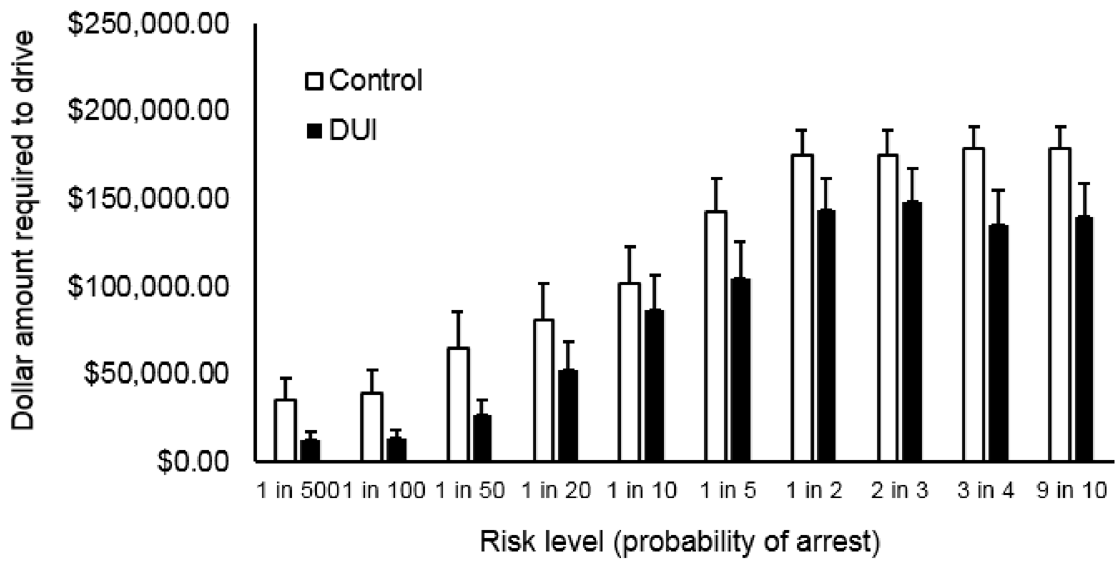


Figure 2 (cont). Money required to drive on the Risk versus Reward Driver Decision task.

Chapter 3

Acute Effects of Alcohol and Expectancy Manipulation on Driving Performance and Decision Making in DUI offenders

(Experiment 2)

Introduction

The decision to drive after drinking is, by definition, made in an intoxicated state. Little research, however, has examined how acute alcohol intoxication influences behaviors and decision-making processes related to drunk driving. Prior work has shown that DUI offenders may underestimate the degree to which alcohol impairs their driving performance (Van Dyke & Fillmore, 2014b), suggesting that there may be important differences in acute alcohol effects between those arrested for DUI and their nonoffending peers that may contribute to their decision-making processes. Further, Experiment 1 confirmed the presence of heightened impulsivity and poorer driving performance while sober among DUI offenders, two factors that may contribute to maladaptive decision making while intoxicated. Considering the societal costs of DUI, it is also important to identify strategies for reducing the likelihood of impaired driving in these individuals. Experiment 2 sought to identify changes in driving performance and decision making that occur under alcohol in DUI offenders. Another goal of this experiment was to test whether expectancy manipulation would be an effective method for reducing risk in DUI offenders.

Laboratory Studies on Acute Alcohol Effects on Driving Performance

Much of the work done examining how alcohol affects driving performance employs naturalistic designs on real-world accident rates in intoxicated drivers (Zador, Krawchuk, & Voas, 2000). Another useful technique for understanding how alcohol acutely affects driving performance is to examine how alcohol directly affects driving performance using simulated driving equipment. Simulated driving in controlled laboratory environments affords researchers greater control over dosing and driving-related conditions that facilitate more nuanced outcome measures compared to naturalistic designs. Such laboratory studies have been instrumental in identifying factors that affect drinkers' level of impairment under alcohol, because the improved control of the laboratory allows the experiment to systematically manipulate these variables. For example, laboratory studies using driving simulators have shown that alcohol impairment is worsened when the driver is distracted (Harrison & Fillmore, 2011) and when the driver is older (Sklar, Boissoneault, Fillmore, & Nixon, 2014).

Numerous studies have used this technique to identify groups who are highly sensitive to the effects of alcohol on driving performance. One consistent finding is that groups characterized by impulsivity tend to be poorer drivers under alcohol. Fillmore and colleagues (2009) compared the effects of three doses of alcohol (i.e., placebo, 0.45 g/kg, 0.65 g/kg) on the inhibitory control in high and low sensation-seekers. The high sensation-seeking group showed a larger disruption of inhibitory control under the active dose of alcohol compared to the low sensation-seeking group. Likewise, Fillmore and colleagues (2008) examined driving ability and inhibitory control following two doses of alcohol (i.e., placebo, 0. 65 g/kg) in a group of moderate social drinkers. Participants with the poorest inhibitory control also showed the poorest driving performance under the active alcohol dose. In a similar study, Weafer et al. (2008) directly showed that adults with ADHD experienced greater disruption of driving performance following than did a nonclinical comparison group.

Perceptions of Alcohol-Induced Driving Impairment

The decision to drive after drinking is based, at least in part, on one's perceived level of impairment (Quinn & Fromme, 2012; Thurman, 1986). Unfortunately, drinkers tend to underestimate the degree to which alcohol impairs performance (Aston & Liguori, 2013; Beirness, 1987), perhaps because acute alcohol intoxication disrupts cognitive processes important for accurate self-evaluation (Easdon, Izenberg, Armilio, Yu, & Alain, 2005). This mismatch between subjective appraisal of intoxication and objective impairment may lead some drinkers to drive despite being impaired by alcohol.

The ability to accurately evaluate one's performance on a task is a critical cognitive process when performing demanding tasks such as driving (Holroyd & Coles, 2002). By monitoring one's own behavior, people are able to adjust their actions when changes are needed to meet environmental demands. For example, drivers may notice that their car is moving too quickly and adjust acceleration and braking patterns to produce a more appropriate speed. This process of detecting errors and adjusting behavior accordingly is a critical process for optimal performance (Gehring, Goss, Coles, Meyer, & Donchin, 1993). Cognitive neuroscientists have shown that activity in the brain regions underlying performance monitoring (e.g., posterior medial frontal cortex, anterior cingulate cortex) facilitates trial-and-error learning, presumably by prompting strategic adjustments to one's behavior to improve performance (Ridderinkhof, Ullsperger, Crone, & Nieuwenhuiss, 2004).

Disagreement between subjective and behavioral impairment is pronounced in individuals who show deficits in performance monitoring. Prior research has shown that several groups characterized by impulsivity show performance monitoring deficits, including individuals with ADHD (Shiels & Hawk, 2010), cocaine dependence (Li, Milivojevic, Kemp, Hong, & Sinha, 2006), alcohol dependence (Lawrence, Luty, Bogdan, Sahakian, & Clark, 2009), and borderline personality disorder (de Bruijn et al., 2006). The presence of performance monitoring deficits in these numerous impulsive groups supports other findings for hypofunctionality in brain regions associated with performance monitoring in impulsive individuals, suggesting that an impaired ability to monitor performance may contribute to trait impulsiveness (Potts, George, Martin, & Barratt, 2006). Further, task-based studies have shown that deficient performance monitoring, as evidenced by failure to adjust response strategies following failures, is associated with impulsive response-style on these tasks (van Meel, Heslenfeld, Oosterlaan, & Sergeant, 2007).

In the context of alcohol intoxication, there is evidence that impulsive groups may not accurately perceive the degree to which alcohol impairs performance on skill-based tasks. Weafer and colleagues (2008) found that adults with ADHD rated themselves as less impaired by alcohol than controls despite objective indicators showing that they were in fact more impaired. Van Dyke and Fillmore (2014b) compared driving performance of DUI offenders and nonoffending controls following placebo and 0.64 g/kg alcohol. Results of the study found that driving performance was impaired by alcohol in both groups to a similar extent, suggesting that DUI offenders are no more impaired by alcohol than controls. Despite the lack of group difference in terms of behavioral impairment, DUI offenders perceived themselves as less impaired following alcohol and reported greater willingness to drive than did controls. Considering the importance of perceived impairment for deciding to drive after drinking, intervention strategies that address this deficit in self-evaluation may be helpful for reducing risk of impaired driving. One possible strategy for doing so is challenging drinkers' alcohol expectancies.

Alcohol Expectancies

Alcohol expectancies are beliefs individuals hold about the effects that alcohol will have on their behavior. These beliefs can be positive (e.g., alcohol increases sociability) or negative (e.g., alcohol causes hangover), and they are formed based on direct or indirect experience with alcohol (Jones, Corbin, & Fromme, 2001). Alcohol expectancies have been widely studied because they play an important role in governing people's behavior related to alcohol use. For example, people who hold more favorable alcohol expectancies are more likely to transition from non-problem drinking to problem drinking over a 12 month period (Christiansen, Roehling, Smith, & Goldman, 1989). Other studies have found similar associations between drinkers' alcohol expectancies and their quantity/frequency of alcohol use (Fromme & D'Amico, 2000; Sher, Wood, Wood, & Raskin, 1996).

Recognizing the relation between alcohol expectancies and alcohol use behavior, clinical researchers have attempted to develop intervention strategies to alter expectancies in a way that reduces alcohol use. In a human laboratory study, Sharkansky and Finn (1998) showed that participants who were given the expectancy that alcohol would impair their performance on a cognitive task consumed less alcohol when given *ad libitum* access. Likewise, priming drinkers with positive alcohol expectancies increases their *ad libitum* alcohol consumption (Roehrich & Goldman, 1995). Clinical trials of interventions that aimed at modifying drinkers' alcohol expectancies have shown that such interventions can reduce subsequent drinking (Dunn, Lau, & Cruz, 2000; Wood, Capone, Laforge, Erickson, & Brand, 2007). These studies show that changing drinkers' expectancies is an effective method for changing people's behavior related to alcohol use.

The link between alcohol expectancies and behavior is also present in the context of alcohol-impaired driving: People who expect that alcohol will impair their ability to drive are less likely to drive after drinking than those who do not hold this belief. McCarthy and colleagues have shown in two studies that adolescents and young adults who view alcohol as being less detrimental for driving ability endorse frequently driving after drinking (McCarthy, Lynch, & Pedersen, 2007; McCarthy et al., 2006). Likewise, DUI offenders who expect that alcohol intoxication increases their risk of accidents are more likely to drive after drinking that those who do not (Aberg, 1993).

Expectations of Impairment and Acute Alcohol Effects

Most of the research on alcohol expectancies has focused on understanding how these expectancies influence people's decisions to use alcohol in different contexts. Another line of research has shown that expectancies also can alter a drinker's behavior after drinking. Specifically, when individuals hold the expectation that alcohol will disrupt their performance on a given task, they will compensate for this expected impairment by increasing effort or using alternative behavioral strategies, particularly when impairment is undesirable in that context. Classic examples of this phenomenon are described by Goldberg and Havard (1968), wherein intoxicated drivers who have been stopped by police were able to compensate against the disruptive effects of alcohol long enough to pass a field sobriety test, despite clear outward signs of alcohol intoxication. Subsequent empirical studies in this area have confirmed that beliefs and events that occur after a drinker has consumed alcohol can influence the behavioral effects of the drug (Vogel-Sprott & Sdao-Jarvie, 1989).

Research in this area has been conducted using dose-response paradigms in which participants receive alcohol challenge and perform skill-based behavioral tasks. They are then given information that alcohol should impair performance on an upcoming behavioral task (Fillmore & Blackburn, 2002; Fillmore, Roach, & Rice, 2002). An example of an experimental method for manipulating participants' alcohol expectancies is as follows. Participants first receive a dose of alcohol. After they consume the drug, the experimenter provides them with information that the dose of alcohol they just received has caused significant impairment on an upcoming behavioral task among other participants. Participants then complete the task and performance is compared between participants in the expectancy manipulation condition and those in an alcohol only comparison condition.

These studies reliably show that participants who receive the expectancy treatment are less impaired by alcohol relative to those who did not receive such expectancies. Fillmore & Vogel-Sprott (1996) used this experimental design to examine the effects of 0.56 g/kg alcohol and expectancies on a psychomotor coordination task. They found that participants who received the expectancy manipulation alongside the alcohol dose performed similarly to the no beverage control group, whereas the alcohol only group showed appreciable alcohol impairment. Further evidence that this protective effective of expectancies results from a compensatory behavioral response against the expected impairment comes from studies using placebo control conditions. Fillmore and Blackburn (2002) examined the effects of an expectancy manipulation on participants who received a placebo beverage. In this study, participants received a placebo beverage and half were informed that the dose of alcohol they received would result in a slowing of response time on a speeded response task. Participants who received the expectancy treatment responded more quickly than those in a no beverage control group. This finding indicates that the compensatory response caused by expectancy manipulation can occur independently of any pharmacological factors.

Acute Alcohol Effects on Decision Making

It is also important to determine whether an acute dose of alcohol changes how situational characteristics influence the decision to drive after drinking. The alcohol myopia model (Steele & Josephs, 1990) proposes that alcohol reduces the amount of information that can be processed and evaluated in a situation. This restriction of information processing capacity results in a state of shortsightedness in which immediate and highly salient cues in the environment exert greater influence over behavior than peripheral cues. As such, acute alcohol intoxication may increase the degree to which potential for reward (e.g., quick transportation to next location) influences the decision to drive after drinking. Likewise, less salient situational factors (e.g., perceived risk of being caught) may become less influential in an intoxicated state. To test this notion, MacDonald et al. (1995) conducted a laboratory study examining willingness to drive after drinking in sober and intoxicated adults. Although there were no differences in basic attitudes towards drinking and driving, the intoxicated adults were reportedly more willing to drive when immediate loss or gain was associated with the decision. This study demonstrates how an acute alcohol dose can change how drinkers evaluate situational information when deciding whether to drive after drinking.

Experiment 2

Experiment 2 examined how acute doses of alcohol affected driving performance and decision-making processes in DUI offenders and their nonoffending peers. This experiment also examined whether creating expectations of alcohol impairment in participants changed their driving performance under alcohol or factors related to their decision making. Participants completed precision and motivational conflict driving tasks and the RRDD, and they provided subjective ratings of willingness and ability to drive during three separate sessions. During the first two dose-challenge sessions, participants received 0.64 g/kg alcohol and placebo before completing the tasks. For the third session (0.64 g/kg alcohol + expectancy manipulation), participants received 0.64 g/kg alcohol and received sham performance feedback (i.e., expectancy manipulation) indicating that their driving performance during the prior sessions was significantly impaired by alcohol. The 0.64 g/kg alcohol dose was selected because it was expected to produce a peak BAC of 80 mg/100 ml, which is the legal limit for driving in the United States. Three sets of hypotheses were offered:

Acute effects of alcohol. Based on prior work, I predicted that 0.64 g/kg alcohol would impair driving performance in both groups compared to placebo (Fillmore et al., 2009). On the RRDD task, I predicted that 0.64 g/kg alcohol would decreased average money required to drive and risk slope compared to placebo (MacDonald, Zanna, & Fong 1995), indicative of riskier decision making following the active alcohol dose. I also predicted that 0.64 g/kg alcohol would reduce participants' perceived willingness and ability to drive compared to placebo.

