

**The