Effects of expectancy manipulation. I hypothesized that participants would be less impaired by 0.64 g/kg alcohol following expectancy manipulation relative to 0.64 g/kg alcohol with no expectancy manipulation. On the RRDD task, I predicted that average money required to drive and risk slope would both increase following 0.64 g/kg alcohol + expectancy manipulation compared to 0.64 g/kg with no expectancy manipulation. I also predicted that participants would report lower willingness and ability to drive following 0.64 g/kg alcohol + expectancy manipulation compared to 0.64 g/kg alcohol with no expectancy manipulation.

Differential effects in DUI offenders and control participants. I did not predict that DUI offenders would show more impairment under alcohol compared to controls (Van Dyke & Fillmore, 2014a). I predicted that relative to control participants, participants in the DUI group would show a larger shift towards riskier decision making (i.e., lower average money required to drive and risk slope) following 0.64 g/kg alcohol compared to placebo. I predicted that the group differences in RRDD variables would smaller in the 0.64 g/kg alcohol + expectancy condition compared to 0.64 g/kg alcohol with no expectancy manipulation. I predicted that DUI offenders would report being less impaired and more willing to drive following 0.64 g/kg alcohol than controls. I predicted that this difference in perceived driving fitness would be reduced following 0.64 g/kg alcohol + expectancy. To determine whether this hypothesized group difference in perceived driving fitness could be attributed to lower alcohol sensitivity in the DUI group, I assessed subjective alcohol effects unrelated to perceived driving impairment (i.e., subjective “liking”, “feeling”, and “desire”). I predicted that there would be no group differences in these subjective alcohol effects in any condition.

Method

Participants

Participants in this experiment were the same as those in experiment 1. See pages 24 - 25 and Table 2 of this dissertation for participant characteristics.

Materials and Measures

Most materials used in this experiment (i.e., stimulated driving tasks, RRDD task) were described previously in the method section of Experiment 1 (pp. 15-24).

Visual-analogue scale. Participants rated the degree to which their driving ability was impaired by the alcohol and their willingness to drive. They did so using a visual analog scale (VAS) by placing a vertical line on a 100-mm horizontal line ranging from 0 mm (*not at all*) to 100 mm (*very much*). A similar scale was used for participants to rate how much they *felt* the alcohol, how much they *liked* the effects of the alcohol, and how much they *desired* more alcohol.

Procedure

Familiarization session. Participants attended a familiarization session during which they provided informed consent and were screened to ensure that they met criteria for the experiment.

Dose-challenge sessions. Participants first completed a presession checklist to ensure compliance with the study requirements. They provided a urine sample that was tested for the presence of drug metabolites (ICUP Drug Screen, Instant Technologies) and, for women, human chorionic gonadotropin in order to verify that they were not pregnant (Icon25 Hcg Urine test, Beckman Coulter). Participants were instructed to abstain from consuming any alcohol 24 hours prior to each session. Expired air samples were taken at the beginning of the session to verify zero BAC (Intoxilyzer, Model 400; CMI, Owensboro, KY). They also were instructed to fast 4 hours prior to each dose-challenge session.

Participants completed the tasks under the following conditions: 0.64 g/kg alcohol (alcohol session), 0.64 g/kg alcohol + expectancy treatment (alcohol + expectancy session), and placebo. Following the 0.64 g/kg alcohol doses, a peak BAC of 80 mg/100 ml was expected to occur approximately 75 minutes after dose administration. This dose was selected because it corresponds to the legal limit of intoxication in the United States, so it is important to understand how this dose of alcohol affects drivers. Doses were calculated based on body weight. Dose order was partially randomized. The 0.64 g/kg alcohol and placebo sessions were completed first and second in a counterbalanced order, and the 0.64 g/kg alcohol + expectancy session was completed last. This order was necessary to avoid carryover effects of the expectancy manipulation. The alcohol beverage was served as one part alcohol and three parts carbonated mix divided equally into two glasses. The placebo consisted of four parts carbonated mix that matched the volume of the 0.64 g/kg dose. Five ml of alcohol was floated on the top of each placebo glass, and the glasses was sprayed with an alcohol mist that resembles condensation and provides a strong alcohol odor. Participants were instructed to consume the first serving within two minutes and the second serving within six minutes.

The timeline of each dose challenge session was identical. Participants completed the precision driving task, motivational conflict driving task, subjective effect questionnaire, and each scenario of the RRDD task, between 30 and 65 minutes past dose, which corresponds to the ascending limb of the BAC curve. Expired air samples were used to estimate participants' BACs throughout the session. Following the testing session, participants remained at leisure in a lounge area until their BAC fell to 20 mg/ 100 ml or below, at which time they were offered transportation home. They were verbally instructed not to drive for several hours following their release from the laboratory.

Expectancy treatment. During the alcohol + expectancy manipulation session, participants received information that they showed pronounced impairment during the alcohol only session. Participants experienced the session as identical to the placebo and 0.64 g/kg alcohol session with the exception that they received this sham performance feedback. Immediately following the administration of the alcohol dose, the experimenter casually approached the participant and invited them to look at a graph displayed on a PC. This graph ostensibly illustrated their severe level of impairment (see Figure 3). The experimenter then explained the meaning of the graph, verbally confirmed that the participant understood its meaning, and provided additional clarification if necessary. The experimenter then left the participant to absorb the alcohol and the session proceeded in the same fashion as the previous two. This method of expectancy manipulation is similar to that used in prior research (Fillmore & Vogel-Sprott, 1996).

Results

Observed BACs

BACs in the active dose conditions were analyzed by a 2 group (DUI versus control) X 2 condition (0.64 g/kg alcohol versus 0.64 g/kg alcohol + expectancy) X 2 time (25 minutes past dose versus 65 minutes past dose) mixed-design ANOVA. There was a main effect of time, $F(1,38) = 119.8$, $p < .001$, due to the increase in BAC that occurred from the first to second measurement. There was no significant main effect of group or condition or interaction effect (*ps* > .100). BACs are listed separately by group and condition in Table 6. No detectable BAC was observed following placebo beverage.

Precision Driving Scenario

Driving performance on the precision driving task is displayed in Table 7. These data were analyzed using 2 (group) X 3 (condition) ANOVAs. As seen in this table, there were no significant main effects of group or group X condition interactions. There were, however, significant main effects of condition on LPSD, steering rate, and line crossings. These effects were probed using *a priori t* tests. Because there was no significant main effect or interaction effect involving group, these *a priori t* tests collapsed across group. Analysis of LPSD shows that compared to placebo, participants had higher LPSD under 0.64 g/kg alcohol, $t(39) = 3.3$, $p = .002$, and 0.64 g/kg alcohol + expectancy manipulation, $t(39) = 3.6$, $p < .001$. There was no significant difference in LPSD following 0.64 g/kg alcohol and 0.64 g/kg alcohol + expectancy manipulation, $t(39) = 0.7$, $p = 0.478$.

A priori t tests also probed the effects of dose and expectancy manipulation on steering rate. Compared to placebo, participants had higher steering rate following 0.64

g/kg alcohol, *t* (39) = 2.2, *p* = .032, but not 0.64 g/kg alcohol + expectancy, *t* (39) = 2.0, *p* = .056. However, there was no significant difference following 0.64 g/kg alcohol with and without expectancy manipulation, *t* (39) = 1.3, *p* = .216.

Lastly, *a priori t* tests probed the effects of dose and expectancy manipulation on line crossings. Compared to placebo, participants made more line crossings following 0.64 g/kg alcohol, *t* (39) = 3.3, *p* = .002, and 0.64 g/kg alcohol + expectancy, *t* (39) = 3.4, *p* = .002. There was no significant difference following 0.64 g/kg alcohol with and without expectancy manipulation, *t* (39) = 0.4, *p* = .693.

Motivational Conflict Driving Scenario

Driving performance on the motivation conflict drive are presented in Table 8. These data were analyzed using 2 (group) X 3 (condition) mixed-design ANOVAs. As seen in this table, there was a main effect of condition on LPSD, average speed, and braking distance. There was also a main effect of group on speed standard deviation and traffic tickets, showing that participants in the DUI group had higher speed standard deviation and received more traffic violations compared to controls. No group X condition interaction was significant. Significant effects of condition were probed using *a priori t* tests. Because there was no significant main effect of group or group X condition interaction on LPSD, data were collapsed across group. Compared to placebo, participants had higher LPSD following 0.64 g/kg alcohol, *t* (39) = 4.2, *p* < .001, and 0.64 g/kg alcohol + expectancy, *t* (39) = 6.3, *p* < .001. There was no significant difference in performance following 0.64 g/kg alcohol with and without expectancy manipulation, *t* (39) = 1.0, *p* = .341.

The main effect of condition on average speed was probed using *a priori t* tests. There was no significant difference in average speed following placebo and 0.64 g/kg alcohol, t (39) = 0.4, p = .681. However, participants drove more quickly following 0.64 g/kg alcohol + expectancy compared to placebo, t (39) = 3.2, p = .003. The difference between 0.64 g/kg alcohol with and without expectancy manipulation was also significant, t (39) = 2.2, p = .032.

The main effect of condition on line crossings was probed using *a priori t* tests, Compared to placebo, participants made more line crossings following 0.64 g/kg alcohol, t (39) = 2.9, p = .006, and 0.64 g/kg alcohol + expectancy, t (39) = 2.7, p = .011. There was no significant difference following 0.64 g/kg alcohol with and without expectancy manipulation, t (39) = 0.8, p = .436.

The main effect of condition on braking distance was probed using *a priori t* tests. Compared to placebo, participants had a shorter braking distance following 0.64 g/kg alcohol, t (39) = 2.6, p = .012, and 0.64 g/kg alcohol + expectancy, t (39) = 3.6, p = .001. There was no significant difference in braking distance following 0.64 g/kg alcohol with and without expectancy manipulation, t (39) = 0.8, p = .406.

Perceived Driving Fitness

Participants' ratings of perceived willingness and ability to drive are graphed in Figure 4. Rating were analyzed using 2 (group) X 3 (condition) mixed-design ANOVAs. For perceived ability to drive, there was a significant main effect of condition, F (2, 76) = 139.9, $p < .001$, and the main effect of group approached significance, F (1, 38) = 3.3, p = .079. There was a significant group X condition interaction, F (2, 76) = 5.2, p = .008.

This interaction was probed using *a priori t* tests. These *t* tests found that within the control group, perceived ability to drive following placebo was significantly higher than following both 0.64 g/kg alcohol, t (19) = 10.2, $p < .001$, and 0.64 g/kg alcohol + expectancy, t (19) = 11.6, $p < .001$. In the control group there was no significant difference between perceived ability to drive following 0.64 g/kg alcohol with and without the expectancy manipulation, t (19) = 0.8, $p = .448$. In the DUI group, perceived ability to drive following placebo was higher than following 0.64 g/kg alcohol, t (19) = 10.6, $p < .001$, and 0.64 g/kg alcohol + expectancy, t (19) = 10.9, $p < .001$. In the DUI group, perceived ability to drive following 0.64 g/kg alcohol + expectancy was lower than following 0.64 g/kg alcohol with no expectancy manipulation, t (19) = 2.9, $p = .009$. These tests also showed that the DUI group had significantly higher perceived driving ability ratings than did controls following 0.64 g/kg, t (38) = 2.9, $p = .006$. They did not differ from controls following placebo, t (38) = 0.8, $p = .423$, or 0.64 g/kg alcohol + expectancy, t (19) = 1.2, $p = .249$.

For willingness to drive, there was a significant main effect of condition, F (2, 76) = 96.7, $p < .001$, but no significant main effect of group, F (1, 38) = 1.9, $p = .964$. The group X condition interaction was significant, F (2, 76) = 10.7, $p < .001$. This interaction was probed using *a priori t* tests. In the control group, willingness to drive following placebo was significantly higher than following 0.64 g/kg alcohol, t (19) = 10.4, $p <.001$, and 0.64 g/kg alcohol + expectancy, t (19) = 10.4, $p <.001$. However, there was no significant difference in willingness to drive following 0.64 g/kg alcohol with and without expectancy manipulation, t (19) = 0.4, $p =.682$. Among DUI offenders, willingness to drive following placebo was significantly higher than following 0.64 g/kg alcohol, *t* (19) = 6.1, *p* <.001, and 0.64 g/kg alcohol + expectancy, *t* (19) = 4.5, *p* <.001. There was no significant difference in willingness to drive following 0.64 g/kg alcohol with and without expectancy manipulation, *t* (19) = 0.5, *p* =.656. Additional *t* tests comparing groups on willingness to driving within each session showed that DUI offenders were less willing to drive than controls following placebo, *t* (38) = 2.4, *p* = .020. There was no significant difference between DUI offenders and controls following 0.64 g/kg alcohol, *t* (38) = 1.9, *p* = .065, and 0.64 g/kg alcohol + expectancy, *t* (19) = 1.7, *p* = .099.

Subjective Alcohol Effects

Participant's subjective ratings of alcohol effects on the VAS are reported in Table 9. As seen in this table, there was a main effect of condition on subjecting ratings of "feeling", "liking" and "desire," but there was no significant main effect of group or interaction effect.

Risk and Reward Driver Decision Task

The primary outcome variables of the driving risk tasks slope and mean are graphed in Figures 5 and 6, respectively. Data from one participant in the control group was removed from the analyses due to content irrelevant responding. Effects of condition on responses on the driving risk task were analyzed using 2 (group) X 3 (condition) mixed-design ANOVAs. Any significant main effect of condition or interaction effect was probed using *a priori t* tests.

Distance to be traveled. There was no significant main effect of group on average money required to drive, *F* (1, 37) = 2.1, *p* = .152, or risk slope, *F* (1, 37) = 2.3, *p* = .136. There was no significant effect of condition on mean, *F* (2, 74) = 1.3, *p* = .277, or slope, *F* (2, 74) = 0.1, *p* = .862. The group X condition interaction was not significant for average money required to drive, *F* (2, 74) = 1.0, *p* = .370, but there was a significant group X condition interaction of risk slope, *F* (2, 74) = 3.4, *p* = .040.

The significant group X condition interaction on risk slope was probed using *a priori t* tests. These tests found that within the control group, there was no significant difference in risk slope following placebo compared to 0.64 g/kg alcohol, *t* (18) = 2.0, *p* = .067, or 0.64 g/kg alcohol + expectancy, *t* (18) = 1.2, *p* = .230. There was no significant difference in risk slope following 0.64 g/kg alcohol with and without expectancy manipulation, *t* (18) = 0.8, *p* = .417. In the DUI group, there no significant difference in risk slope following placebo compared to 0.64 g/kg alcohol, *t* (19) = 1.8, *p* = .086, or 0.64 g/kg alcohol + expectancy, *t* (19) = 0.5, *p* = .643. Likewise, there was no significant difference in risk slope following 0.64 g/kg alcohol with and without expectancy manipulation, *t* (19) = 1.1, *p* = .287.

Blood alcohol concentration. There was no significant main effect of group on average money required to drive, *F* (1, 37) = 3.0, *p* = .089, or risk slope, *F* (1, 37) = 2.8, *p* = .102. There was no significant effect of condition on average money required to drive, *F* (2, 74) = 0.5, *p* = .586, or risk slope, *F* (2, 74) = 0.2, *p* = .799. The group X condition interaction was not significant for average money required to drive, *F* (2, 74) = 0.5, *p* = .624, or risk slope, *F* (2, 74) = 0.2, *p* = .825.

Time since drinking. There was no significant main effect of group on average money required to drive, *F* (1, 37) = 3.4, *p* = .073, or risk slope, *F* (1, 37) = 1.7, *p* = .199. There was no significant effect of condition on average money required to drive, *F* (2, 74) = 1.8, *p* = .181, or risk slope, *F* (2, 74) = 0.8, *p* = .455. The group X condition interaction was not significant for average money required to drive, F (2, 74) = 1.0, p = .385, or risk slope, F (2, 74) = 1.6, p = .204.

Probability of arrest. There was a significant main effect of group on risk slope, F (1, 37) = 5.2, p = .028. As seen in Figure 5, participants in the control group showed a steeper slope compared to those in the DUI group. There was no significant main effect of group on average money required to drive, F (1, 37) = 2.6, p = .119. There was no significant effect of condition on average money required to drive, F (2, 74) < 0.1, p = .967, or risk slope, F (2, 74) = 1.6, p = .218. The group X condition interaction was not significant for average money required to drive, F (2, 74) = 2.0, p = .138, or risk slope, F (2, 74) = 0.6 p = .539.

Discussion

Experiment 2 examined the acute effects of alcohol on simulated driving performance and decision-making processes related to alcohol intoxicated driving in DUI offenders and nonoffending controls. It also examined the effects of expectancy manipulation on driving performance and decision-making (Vogel-Sprott, 1992). My first set of hypotheses were associated with the acute effects of alcohol on driving performance and decision making. In general, the hypothesis that 0.64 g/kg alcohol would impair driving performance was supported. On the precision driving task, participants showed increased LPSD, steer rate, and line crossings following 0.64 g/kg alcohol compared to placebo, consistent with the notion that alcohol increases within-lane drift. A similar pattern was observed on the motivational conflict-driving task. Following 0.64 g/kg alcohol, participants showed increased LPSD and steer rate compared to placebo. 0.64 g/kg alcohol also shortened breaking distance on the motivational conflict drive, a change that is indicative of a riskier driving style. The hypotheses that 0.64 g/kg would cause riskier decision-making was not supported. Participants did not become willing to tolerate more risk for less money after receiving 0.64 g/kg alcohol compared to placebo. As expected, participants reported lower perceived ability and willingness to drive following 0.64 g/kg alcohol compared to placebo.

The second set of hypotheses addressed the effect of expectancy manipulation on simulated driving performance and decision-making on the RRDD task.
Contrary to my hypotheses, there was no evidence for an effect of expectancy manipulation on any measure of driving performance. In fact, the only significant effect in these comparisons indicated higher risk driving following expectancy manipulation. In the motivational conflict drive, participants drove faster following 0.64 g/kg alcohol + expectancy compared to 0.64 g/kg alcohol. The likely has to do with session order rather than any effect of expectancy manipulation. Participants always completed the alcohol expectancy + 0.64 g/kg alcohol after both other sessions, so they may have increased their speed as they become more familiar with the motivational conflict task in order to maximize their amount of money earned. The hypothesis that expectancy manipulation would decrease decision-making risk was not supported. Responses on the RRDD task did not appear to be affected by expectancy manipulation.

The final set of hypotheses concerned group differences in the effects of alcohol and expectancy manipulation on simulated driving ability, decision making, and perceived ability and willingness to drive. There was no group difference in alcohol effects on the simulated driving tasks, replicating prior work suggesting that DUI offenders are no more impaired by alcohol than their nonoffending peers (Van Dyke & Fillmore, 2014b). Neither 0.64 g/kg alcohol nor expectancy manipulation altered responses on the RRDD task; both groups were equally unaffected by these manipulations on the measures of decision making. There were, however, several group differences in responses on this task. When considering probability of arrest on the RRDD task, DUI offenders had a smaller risk slope compared to controls overall. This pattern suggests that DUI offenders need less incentive to ignore riskier situations when the risk factor in question is probability of being arrested.

There were important group differences in the effects of alcohol and expectancy manipulation on perceived driving fitness (e.g., self-reported ability to drive). Both groups showed decreased perceived driving ability following 0.64 g/kg alcohol compared to placebo; however, control participants rated themselves as less able to drive in this condition compared to DUI offenders. This finding is consistent with prior work showing that DUI offenders perceive themselves as less impaired by alcohol, despite showing similar levels of behavioral impairment (Van Dyke & Fillmore, 2014b). Interestingly, in the 0.64 g/kg alcohol + expectancy condition, DUI offenders' perceived ability to drive was similar to that of controls. This finding cannot be attributed to general group differences in sensitivity to the subjective effects of alcohol, because there were no other group differences in other subjective alcohol effects (i.e., subjective feeling, liking, and desire for more alcohol). Taken together, these finding supported my hypothesis and suggests that the expectancy manipulation used in the current study was effective at changing DUI offenders' perceptions of their driving ability to be more consistent with that of nonoffenders.

Results of this study cannot be attributed to group differences in demographic variables or drinking history, because the groups were matched on these variables (see Experiment 1). The carefully controlled weight-adjusted dosing procedure ensured that BACs that were similar between groups and sessions. Expired air samples confirmed that participants achieved similar BACs before and after completing the tasks during each session in which alcohol was administered.

Table 6. Blood alcohol concentrations by group and condition

	Condition			
	0.64 g/kg		0.64 g/kg + Expectancy	
	M	*SD*	*M*	*SD*
Control				
25 min	63.4	16.6	56.8	12.4
65 min	80.2	11.0	79.0	13.5
DUI				
25 min	58.2	15.0	57.9	12.5
65 min	80.1	11.5	83.7	7.9

Note. BAC values are reported in mg/100 ml. Min = minutes past dose.

Table 7. Precision driving task performance by group and condition

	Condition								
	Placebo		0.64 g/kg alcohol		0.64 g/kg alcohol + expectancy		*F* Group	*F* Condition	*F* Interaction
	Control	DUI	Control	DUI	Control	DUI			
LPSD	1.4 (0.3)	1.4 (0.4)	1.6 (0.6)	1.6 (0.5)	1.6 (0.5)	1.6 (0.5)	< 0.1	8.5***	0.3
Steer Rate	3.8 (4.3)	9.5 (13.6)	12.1 (4.6)	11.6 (20.2)	11.9 (5.6)	9.8 (14.5)	0.1	3.4*	0.7
Average Speed	55.2 (2.0)	55.1 (1.6)	54.4 (2.3)	55.5 (2.9)	55.4 (3.0)	55.9 (2.1)	0.6	2.5	1.9
Speed SD	5.0 (2.1)	5.4 (1.5)	5.51 (2.6)	5.9 (2.4)	6.6 (4.1)	5.9 (2.5)	< 0.1	2.3	0.9
Collisions	0.5 (0.8)	0.2 (0.5)	1.1 (2.1)	0.5 (0.9)	1.1 (1.6)	0.5 (0.9)	2.9	2.4	0.4
Line Crossings	16.8 (13.6)	20.5 (18.0)	30.6 (29.3)	28.6 (26.7)	33.7 (29.9)	27.5 (23.6)	< 0.1	8.9***	1.3

Note. Note. Parenthetical values are standard deviations. LPSD = Lane position standard deviation. Speed SD = Speed standard deviation. For main effect of group, df = 1, 38. For main effect of condition and interaction, df = 2, 76.

* $p < .05$, ** $p < .01$, *** $= p < .001$

Table 8. Motivational conflict driving task performance by group and condition

	Condition						*F*	*F*	*F*
	Placebo		0.64 g/kg alcohol		0.64 g/kg alcohol + expectancy		Group	Condition	Interaction
	Control	DUI	Control	DUI	Control	DUI			
LPSD	1.0 (0.3)	1.1 (0.4)	1.3 (0.3)	1.4 (0.6)	1.4 (0.4)	1.4 (0.3)	0.3	16.2***	0.3
Steer Rate	9.0 (4.2)	8.1 (14.1)	9.4 (4.4)	10.6 (17.5)	9.7 (3.9)	7.2 (7.2)	0.1	0.6	0.7
Average Speed	60.4 (3.9)	57.3 (6.5)	59.7 (5.2)	58.6 (7.0)	60.8 (3.1)	61.0 (5.6)	0.8	4.8*	2.6^t
Speed SD	26.1 (2.0)	23.9 (5.3)	25.7 (2.7)	25.1 (2.1)	26.8 (1.3)	25.0 (3.0)	4.9*	1.2	1.0
Collisions	0.0 (0.0)	0.0 (0.00)	0.1 (0.2)	0.1 (0.5)	0.1 (0.3)	0.1 (0.2)	****	****	****
Line Crossings	4.2 (5.8)	7.5 (8.5)	9.5 (10.3)	10.0 (8.2)	10.7 (9.0)	11.4(14.4)	0.4	5.4**	0.4
Brake Distance	457 (77)	484 (117)	426 (85)	440 (107)	401 (55)	440 (95)	1.3	6.6**	0.4
Traffic Tickets	0.6 (1.0)	1.1 (1.1)	0.9 (1.0)	1.4 (1.0)	0.7 (0.8)	1.5 (1.2)	5.5*	1.6	0.8

Note. Parenthetical values are standard deviations. LPSD = Lane position standard deviation. Speed SD = Speed standard deviation
For main effect of group, df = 1, 38. For main effect of condition and interaction, df = 2, 76.
* $p < .05$, ** $p < .01$, ***$p < .001$, ^{t} $p = .082$, ****data could not be analyzed due to invariance in one or more cells

Table 9. Subjective alcohol effects on the visual analogue scale by group and condition

	Condition								
	Placebo		0.64 g/kg alcohol		0.64 g/kg alcohol + expectancy		*F* Group	*F* Condition	*F* interaction
	Control	DUI	Control	DUI	Control	DUI			
Feel	7.9 (8.2)	15.5 (10.4)	65.0 (24.7)	57.9 (16.5)	71.0 (25.0)	66.4 (19.6)	< 0.1	8.5***	0.3
Like	35.6 (20.7)	39.8 (20.9)	59.9 (24.7)	60.0 (20.2)	60.8 (23.3)	61.5 (20.0)	0.1	3.4*	0.7
Desire	20.3 (25.7)	25.6 (24.4)	33.2 (33.4)	48.6 (30.4)	29.6 (29.5)	37.3 (24.2)	0.6	2.5	1.9

Note. Parenthetical values are standard deviations. For main effect of group, df = 1, 38. For main effect of condition and interaction, df = 2, 76.
$p < .01$**, $p < .001$***

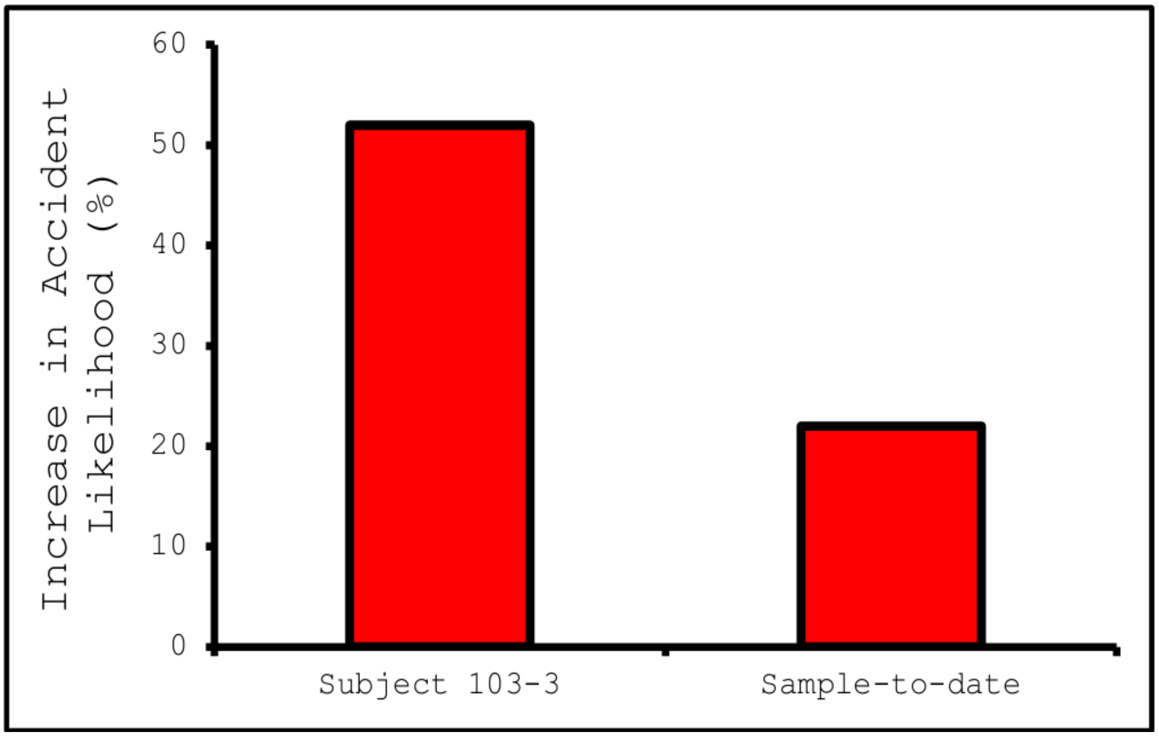


Figure 3. Sham graph used to manipulate expectation of alcohol impairment

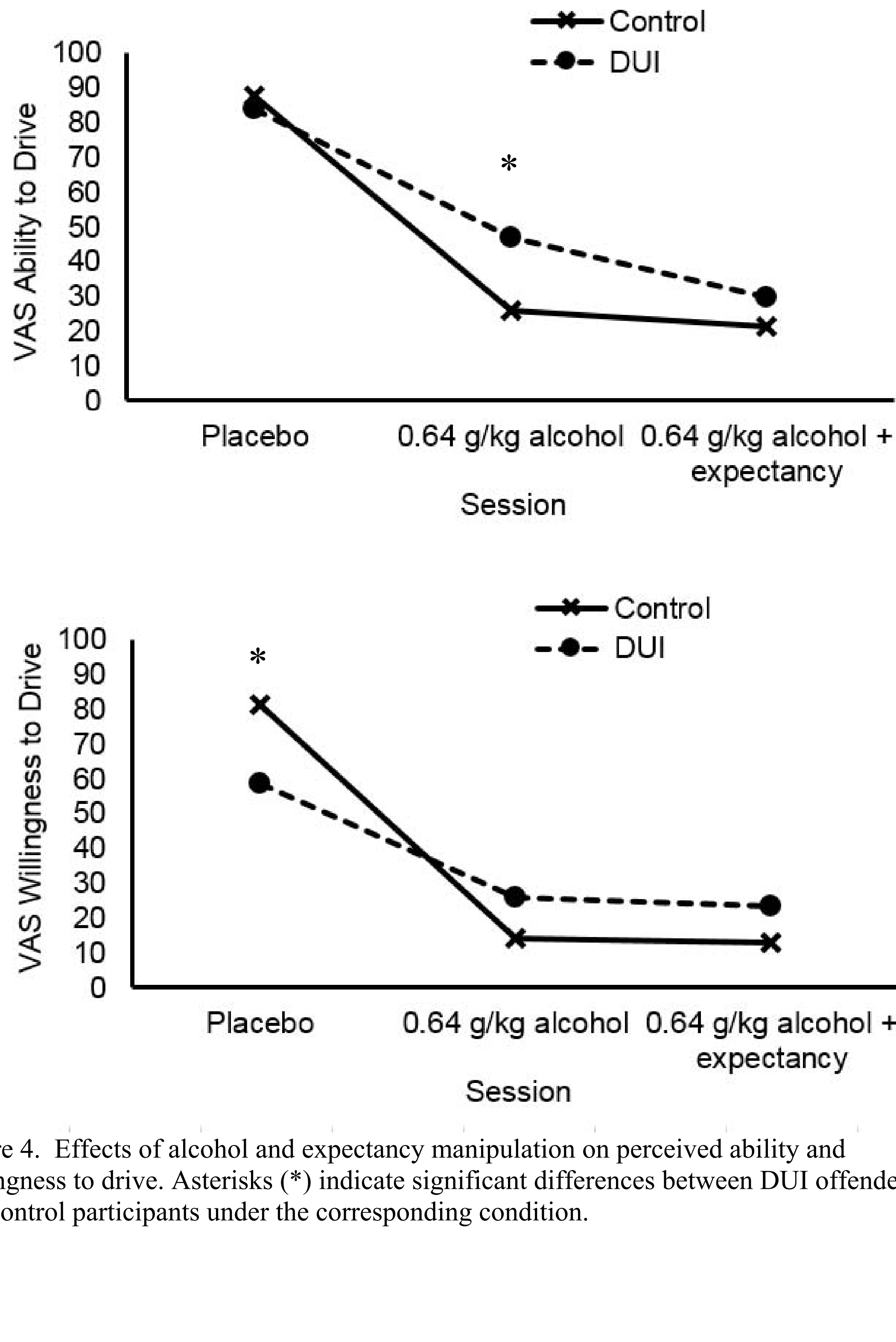


Figure 4. Effects of alcohol and expectancy manipulation on perceived ability and willingness to drive. Asterisks (*) indicate significant differences between DUI offenders and control participants under the corresponding condition.

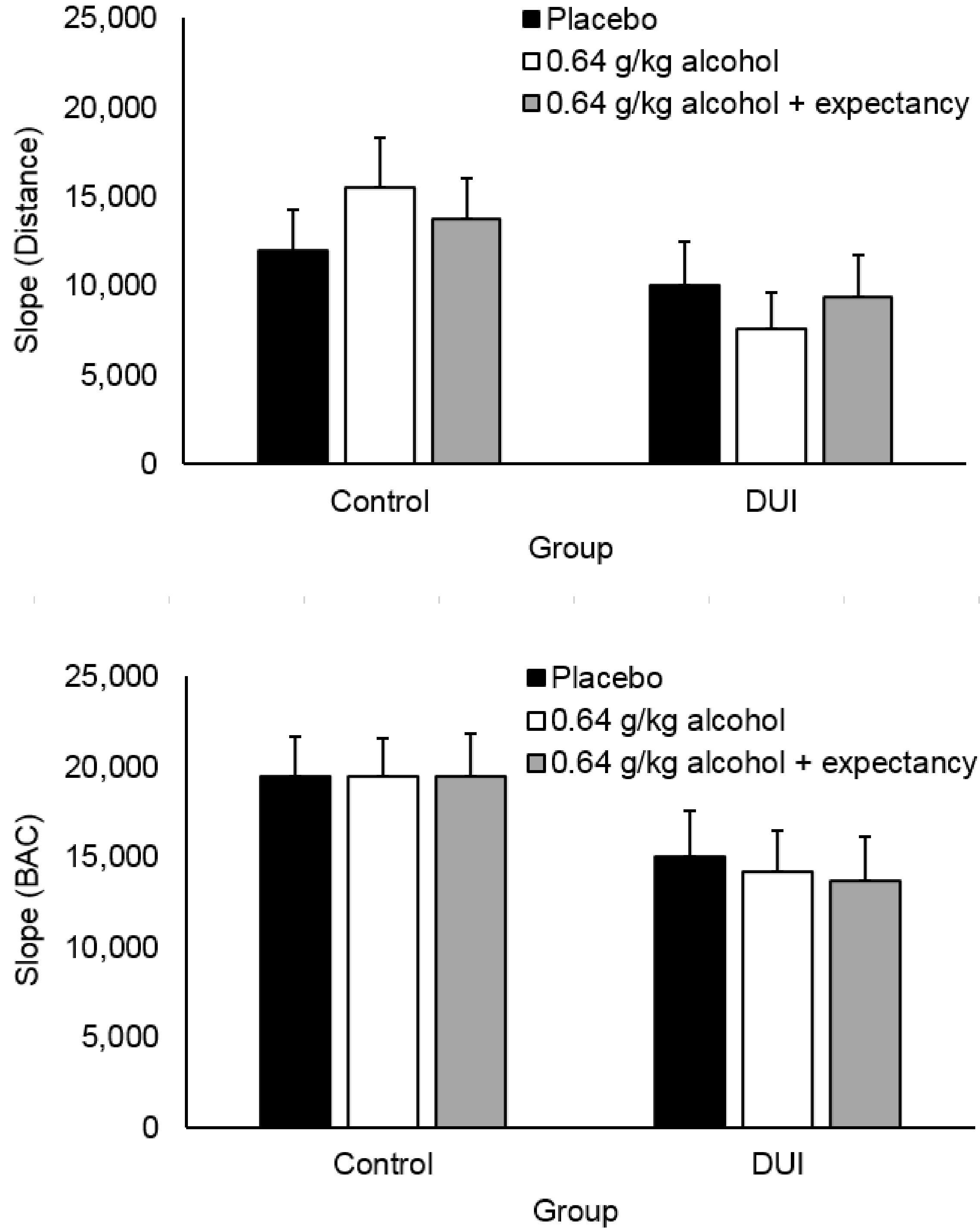


Figure 5. Effects of alcohol and expectancy manipulation on risk slope on Risk versus Reward Driver Decision task

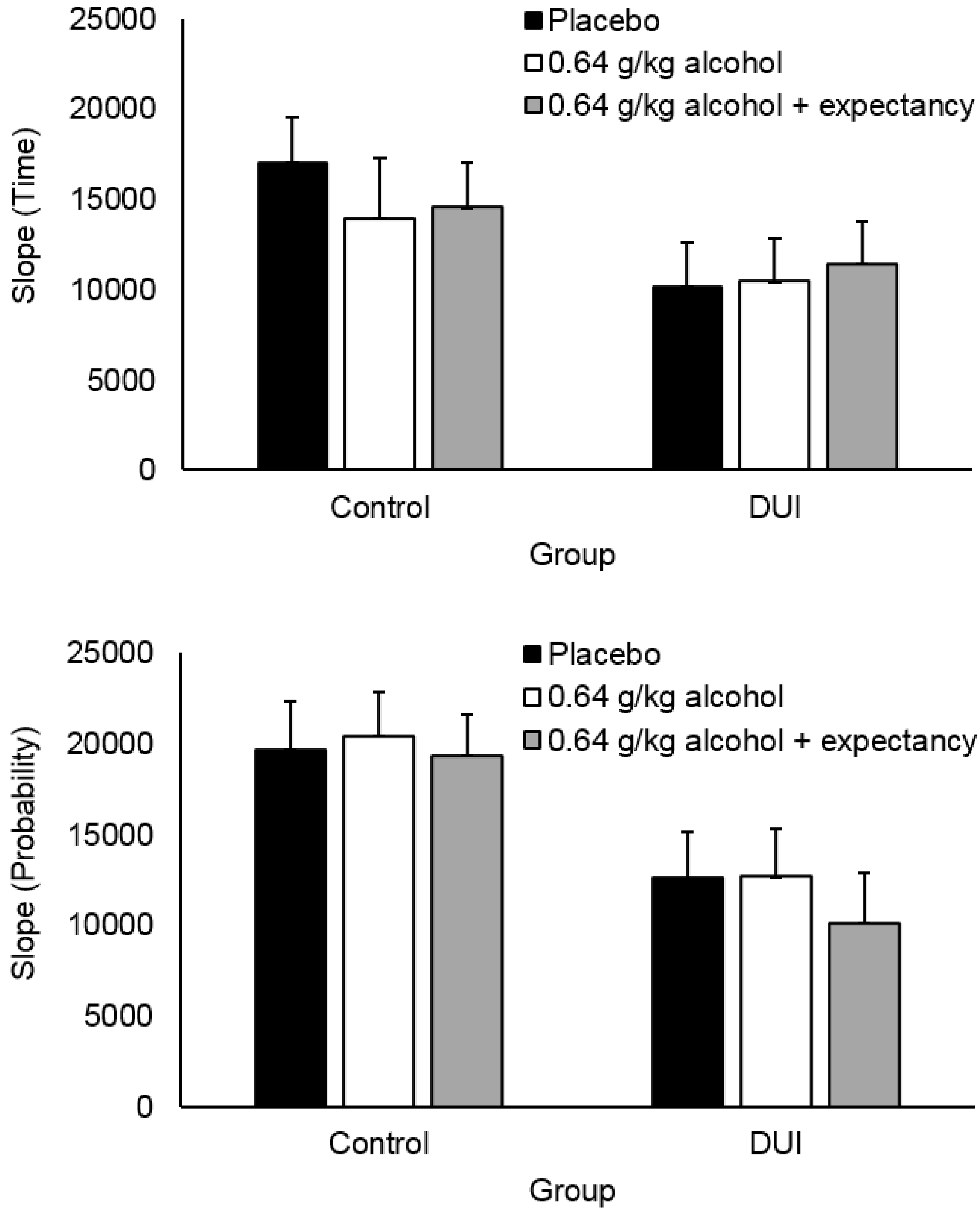


Figure 5 (cont). Effects of alcohol and expectancy manipulation on risk slope on Risk versus Reward Driver Decision task

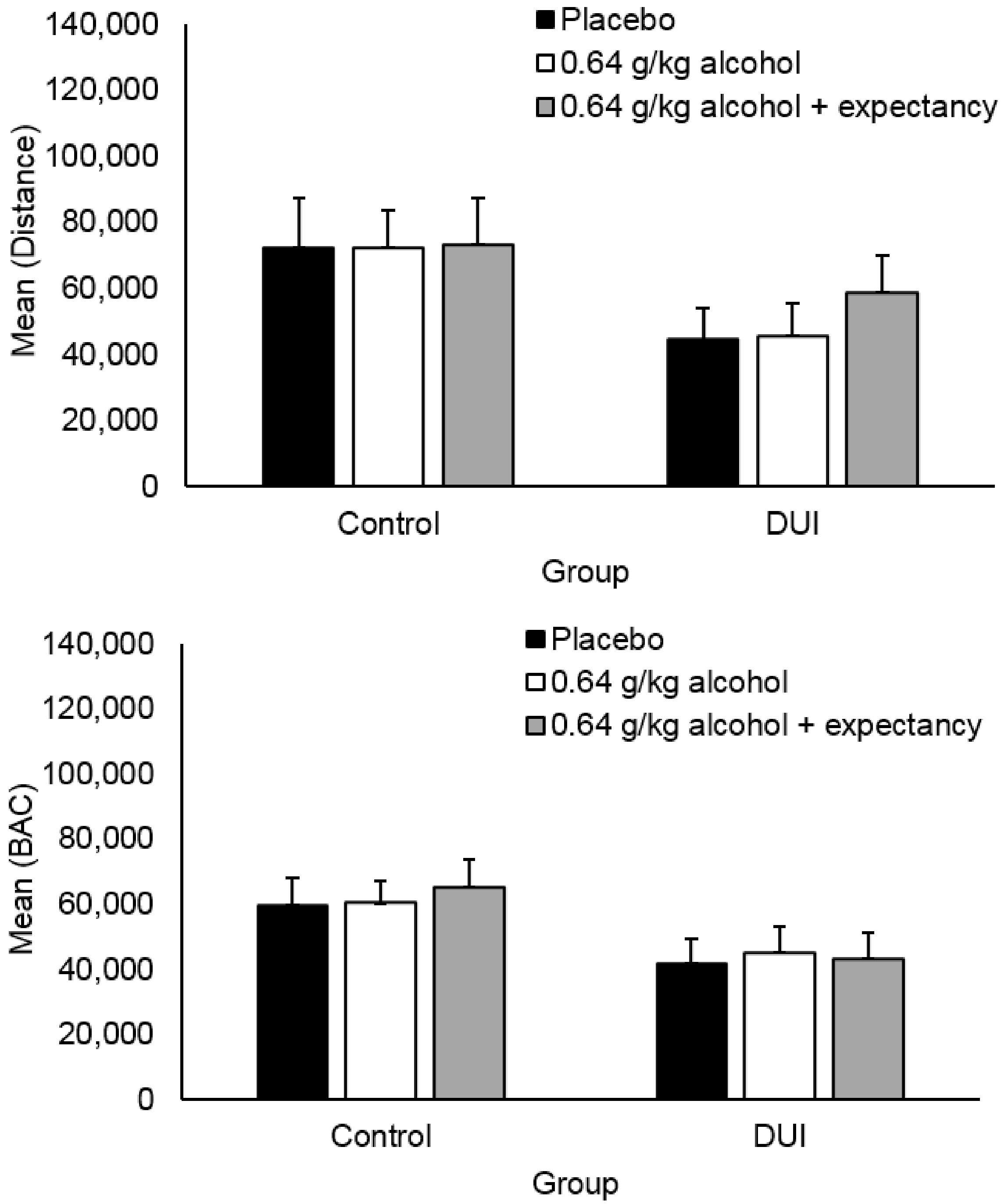
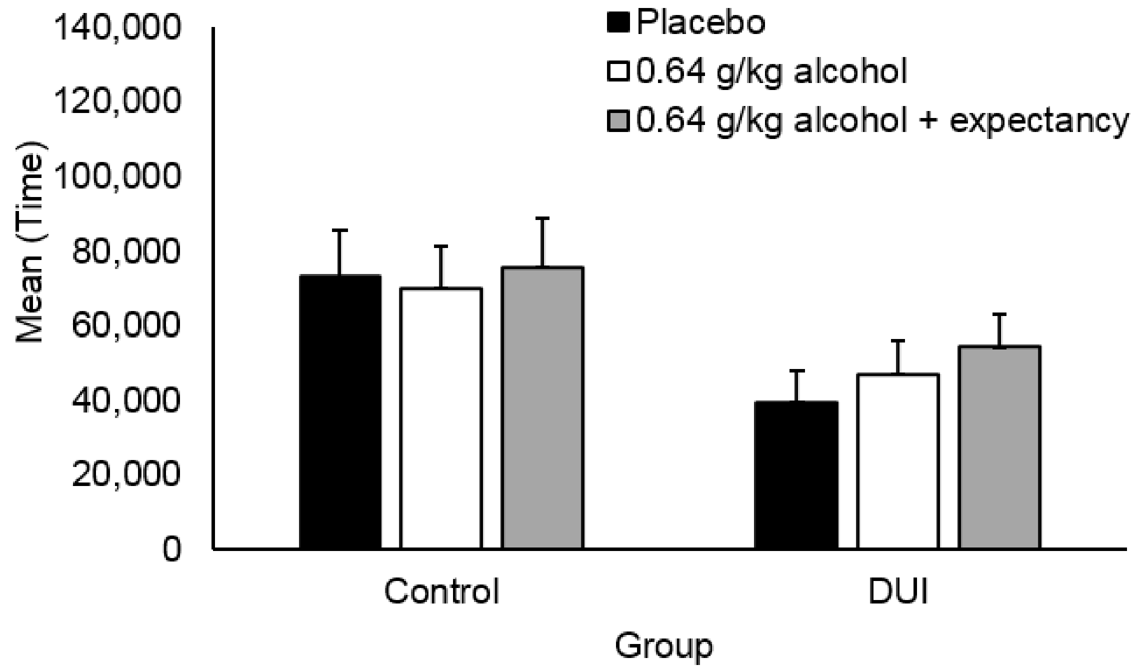


Figure 6. Effects of alcohol and expectancy manipulation on average money required to drive on Risk versus Reward Driver Decision task



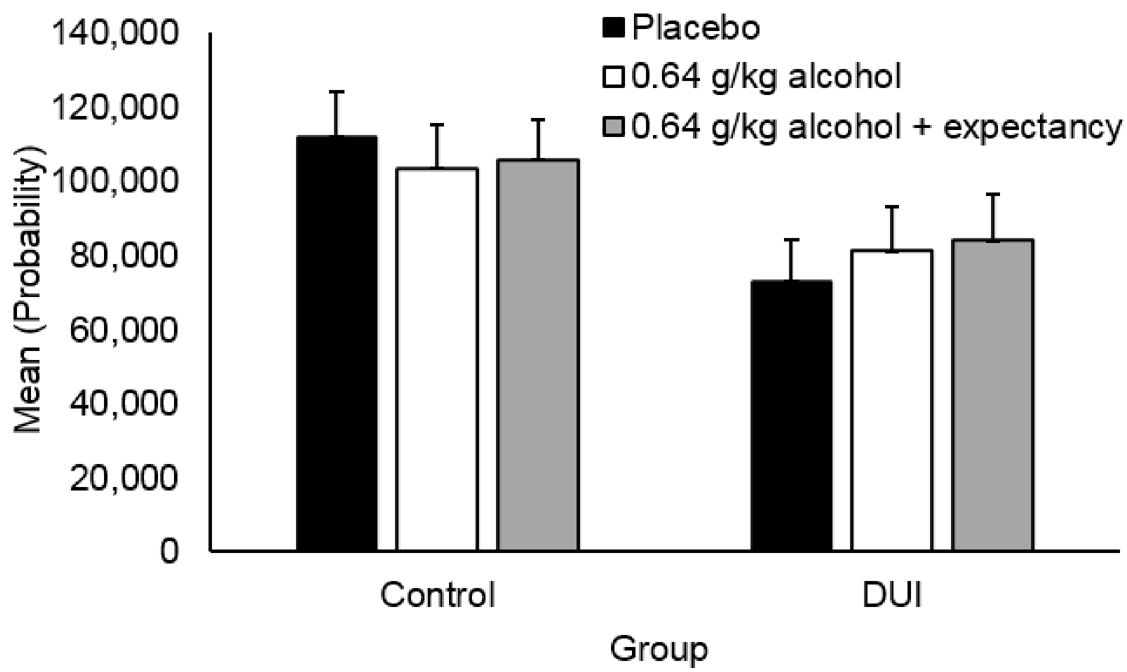


Figure 6 (cont.) Effects of alcohol and expectancy manipulation on average money required to drive on Risk versus Reward Driver Decision task

Chapter 4: General Discussion

This pair of studies examined characteristics of DUI offenders that may place them at risk for impaired driving. Experiment 1 examined impulsivity, simulated driving performance, and decision-making related to alcohol-impaired driving in this group. DUI offenders showed poorer driving performance and reported higher levels of impulsivity compared to controls, although they did not perform more poorly on behavioral measures of impulsivity. On the RRDD task, DUI offenders' responses were indicative of riskier decision making compared to control participants. Experiment 2 extended this research on DUI offenders by examining the acute effects of alcohol and expectancy manipulation on simulated driving performance and decision making in this group. Alcohol impaired driving performance in both groups but did not affect responses on the RRDD task. DUI offenders rated themselves as more able to drive under 0.64 g/kg alcohol compared to controls. Following expectancy manipulation at this same dose of alcohol, however, DUI offenders rated themselves no more able to drive than did control participants.

Impulsivity in DUI Offenders

This research is predicated on previous findings that DUI offenders are more impulsive than their nonoffending peers (Chalmers, Olenick, & Stein, 1993; Ryb, Dischinger, Kufera, & Read, 2006; Van Dyke & Fillmore, 2014a). Experiment 1 was able to replicate and extend these findings using the UPPS model of impulsivity, which decomposes impulsivity into four distinct personality processes. The largest group differences were found in urgency (i.e., tendency to act rashly when experiencing intense emotions) and (lack of) premeditation (i.e., tendency to act without considering the potential consequences of one's actions). Both of these findings can provide insight into situations where DUI offenders may be at high risk to reoffend. For example, heightened urgency suggests that strong negative or positive emotions may prompt impulsive decision making, such as deciding to drive after drinking following an interpersonal dispute (negative urgency) or in a celebratory context (positive urgency). Higher levels of (lack of) premeditation may suggest that DUI offenders are less responsive punishment-based deterrents, as they may not consider potential consequences of their actions before deciding to drive. This may explain why DUI offenders are likely to reoffend following criminal-justice oriented interventions (Nochajski & Stasiewicz, 2006).

The finding that DUI offenders report heightened levels of urgency builds on a growing literature highlighting the importance of urgency in negative substance-use outcomes. This link appears to be present across a range of problematic substance-related behaviors. A recent meta-analysis found a reliable association between urgency and problematic alcohol use (e.g., physically injuring oneself while drinking, engaging in unsafe sexual activities) among adolescents (Stautz & Cooper, 2013). Similar relations between urgency and alcohol use has been shown in adults (Kaiser, Milich, Lynam, & Charnigo, 2012). Such findings suggest that urgency begets problematic substance use because users may engage in risk behaviors in order to cope with or avoid situations that elicit negative emotions (Verdejo-Garcia, Bechara, Recknor, & Perez-Garcia, 2007). A similar pathway may exist in DUI offenders such that they drive impulsively after drinking in order to escape a negative condition.

Information about the nature of impulsivity in DUI offenders can inform the development of targeted intervention strategies. Knowledge of trait risk factors can be useful for targeting individuals most at risk. Further, identifying how such traits contribute to risk can facilitate developing intervention strategies that more appropriately address these areas of concern. Conrod's group (Conrod, Castellanos-Ryan, & Strang, 2010; O'Leary-Barrett, Mackie, Castellanos-Ryan, Al-Khudhairy, & Conrod, 2010) has advanced this technique by developing targeted interventions that are appropriate for individuals with substance use problems and specific personality traits. Such interventions take into account how these traits might contribute to the problem in question and provides the individual with tools to deal with that pattern of behavior. In a similar vein, interventions for DUI offenders may be more effective if it includes strategies for tolerating emotional distress (urgency) or anticipating the consequences of one's actions ([lack of] premeditation; Zapolski, Settles, Cyders, & Smith, 2010).

Despite the consistent group differences on self-report measures of impulsivity, there were few group differences on the behavioral measures. The groups performed similarly on the money choice task, time estimation task, and letter memory task. On the ABBA task, there was no evidence that the DUI group was more disinhibited than control participants, and their inhibitory control was no worse when they were made to inhibit to alcohol cues. The lack of group difference on these tasks is surprising given consistent evidence for impulsivity in DUI offenders across numerous studies. A possible explanation for this inconsistency is the lack of agreement between behavioral and self-report measures of impulsivity. In general, people's scores on behavioral and questionnaire-based measures of impulsivity do not correlate with one another, even when they are designed to measure identical constructs (Lane, Cherek, Rhoades, Pietras, & Tcheremissine, 2003; Lawrence, Luty, Bogdan, Sahakian, & Clark, 2009). Other studies have found that behavioral tasks are not successful in differentiating clinical groups from their nonclinical peers, even those for whom impulsivity is a core feature of their disorder (e.g., individuals with borderline personality disorder; Jacob et al., 2010).

Simulated Driving Performance

Driving in the sober state. Results of the simulated driving tasks provided insight into sober-state driving performance in DUI offenders. In understanding these results, it is important to distinguish between risk and skill-based measures of driving performance. Contemporary models of driving distinguish between driving errors associated with a lack of knowledge or skill and errors associated with drivers' willingness to tolerate unsafe levels of risk. Although unskilled drivers are more likely to be involved in motor vehicle collisions (McKnight & McKnight, 2003), adequately skilled individuals can engage in risky driving because they are motivated to do so (Ranney, 1994). Given the heightened impulsivity observed in DUI offenders, it was important to assess both skill-based driving as well as driving in situations that may elicit impulsive behavior behind the wheel, such as when participants receive reward for driving quickly but are punished for driving *too* quickly. This increased willingness to tolerate risk is thought to explain why impulsive individuals report poorer driving histories and outcomes (Owsley, McGwin, & McNeal, 2003).

Results of experiment 1 were not consistent with prediction. Despite their higher levels of self-reported impulsivity, DUI offenders showed worse sober-state driving compared to control participants only in the precision driving scenario. This scenario required participants to navigate a curve-filled country road and contained few other cars or roadway hazards. The challenge of this driving scenario was to maintain road position by making small adjustments to the steering column. DUI offenders did so with poorer precision than controls, as evidenced by more swerving within their lane as well as more instances of crossing the center or outside line of the road. DUI offenders also showed more variability in speed than did controls. These findings suggest impairment among DUI offenders in driving scenarios that require skills such as sustained attention and motor control. Although this was not consistent with my original predictions, prior work has shown that DUI offenders evidence deficits in cognitive functions such as sustained attention (Glass, Chan, & Rentz, 2000), which may explain their impairment in precision driving. In contrast, the lack of significant group differences in the motivational conflict drive does not support the notion that DUI offenders are more likely take risks while driving when doing so may yield reward. Taken together, these findings indicate that DUI offenders are more likely to show a lack of skill rather than a tendency towards taking risks behind the wheel, which may explain their poorer driving records.

Driving under alcohol. Alcohol impaired performance in both the motivational conflict and precision driving scenarios. Prior research shows that alcohol can impair skills implicated in skill-based driving (e.g., motor control, reaction time, sustained attention; Koelega, 1995; Mitchell, 1985). Intoxicated drivers also show a willingness to tolerate greater risks than when driving sober (Burian, Liguori, & Robinson, 2002). Results of this study confirmed alcohol impairment on both of these factors in both DUI offenders and controls. On the precision drive, alcohol caused greater variability in lane position, a shift that likely contributes to higher rates of vehicle collisions following alcohol consumption. On the motivational conflict drive, alcohol led to shorter braking distance, faster average speed, and greater variability in lane position. Taken together, these alcohol-induced changes in driving support the notion that alcohol may cause drivers to become more erratic and willing to tolerate greater risk, especially in the presence of opportunity for reward.

Experiment 2 was the first to use an expectancy manipulation to attempt to reduce the effect of alcohol on driving performance. This manipulation was based on a large collection of prior work showing that the behavioral effects of alcohol can be minimized by providing drinkers with feedback that alcohol will impair their performance on a skilled task (Fillmore & Vogel-Sprott, 1996; Beirness & Vogel-Sprott, 1984; Fillmore & Blackburn, 2002). Interestingly, using a very similar method of expectancy manipulation, I was not able to improve driving performance under alcohol in either the motivational conflict or precision driving scenario. Indeed, performance following 0.64 g/kg alcohol was strikingly similar to performance following 0.64 g/kg alcohol + expectancy manipulation. Theoretical accounts of functionional tolerance state that drinkers are able to offset impairment by using behavioral strategies (e.g., allocating additional effort) in order to compensate for the effects of alcohol (Vogel-Sprott, 1992). Findings on functional tolerance are noteworthy because such feedback consistently improves performance on many different types of tasks. The finding that driving performance under alcohol is not improved by expectancy manipulation is unique and suggests that alcohol effects on driving may be particularly difficult to compensate for and overcome, perhaps because driving is a relatively complex task with many cognitive demands (Maylor, Rabbitt, James, & Kerr, 1992).

The finding that DUI offenders did not differ from control participants in terms of alcohol effects on simulated driving performance indicates that they do not show increased impairment of driving ability under the drug. This was somewhat surprising given that the current sample of DUI offenders showed several characteristics previously associated with increased behavioral impairment under alcohol, such as poor driving ability when sober (Harrison & Fillmore, 2005) and impulsivity (Fillmore, Ostling, Martin, & Kelly, 2009). Nonetheless, it replicates prior research also finding that DUI offenders do not show more driving impairment under alcohol than nonoffenders (Van Dyke & Fillmore, 2014b). One possibility is that a group of more impaired DUI offenders, such as repeat offenders (Ouimet et al., 2007), may show this increased impairment under alcohol. Taken together with the findings of Van Dyke and Fillmore (2014b), the findings of experiment 2 provide strong evidence that DUI offenders are not characteristically more impaired by alcohol than their nonoffending peers.

Decision-Making Processes

If DUI offenders are not more impaired by alcohol, then they must be choosing to drive in situations that their nonoffending peers would not. Decision-making processes were explored in both experiments using the newly developed RRDD task. This task was used to explore how situational variables might influence decision making in DUI offenders by modeling a situation in which they must decide between obtaining a reward by taking risks. Results of this task were generally supportive of its validity. As expected, participants required more money to drive as level of risk increased, and this increase occurred in a linear fashion. The increase in money required to drive as a function of risk occurred in each factor, supporting the notion that participants consider time since drinking, probability of arrest, distance to be travelled, and BAC to be relevant factors when deciding whether to drive after drinking (Thurman, 1986). The finding that

DUI offenders were willing to drive for less money overall for some factors (i.e., time since drinking) supports the validity of the task, as does the finding that DUI offenders showed less of an increase in money required to drive as time since drinking decreased. This suggests that this group may be less likely to consider the variable when deciding whether to drive after drinking.

After collecting evidence for the validity of the RRDD task, the next step was to use it to understand how decision-making related to alcohol-impaired driving when an individual has consumed alcohol. In experiment 2, responses on this task were summarized as average money required to drive and risk slope. Average money required to drive provided an overall estimate of willingness to drive across different levels of risk. Risk slope provided an estimate of how much changes in risk affected motivation to drive. Less steep risk slopes suggest relative insensitivity to changes in risk. There was little effect of alcohol on responses on the RRDD task: average money required to drive and slope were generally stable between doses. This finding is surprising given ample evidence that alcohol can impair decision making across a number of contexts, including gambling (George, Rogers, & Duka, 2005) and sexual activity (Abbey, Saenz, Buck, Parkhill, & Hayman, 2006). One possibility is that alcohol did not alter responses on the RRDD task because they were hypothetical. Indeed, one study showed that alcohol did not affect impulsive responding (i.e., delay discounting) on a hypothetical money choice task (Reynolds, Richards, & de Wit, 2006). In this same study, however, alcohol caused an increase in impulsive responding when performing an experiential discounting task in which they received the reinforcer immediately after responding, effectively removing the hypothetical nature of the task. Changing the RRDD task to make it less hypothetical may improve its ability to detect acute alcohol effects. Another possibility is that higher doses of alcohol than that used in experiment 2 (0.64 g/kg) are necessary to produce reliable changes in decision-making processes.

Responses on the RRDD task were not affected by expectancy manipulation. This is also surprising given that providing a drinker with information that his or her ability to drive is extremely impaired by alcohol should increase the level of risk associated with the decision to drive after drinking. Level of risk is a central factor in decision making (Weber & Johnson, 2009), and a decider is less likely to make a choice when that choice is associated with higher levels of risk. Indeed, results of the RRDD task in both experiments showed that participants needed more incentive to drive when the level of risk increased, confirming that levels of risk played a role in decision-making processes in this sample. One possible explanation for this lack of effect is that participants did not perceive level of driving impairment under alcohol to be a pertinent factor in evaluating the level of risk associated with deciding to drive after drinking. Other outcomes, such as being arrested, may be a more salient undesirable outcome for these drivers when they are deciding whether to drive after drinking. Future research should use a more comprehensive feedback strategy that incorporates more emotionally salient outcomes to manipulate drivers' expectancies (e.g., increasing likelihood of arrest, increased punishment following arrest, increased likelihood of injuring another motorist), because emotionally salient information can influence decision making (Loewenstein, Weber, Hsee, & Welch, 2001).

Another interpretation is that the expectancy manipulation simply was not effective, although this was not supported by participants' ratings of their ability to drive.

Indeed, participants in the DUI group rated themselves as more able to drive than did controls following 0.64 g/kg alcohol, despite their performance on the driving simulator being similar to that of control participants. This finding is consistent with previous work showing that DUI offenders underestimate their level of driving impairment under alcohol (Van Dyke & Fillmore, 2014b). Experiment 2 extended this prior research by identifying a strategy for reducing perceived ability to drive while intoxicated in the DUI offenders. Following expectancy manipulation, DUI offenders rated their ability to drive at a level that was similar to control participants. This finding is important because the decision to drive after drinking is based in part on perceived level of intoxication and impairment (Quinn & Fromme, 2012). As such, altering expectations about alcohol impairment may be a viable strategy for reducing risk of impaired driving among DUI offenders. Such interventions could be modelled after existing feedback-based interventions that seek to change drinking behavior by challenging expectations about normative drinking (Walters & Neighbors, 2005). Such techniques provide more comprehensive (i.e., several sessions) expectancy challenges and are quite effective at reducing problematic alcohol-related behaviors.

This finding is consistent with the notion that DUI offenders, by virtue of their impulsivity, are not able to perceive accurately the degree to which alcohol impairs their driving performance. One characteristic of impulsive individuals is limited insight into their own performance (de Bruijn et al., 2006), leading to overestimation of their competence at certain tasks. In the context of alcohol intoxication, high-risk impulsive individuals (e.g., binge drinkers, those with ADHD) appear to overestimate their abilities when intoxicated (Marczinski, Harrison, & Fillmore, 2008; Weafer, Camarillo, Fillmore, Milich, & Marczinski, 2008). Participants' ratings of perceived ability to drive supported the notion that DUI offenders underestimate their level of impairment, a deficit that can be corrected using external sources of information to develop a more realistic evaluation of their abilities.

Limitations and Future Directions

The research in this dissertation provides into impulsivity, decision-making, and acute responses to alcohol and expectancy manipulation among DUI offenders; however, there are some interpretive limitations to these findings. I was not able to recruit a group of recidivist DUI offenders. Repeat offenders may be more likely to show higher levels of impulsivity and more pronounced differences in decision making compared to their nonoffending peers (Ouimet et al., 2007). Considering previous work showing differences between recidivist and one-time DUI offenders, future research should include both of these groups in order to identify differences between them. Another limitation is that experiment 2 only examined driving performance and decision-making under a single active dose of alcohol (i.e., 0.64 g/kg). This dose was chosen for its ecological relevance to DUI: it is the legal limit for driving in the United States. However, it is possible that DUI offenders will show more impairment than controls below the legal limit of intoxication. Future research should include an additional lower dose of alcohol to test this possibility.

Another limitation to the current research involves the RRDD task. Because this task was developed for this pair of experiments, there is little evidence for its validity beyond data reported in this dissertation. Several findings supported the validity of the task, but there are still many open questions about how to interpret the results of the task.

Additional studies will be necessary to refine this task. Manipulations of parametric characteristics (e.g., changing the levels of risk and reward) and testing different methods of data reduction and interpretation may increase the validity of the task. An advantage of this task is its flexibility. Simple changes to the scenarios could be made to include additional risk factors, such as driving after mixing alcohol and other drugs. Such alterations could be useful in understanding how people decide to drive after drinking in many different circumstances of substance use.

The finding that expectancy manipulation decreased perceived driving ability in DUI offenders could guide the development of interventions for this group. However, it is unclear whether this finding will generalize to behavior outside of the laboratory setting. Additional research will be necessary to determine whether this style of expectancy manipulation causes enduring changes in perceived ability to drive while intoxicated and test whether these reductions result in decreased rates of driving while intoxicated. One method for establishing the validity of this task will be examining its relation to DUI variables at the level of individual difference. The current study was not sufficiently powered to conduct these analyses, so future research should include larger sample to determine whether responses on this task relate to drinking and driving behavior.

In sum, results of these two experiments provide new information about impulsivity and acute responses on alcohol in DUI offenders. These individuals are indeed more impulsive than their nonoffending peers, and this impulsivity appears to manifest as riskier decision making in the context of choosing whether to drive after drinking. Although DUI offenders do not appear to become more impaired under

Results of this study cannot be attributed to group differences in demographic variables or drinking history, because the groups were matched on these variables (see Experiment 1). The carefully controlled weight-adjusted dosing procedure ensured that BACs that were similar between groups and sessions. Expired air samples confirmed that participants achieved similar BACs before and after completing the tasks during each session in which alcohol was administered.

References

Abbey, A., Saenz, C., Buck, P. O., Parkhill, M. R., & Hayman, L. W. (2006). The effects of acute alcohol consumption, cognitive reserve, partner risk, and gender on sexual decision making. *Journal of Studies on Alcohol, 67*, 113-121.

Aberg, L. (1993). Drinking and driving: Intentions, attitudes, and social norms of Swedish male drivers. *Accident Analysis and Prevention, 25*, 289-296.

Aston, E. R., & Liguori, A. (2013). Self-estimation of blood alcohol concentration: A review. *Addictive Behaviors, 38,* 1944-1951.

Bakker, L. W., Hudson, S. M., & Ward, T. (2000). Reducing recidivism in driving while disqualified: A treatment evaluation. *Criminal Justice and Behavior, 27*, 531-560.

Barkley, R. A. (2011). *Barkley Adult ADHD Rating Scale*. New York: The Guilford Press.

Barkley, R. A., Murphy, K. R., & Bush, T. (2001). Time perception and reproduction in young adults with attention deficit hyperactivity disorder. *Neuropsychology, 15*, 351-360.

Bechara, A. (2005). Decision making, impulse control and loss of willpower to resist drugs: A neurocognitive perspective. *Nature Neuroscience, 8*, 1458-1463.

Beirness, D. J. (1987). Self-estimates of blood-alcohol concentration in drinking-driving Context. *Drug and Alcohol Dependence*, 19, 79-90.

Burian, S. E., Liguori, A., & Robinson, J. H. (2002). Effects of alcohol on risk-taking during simulated driving. *Human Psychopharmacology: Clinical and Experimental, 17*, 141-150.

Buzzed driving is drunk driving. (2013). Retrieved July 10, 2013, from http://buzzeddriving.adcouncil.org.

Cavaiola, A. A., & Wuth, C. (2002). *Assessment and Treatment of the DWI Offender*. Binghamton, New York: The Haworth Press, Inc.

Cavaiola, A. A., Strohmetz, D. B., & Abreo, S. D. (2007). Characteristics of DUI recidivists: a 12-year follow-up study of first time DUI offenders. *Addictive Behaviors, 32*, 855-861.

Cavaiola, A. A., Strohmetz, D. B., Wolf, J. M., & Lavender, N. J. (2003). Comparison of DWI offenders with non-DWI individuals on the MMPI-2 and the Michigan Alcoholism Screening Test. *Addictive Behaviors, 28*, 971-977.

Chalmers, D., Olenick, N. L., & Stein, W. (1993). Dispositional traits as risk in problem drinking. *Journal of Substance Abuse, 5*, 401-410.

Christiansen, B. A., Roehling, P. V., Smith, G. T., & Goldman, M. S. (1989). Using alcohol expectancies to predict adolescent drinking behavior after one year. *Journal of Consulting and Clinical Psychology*, *57*, 93-99.

Collins, R. L., & Lapp, W. M. (1992). The temptation and restraint inventory for measuring drinking restraint. *British Journal of Addiction, 87*, 625-633.

Conrod, P. J., Castellanos-Ryan, N., & Strang, J. (2010). Brief, personality-targeted coping skills interventions and survival as a non-drug user over a 2-year period during adolescence. *Archives of General Psychiatry, 67*, 85-93.

de Bruijn, E. R. A., Grootens, K. P., Verkes, R. J., Buchholz, V., Hummelen, J. W., & Hulstijn, W. (2006). Neural correlates of impulsive responding in borderline personality disorder: ERP evidence for reduced action monitoring. *Journal of Psychiatric Research, 40*, 428-437.

Dick, D. M., Smith, G., Olausson, P., Mitchell, S. H., Leeman, R. F., O'Malley, S. S., & Sher, K. (2010). Understanding the construct of impulsivity and its relationship to alcohol use disorders. *Addiction Biology, 15*, 217-226.

Donovan, D. M., & Marlatt, G. A. (1982). Personality subtypes among driving-while-intoxicated offenders: Relationship to drinking behavior and driving risk. *Journal of Consulting and Clinical Psychology, 50*, 241-249.

Donovan, D. M., Marlatt, G. A., & Salzberg, P. M. (1983). Drinking dehavior, personality-factors and high-risk driving: A review and theoretical formulation. *Journal of Studies on Alcohol, 44*, 395-428.

Donovan, D. M., Umlauf, R. L., & Salzberg, P. M. (1990). Bad drivers: Identification of a target group for alcohol-related prevention and early intervention. *Journal of Studies on Alcohol, 51*, 136-141.

Dougherty, D. M., Mathias, C. W., Marsh, D. M., & Jagar, A. A. (2005). Laboratory behavioral measures of impulsivity. *Behavior Research Methods, 37*, 82-90.

Dunn, M. E., Lau, H. C., & Cruz, I. Y. (2000). Changes in activation of alcohol expectancies in memory in relation to changes in alcohol use after participation in an expectancy challenge program. *Experimental and Clinical Psychopharmacology, 8,* 566-575.

Easdon, C., Izenberg, A., Armilio, M. L., Yu, H., & Alain, C. (2005). Alcohol consumption impairs stimulus- and error-related processing during a Go/No-Go Task. *Cognitive Brain Research, 25,* 873-883.

Federal Bureau of Investigation (2015). Crime in the United States, 2014. Retrieved from https://www.fbi.gov/about-us/cjis/ucr/crime-in-the-u.s/2014/crime-in-the-u.s.-2014/tables/table-29

Fillmore, M. T. (2001). Cognitive preoccupation with alcohol and binge drinking in college students: Alcohol-induced priming of the motivation to drink. *Psychology of Addictive Behaviors, 15*, 325-332.

Fillmore, M. T., & Blackburn, J. (2002). Compensating for alcohol-induced impairment: Alcohol expectancies and behavioral disinhibition. *Journal of Studies on Alcohol, 63*, 237-246.

Fillmore, M. T., Ostling, E. W., Martin, C. A., & Kelly, T. H. (2009). Acute effects of alcohol on inhibitory control and information processing in high and low sensation-seekers. *Drug and Alcohol Dependence, 100*, 91-99.

Fillmore, M. T., Roach, E.L., & Rice, J. T. (2002). Does caffeine counteract alcohol-induced impairment? The ironic effects of expectancy. *Journal of Studies on Alcohol, 63*, 745-754.

Fillmore, M. T., & Vogel-Sprott, M. (1996). Evidence that expectancies mediate behavioral impairment under alcohol. *Journal of Studies on Alcohol, 57*, 598-603.

Fine, E. W., & Steer, R. A. (1979). Short-term spatial memory deficits in men arrested for driving while intoxicated. *American Journal of Psychiatry, 136*, 594-597.

Finn, P. R., Justus, A., Mazas, C., & Steinmetz, J. E. (1999). Working memory, executive processes and the effects of alcohol on Go/No-Go learning: Testing a model of behavioral regulation and impulsivity. *Psychopharmacology, 146*, 465-472.

Finn, P. R., Mazas, C. A., Justus, A. N., & Steinmetz, J. (2002). Early-onset alcoholism with conduct disorder: Go/no go learning deficits, working memory capacity, and personality. *Alcoholism: Clinical and Experimental Research, 26*, 186-206.

First, M. B., Spitzer, R. L., Gibbon, M., & Williams, J. B. W. (2002). Structured clinical interview for DSM-IV-TR axis I disorders, research version, patient edition. *New York: Biometrics Research, New York State Psychiatric Institute*.

Fleming, K. A., & Bartholow, B. D. (2014). Alcohol cues, approach bias, and inhibitory control: Applying a dual process model of addiction to alcohol sensitivity. *Psychology of Addictive Behaviors, 28*, 85-96.

Fromme, K., & D'Amico, E. J. (2000). Measuring adolescent alcohol outcome expectancies. *Psychology of Addictive Behaviors, 14*, 206-212.

Gehring, W. J., Goss, B., Coles, M. G., Meyer, D. E., & Donchin, E. (1993). A neural system for error detection and compensation. *Psychological Science, 4*, 385-390.

George, S., Rogers, R. D., & Duka, T. (2005). The acute effect of alcohol on decision making in social drinkers. *Psychopharmacology, 182*, 160-169.

Gerbing, D. W., Ahadi, S. A., & Patton, J. H. (1987). Toward a conceptualization of impulsivity: Components across the behavioral and self-report domains. *Multivariate Behavioral Research, 22*, 357-379.

Glass, R. J., Chan, G., & Rentz, D. (2000). Cognitive impairment screening in second offense DUI programs. *Journal of Substance Abuse Treatment, 19*, 369-373.

Glicksohn, J., Leshem, R., & Aharoni, R. (2006). Impulsivity and time estimation: Casting a net to catch a fish. *Personality and Individual Differences, 40*, 261-271.

Goldberg, L., & Havard, J. D. J. (1968). Research on the effects of alcohol and drugs on driver behaviour and their importance as a cause of road accidents. Organization for Economic Cooperation and Development, Paris.

Groeger, J. A. (2000). *Understanding driving: Applying cognitive psychology to a complex everyday task*. New York: Psychology Press.

Gustin, J. L., & Simons, J. S. (2008). Perceptions of level of intoxication and risk related to drinking and driving. *Addictive Behaviors, 33*, 605-615.

Harrison, E. L., & Fillmore, M. T. (2011). Alcohol and distraction interact to impair driving performance. *Drug and Alcohol Dependence, 117*, 31-37.

Harrison, E. L., & Fillmore, M. T. (2005). Are bad drivers more impaired by alcohol? Sober driving precision predicts impairment from alcohol in a simulated driving task. *Accident Analysis and Prevention, 37*, 882-889.

Hinson, J. M., Jameson, T. L., & Whitney, P. (2003). Impulsive decision making and working memory. *Journal of Experimental Psychology: Learning Memory and Cognition, 29*, 298-306.

Holroyd, C. B., & Coles, M. G. H. (2002). The neural basis. of human error processing: Reinforcement learning, dopamine, and the error-related negativity. *Psychological Review, 109*, 679-709.

Hubicka, B., Kallmen, H., Hiltunen, A., & Bergman, H. (2010). Personality traits and mental health of severe drunk drivers in Sweden. *Social Psychiatry and Psychiatric Epidemiology, 45*, 723-731.

Jacob, G. A., Gutz, L., Bader, K., Lieb, K., Tuscher, O., & Stahl, C. (2010). Impulsivity in borderline personality disorder: Impairment in self-report measures, but not behavioral inhibition. *Psychopathology, 43*, 180-188.

Jones, B. T., Corbin, W., & Fromme, K. (2001). A review of expectancy theory and alcohol consumption. *Addiction, 96*, 57-72.

Kaiser, A. J., Milich, R., Lynam, D. R., & Charnigo, R. J. (2012). Negative urgency, distress tolerance, and substance abuse among college students. *Addictive Behaviors, 37*, 1075-1083.

Kasar, M., Gleichgerrcht, E., Keskinkilic, C., Tabo, A., & Manes, F. F. (2010). Decision-making in people who relapsed to driving under the influence of alcohol. *Alcoholism: Clinical and Experimental Research, 34*, 2162-2168.

Kaufman, A. S., & Kaufman, N. L. (2004). *Kaufman Brief Intelligence Test: Manual*. Circle Pines, MN: American Guidance Service.

Koelega, H. S. (1995). Alcohol and vigilance performance: A review. *Psychopharmacology, 118*, 233-249.

Lane, S. D., Cherek, D. R., Rhoades, H. M., Pietras, C. J., & Tcheremissine, O. V. (2003). Relationships among laboratory and psychometric measures of impulsivity: Implications in substance abuse and dependence. *Addictive Disorders & Their Treatment, 2*, 33-40.

Lapham, S. C., de Baca, J. C., McMillan, G., & Hunt, W. C. (2004). Accuracy of alcohol diagnosis among DWI offenders referred for screening. *Drug and Alcohol Dependence, 76*, 135-141.

Lawrence, A. J., Luty, J., Bogdan, N. A., Sahakian, B. J., & Clark, L. (2009). Impulsivity and response inhibition in alcohol dependence and problem gambling. *Psychopharmacology, 207*, 163-172.

Lewis, M. W., Merz, J. F., Hays, R. D., & Nicholas, R. (1995). Perceptions of intoxication and impairment at arrest among adults convicted of driving under the influence of alcohol. *Journal of Drug Issues, 25,* 141-160.

Li, C. S. R., Milivojevic, V., Kemp, K., Hong, K., & Sinha, R. (2006). Performance monitoring and stop signal inhibition in abstinent patients with cocaine dependence. *Drug and Alcohol Dependence, 85*, 205-212.

Logan, G. D., Cowan, W. B., & Davis, K. A. (1984). On the ability to inhibit simple and choice reaction-time responses: A model and a method. *Journal of Experimental Psychology: Human Perception and Performance, 10*, 276-291.

Loewenstein, G. F., Weber, E. U., Hsee, C. K., & Welch, N. (2001). Risk as feelings. *Psychological Bulletin, 127*, 267-286.

MacDonald, T. K., Zanna, M. P., & Fong, G. T. (1995). Decision-making in altered states: Effects of alcohol on attitudes toward drinking and driving. *Journal of Personality and Social Psychology, 68*, 973-985.

Marczinski, C. A., Harrison, E. L., & Fillmore, M. T. (2008). Effects of alcohol on simulated driving and perceived driving impairment in binge drinkers. *Alcoholism: Clinical and Experimental Research, 32*, 1329-1337.

Maylor, E. A., Rabbitt, P. M. A., James, G. H., & Kerr, S. A. (1992). Effects of alcohol, practice, and task complexity on reaction-time distributions. *Quarterly Journal of*

Experimental Psychology Section A: Human Experimental Psychology, 44, 119-139.

McCarthy, D. M., Lynch, A. M., & Pedersen, S. L. (2007). Driving after use of alcohol and marijuana in college students. *Psychology of Addictive Behaviors, 21*, 425-430.

McCarthy, D. M., Pedersen, S. L., Thompsen, D. M., & Leuty, M. E. (2006). Development of a measure of drinking and driving expectancies for youth. *Psychological Assessment, 18*, 155-164.

McKnight, A. J., & McKnight, A. S. (2003). Young novice drivers: Careless or clueless? *Accident Analysis and Prevention, 35*, 921-925.

McMillen, D. L., Adams, M. S., Wells-Parker, E., Pang, M. G., & Anderson, B. J. (1992). Personality traits and behaviors of alcohol-impaired drivers: A comparison of first and multiple offenders. *Addictive Behaviors, 17*, 407-414.

Miller, M. A., & Fillmore, M. T. (2013). Cognitive and behavioral preoccupation with alcohol in recidivist DUI offenders. *Journal of Studies on Alcohol and Drugs, 75*, 1018-1022.

Mischel, W., & Shoda, Y. (1995). A cognitive-affective system theory of personality: Reconceptualizing situations, dispositions, dynamics, and invariance in personality structure. *Psychological Review, 102*, 246-268.

Mitchell, M. C. (1985). Alcohol-induced impairment of central nervous system function: behavioral skills involved in driving. *Journal of Studies on Alcohol, Supplement, 10*, 109-116.

Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex "frontal lobe" tasks: A latent variable analysis. *Cognitive Psychology, 41*, 49-100.

Myerson, J., Green, L., & Warusawitharana, M. (2001). Area under the curve as a measure of discounting. *Journal of the Experimental Analysis of Behavior, 76*, 235-243.

Morris, N., & Jones, D. M. (1990). Memory updating in working memory: The Role of the central executive. *British Journal of Psychology, 81*, 111-121.

National Highway Traffic Safety Administration. (2008). National survey of drinking and driving attitudes and behaviors (Report No. DOT HS 811 342). Washington, DC: US Department of Transportation.

National Highway Traffic Safety Administration. (2012). 2011 Traffic safety facts: Alcohol-impaired driving (Report No. DOT HS 811 700). Washington, DC: US Department of Transportation.

National Highway Traffic Safety Administration. (2015). 2014 Traffic safety facts: Alcohol-impaired driving (Report No. DOT HS 812 231). Washington, DC: US Department of Transportation.

National Institute on Alcohol Abuse and Alcoholism. (2004). NIAAA council approves definition of binge drinking. *NIAAA Newsletter*, Retrieved from http://pubs.niaaa.nih.gov/publications/Newsletter/winter2004/Newsletter_Number3.pdf

Nigg, J. T. (2000). On inhibition/disinhibition in developmental psychopathology: Views from cognitive and personality psychology and a working inhibition taxonomy. *Psychological Bulletin, 126*, 220-246.

Nochajski, T. H., & Stasiewicz, P. R. (2006). Relapse to driving under the influence (DUI): A review. *Clinical Psychology Review, 26*, 179-195.

Nolan, Y., Johnson, J. A., & Pincus, A. L. (1994). Personality and drunk driving: Identification of DUI types using the Hogan Personality Inventory. *Psychological Assessment, 6*, 33-40.

O'Leary-Barrett, M., Mackie, C. J., Castellanos-Ryan, N., Al-Khudhairy, N., & Conrod, P. J. (2010). Personality-targeted interventions delay uptake of drinking and decrease risk of alcohol-related problems when delivered by teachers. *Journal of the American Academy of Child and Adolescent Psychiatry, 49*, 954-963

Ouimet, M. C., Brown, T. G., Nadeau, L., Lepage, M., Pelletier, M., Couture, S., …Ng Ying Kin, N. M. K. (2007). Neurocognitive characteristics of DUI recidivists. *Accident Analysis and Prevention, 39*, 743-750.

Owsley, C., McGwin, G., Jr., & McNeal, S. F. (2003). Impact of impulsiveness, venturesomeness, and empathy on driving by older adults. *Journal of Safety Research, 34*, 353-359.

Patton, J. H., Stanford, M. S., & Barratt, E. S. (1995). Factor structure of the Barratt impulsiveness scale. *Journal of Clinical Psychology, 51*, 768-774.

Pike, E., Stoops, W. W., Fillmore, M. T., & Rush, C. R. (2013). Drug-related stimuli impair inhibitory control in cocaine abusers. *Drug and Alcohol Dependence, 133*, 768-771.

Potts, G. F., George, M. R. M., Martin, L. E., & Barratt, E. S. (2006). Reduced punishment sensitivity in neural systems of behavior monitoring in impulsive individuals. *Neuroscience Letters, 397*, 130-134.

Quinn, P. D., & Fromme, K. (2012). Event-level associations between objective and subjective alcohol intoxication and driving after drinking across the college years. *Psychology of Addictive Behaviors, 26*, 384-392.

Ranney, T. A. (1994). Models of driving behavior: A review of their evolution. *Accident Analysis and Prevention, 26*, 733-750.

Reynolds, B., Richards, J. B., & de Wit, H. (2006). Acute-alcohol effects on the Experiential Discounting Task (EDT) and a question-based measure of delay discounting. *Pharmacology, Biochemistry, and Behavior, 83*, 194-202.

Ridderinkhof, K. R., Ullsperger, M., Crone, E. A., & Nieuwenhuiss, S. (2004). The role of the medial frontal cortex in cognitive control. *Science, 306*, 443-447.

Roberts, W., Fillmore, M. T., & Milich, R. (2011). Linking impulsivity and inhibitory control using manual and oculomotor response inhibition tasks. *Acta Psychologica, 138*, 419-428.

Roehrich, L., & Goldman, M. S. (1995). Implicit priming of alcohol expectancy memory processes and subsequent drinking behavior. *Experimental and Clinical Psychopharmacology, 3*, 402.

Ryb, G. E., Dischinger, P. C., Kufera, J. A., & Read, K. M. (2006). Risk perception and impulsivity: Association with risky behaviors and substance abuse disorders. *Accident Analysis and Prevention, 38*, 567-573.

Shakeshaft, A. P., Bowman, J. A., & Sanson-Fisher, R. W. (1998). Comparison of three methods to assess binge consumption: One-week retrospective drinking diary, AUDIT, and quantity/frequency. *Substance Abuse, 19*, 191-203.

Sharkansky, E. J., & Finn, P. R. (1998). Effects of outcome expectancies and disinhibition on ad lib alcohol consumption. *Journal of Studies on Alcohol, 59*, 198-206.

Sher, K. J., Wood, M. D., Wood, P. K., & Raskin, G. (1996). Alcohol outcome expectancies and alcohol use: A latent variable cross-lagged panel study. *Journal of Abnormal Psychology, 105*, 561-574.

Shiels, K., & Hawk, L. W. (2010). Self-regulation in ADHD: The role of error processing. *Clinical Psychology Review, 30*, 951-961.

Sklar, A. L., Boissoneault, J., Fillmore, M. T., & Nixon, S. J. (2014). Interactions between age and moderate alcohol effects on simulated driving performance. *Psychopharmacology, 231*, 557-566.

Sobell, L. C., & Sobell, M. B. (1992). Timeline follow-back: A technique for assessing self-reported alcohol consumption. In R. Litten & J. Allen (Eds.), *Measuring alcohol consumption: Psychosocial and biochemical methods* (pp. 41-72). Totowa, New Jersey: Humana Press.

Stautz, K., & Cooper, A. (2013). Impulsivity-related personality traits and adolescent alcohol use: A meta-analytic review. *Clinical Psychology Review, 33*, 574-592.

Steele, C. M., & Josephs, R. A. (1990). Alcohol myopia: Its prized and dangerous effects. *American Psychologist, 45*, 921-933.

Sutker, P. B., Brantley, P. J., & Allain, A. N. (1980). MMPI response patterns and alcohol-consumption in DUI offenders. *Journal of Consulting and Clinical Psychology, 48*, 350-355.

Thurman, Q. C. (1986). Estimating social psychological effects in decisions to drink and drive: A factorial survey approach. *Journal of Studies on Alcohol, 47*, 447-454.

Turrisi, R., & Jaccard, J. (1991). Judgment processes relevant to drunk driving. *Journal of Applied Social Psychology, 21*, 89-118.

Van Dyke, N., & Fillmore, M. T. (2014a). Acute effects of alcohol on inhibitory control and simulated driving in DUI offenders. *Journal of Safety Research, 49*, 1-11.

Van Dyke, N., & Fillmore, M. T. (2014b). Alcohol effects on simulated driving performance and self-perceptions of impairment in DUI offenders. *Experimental and Clinical Psychopharmacology, 22*(6), 484-493.

van Meel, C. S., Heslenfeld, D. J., Oosterlaan, J., & Sergeant, J. A. (2007). Adaptive control deficits in attention-deficit/hyperactivity disorder (ADHD): The role of error processing. *Psychiatry Research, 151*, 211-220.

Verdejo-Garcia, A., Bechara, A., Recknor, E. C., & Perez-Garcia, M. (2007). Negative emotion-driven impulsivity predicts substance dependence problems. *Drug and Alcohol Dependence, 91*, 213-219.

Vogel-Sprott, M. (1992). *Alcohol tolerance and social drinking: Learning the consequences*. New York, NY: Guilford Press.

Vogel-Sprott, M., & Sdao-Jarvie, K. (1989). Learning alcohol tolerance: The contribution of response expectancies. *Psychopharmacology, 98*, 289-296.

Walters, S. T., & Neighbors, C. (2005). Feedback interventions for college alcohol misuse: What, why and for whom? *Addictive Behaviors, 30*, 1168-1182.

Watson, P. E., Watson, I. D., & Batt, R. D. (1981). Prediction of blood-alcohol concentrations in human subjects: Updating the Widmark Equation. *Journal of Studies on Alcohol, 42*, 547-556.

Weafer, J., Camarillo, D., Fillmore, M. T., Milich, R., & Marczinski, C. A. (2008). Simulated driving performance of adults with ADHD: Comparisons with alcohol intoxication. *Experimental and Clinical Psychopharmacology, 16*, 251-263.

Weafer, J., & Fillmore, M. T. (2015). Alcohol-related cues potentiate alcohol impairment of behavioral control in drinkers. *Psychology of Addictive Behaviors, 29*, 290-299.

Weber, E. U., & Johnson, E. J. (2009). Mindful judgment and decision making. *Annual Review of Psychology, 60*, 53-85.

Whiteside, S. P., & Lynam, D. R. (2001). The five factor model and impulsivity: Using a structural model of personality to understand impulsivity. *Personality and Individual Differences, 30*, 669-689.

Wittmann, M., & Paulus, M. P. (2008). Decision making, impulsivity and time perception. *Trends in Cognitive Sciences, 12*, 7-12.

Wood, M. D., Capone, C., Laforge, R., Erickson, D. J., & Brand, N. H. (2007). Brief motivational intervention and alcohol expectancy challenge with heavy drinking college students: A randomized factorial study. *Addictive Behaviors, 32*, 2509-2528.

Zador, P. L., Krawchuk, S. A., & Voas, R. B. (2000). Alcohol-related relative risk of driver fatalities and driver involvement in fatal crashes in relation to driver age and gender: An update using 1996 data. *Journal of Studies on Alcohol, 61*, 387-395.

Zapolski, T. C., Settles, R. E., Cyders, M. A., & Smith, G. T. (2010). Borderline personality disorder, bulimia nervosa, antisocial personality disorder, ADHD, substance use: Common threads, common treatment needs, and the nature of impulsivity. *Independent Practitioner, 30*, 20-23.

Curriculum Vitae
Walter Roberts

Education:

Clinical Psychology Internship Placement — July 2014- July 2016
University of Kentucky Internship Consortium Program

Master of Science in Clinical Psychology — December 2011
University of Kentucky

Bachelor of Arts in Psychology — May 2009
Minor in Sociology
Middle Tennessee State University

Research Grants and Fellowships

Principal Investigator — July 2014-June 2016
Effects of alcohol and the environment on driving ability in high-risk drivers. National Institute on Alcohol Abuse and Alcoholism (NIAAA). F31-AA022263-01A1. Priority score: 11
Amount: $96,054

Research Trainee — July 2013- June 2014
Research Training in Drug Abuse Behavior. National Institute on Drug Abuse (NIDA). T32-DA07304. Principal Investigator/Director: Craig R. Rush, Ph.D.
Amount: $24,000 yearly stipend and tuition scholarship

Fellowship Recipient — July 2012-June 2013
University of Kentucky Presidential Fellowship
Amount: $15,000 yearly stipend and tuition scholarship

Fellowship Recipient — August 2009-July 2012
University of Kentucky Daniel R. Reedy Quality Achievement Fellowship
Amount: $3,000 yearly award

Fellowship Recipient — August 2009- July 2012
University of Kentucky Multi-Year Fellowship
Amount: $18,000 yearly stipend and tuition scholarship

Scholarship Recipient August 2008- May 2009
Middle Tennessee State University Undergraduate Research, Scholarship and Creative Activity (URSCA) Scholarship
Amount: $3,450

Honors and Awards:

University of Kentucky Michael T Nietzel Award 2016

Children and Adults with Attention-Deficit/Hyperactivity Disorder (CHADD) Young Scientist Award 2015

University of Kentucky Jesse G. Harris Dissertation Award 2013

Research Society on Alcoholism Enoch Gordis Award Finalist 2013

University of Kentucky Predoctoral Research Award 2011

Kentucky Psychological Association Graduate Poster Session First Place 2011

Larry Morris Outstanding Senior in Psychology Award 2009

Psi Chi, National Honor Society in Psychology 2008

Phi Kappa Phi Honor Society 2008

Publications

Derefinko, K. J., Eisenlohr-Moul, T. A., Peters, J. R., **Roberts, W.**, Walsh, E. C., Milich, R., & Lynam, D. R. (in press). Physiological reactivity to reward and extinction predicts alcohol, marijuana, and cigarette use two years later. *Drug and Alcohol Dependence.*

Roberts, W., Monem, R. G., & Fillmore, M. T. (2016). Multisensory stop signals can reduce the disinhibiting effects of alcohol in healthy adults. *Alcoholism: Clinical and Experimental Research, 40,* 591-598.

Roberts, W., Milich, M. T., & Fillmore, R. (2016). The effects of preresponse cues on inhibitory control and response speed in adults with ADHD. *Journal of Attention Disorders, 20,* 317-324.

Roberts, W., & Fillmore, M. T. (2015). Attentional bias to alcohol-related stimuli as an indicator of changes in motivation to drink. *Psychology of Addictive Behaviors, 29,* 63-70.

Marks, K. R., **Roberts, W.,** Stoops, W. W., Pike, E., Fillmore, M. T., & Rush, C. R. (2014). Gaze time as a sensitive measure of cocaine-related attentional bias. *Addiction, 109,* 1501-1508.

Roberts, W., Milich, R., & Barkley, R. (2014). Primary symptoms, diagnostic criteria, prevalence, and subtyping. In R. Barkley (Ed), Attention-Deficit Hyperactivity Disorder: A Handbook for Diagnosis and Treatment, Fourth Edition. New York: Guilford Press.

Roberts, W., Peters, J. R., Adams, Z. W., Lynam, D. R., & Milich, R. (2014). Identifying the facets of impulsivity that explain the relation between ADHD symptoms and substance use in a nonclinical sample. *Addictive Behaviors, 39,* 1272-1277.

Roberts, W., Miller, M. A., Weafer, J., & Fillmore, M. T. (2014). Heavy drinking and the role of inhibitory control of attention. *Experimental and Clinical Psychopharmacology, 22,* 133-140.

Roberts, W., & Milich, R. (2013). ADHD and Behavior Disorders in Children. In E. D. Diener & R. Biswas-Diener (Eds), Noba textbook series: Psychology. Champaign, IL: DEF Publishers. DOI: www.nobaproject.com

Roberts, W., & Milich, R. (2013). Examining the proposed changes to ADHD in the DSM-5: One step forward and two steps back. *The ADHD Report, 21,* 1-6.

Roberts, W., Milich, M. T., & Fillmore. R. (2013). Reduced acute recovery from alcohol in adults with ADHD. *Psychopharmacology, 228,* 65-74.

Roberts, W., Fillmore, M. T., & Milich, R. (2012). Constraints on information processing capacity in adults with ADHD. *Neuropsychology*, *26,* 695-703.

Roberts, W., Fillmore, M. T., & Milich, R. (2012). Drinking to distraction: Does alcohol increase attentional bias in adults with ADHD? *Experimental and Clinical Psychopharmacology, 20,* 107-117.

Roberts, W., Fillmore, M. T., & Milich, R. (2011). Separating automatic and intentional inhibitory mechanisms in adults with attention deficit hyperactivity disorder. *Journal of Abnormal Psychology, 120,* 223-233.

Adams, Z. W., **Roberts, W.**, Fillmore, M. T., & Milich, R. (2011). Does response variability predict distractibility among adults with attention-deficit/hyperactivity disorder? *Psychological Assessment, 23,* 427-436.

Roberts, W., Fillmore, M. T., & Milich, R. (2011). Linking impulsivity and inhibitory control using manual and oculomotor response inhibition tasks. *Acta Psychologica, 138*, 419-428.

Presentations:

Roberts, W., & Fillmore, M. T. (2016). *Pairing alcohol cues with reward increases motivation to drink in social drinkers.* Poster presented at the annual meeting of the Research Society on Alcoholism, New Orleans, LA.

Roberts, W., & Fillmore, M. T. (2015). *Redundant stop signals reduce the disinhibiting effect of alcohol.* Poster presented at the annual meeting of the Research Society on Alcoholism, San Antonio, TX.

Roberts, W., & Fillmore, M. T. (2014). *Using the redundant signal effect to strengthen inhibitory control.* Poster presented at the biannual meeting of the International Society for Research on Impulsivity, Cambridge, United Kingdom.

Roberts, W., & Fillmore, M. T. (2014). *Heavy drinking and the role of inhibitory control of attention.* Poster presented at the annual meeting of the Research Society on Alcoholism, Bellevue, WA.

Roberts, W., & Fillmore, M. T. (2014). *Attentional bias to alcohol-related stimuli and the self-reported desire to drink following a dose of alcohol.* Paper presented at the annual meeting of the College of Problems on Drug Dependence, San Juan, PR.

Roberts, W., & Fillmore, M. T. (2013). *Acute effects of alcohol on attentional bias during the ascending and descending limbs.* Paper presented at the annual meeting of the Research Society on Alcoholism, San Francisco, CA.

Marks, K. R., Stoops, W. W., Pike, E., **Roberts, W.**, Fillmore, M. T., & Rush, C. R. (2013). *Gaze time as a sensitive measure of cocaine-related attentional bias.* Poster presented at the annual meeting of the College on Problems of Drug Dependence, San Diego, CA.

Roberts, W., Milich, R., & Fillmore, M. T. (2012). *Dangerous descent: Reduced acute tolerance to alcohol in adults with ADHD.* Poster presented at the annual meeting of the Research Society on Alcoholism, San Francisco, CA.

Roberts, W., Milich, R., & Fillmore, M. T. (2011, July). *Linking Impulsivity and Response Inhibition in Adults with ADHD.* Poster presented at the biannual meeting of the International Society for Child and Adolescent Psychopathology, Chicago, IL.

Roberts, W., Fillmore, M. T., & Milich, R. (2011, July). *Drinking to distraction: Does alcohol increase attentional bias in adults with ADHD?* Paper presented at annual meeting of the Research Society on Alcoholism, Atlanta, GA.

Adams, Z. W., **Roberts, W.** Fillmore, M. T., & Milich, R. (2010, May). *Does response variability predict distractibility among adults with attention-deficit/hyperactivity disorder?* Poster presented at the Eunethydis ADHD Conference, Amsterdam, NL.

Roberts, W., Fromuth, M. E., & Fuller, D. K. (2009, August). *Do personality characteristics moderate between AD/HD symptomology and relationship satisfaction?* Poster presented at the annual meeting of the American Psychological Association, Toronto, ON.

Roberts, W., & Fromuth, M. E. (2009, February). *The relationship between attention problems and relationship satisfaction.* Poster presented at the annual meeting of the Southeastern Psychological Association, New Orleans, LA.

Teaching Experience:

Clinic Assistant Coordinator 2013

Undergraduate Teaching Assistant—General Psychology 2008

Clinical Experience

Intern at Orofacial Pain Center January 2015-Current

Intern at Eastern State Psychiatric Hospital July 2015-December 2015

Intern at University of Kentucky Counseling Center January 2015-July 2015

Intern at Cardinal Hill Rehabilitation Hospital July 2014-December 2014

Psychological Assessment Coordinator at Harris PSC January 2014-July 2014

CA Coordinator at Harris PSC July 2013-December 2013

Therapist at University of Kentucky Counseling Center August 2011-May 2012

Therapist at Jesse Harris PSC May 2010-June 2014

Clinician at Amend Psychological Services Center August 2010-May 2011

University and Academic Service:

2014-2015 Behavioral Neuroscience and Psychopharmacology Colloquium Series Organizer.

2008-2009 Middle Tennessee State University Institutional Review Board Undergraduate Representative

2011- Present Ad hoc reviewer:
Addiction Research & Theory
Abnormal Child Psychology
Journal of Studies on Drugs and Alcohol
Journal of Attention Disorders
Addictive Behaviors
Journal of Abnormal Psychology

Professional Group Affiliations:

2011-Present Research Society on Alcoholism, Student Affiliate

2008-Present American Psychological Association, Student Affiliate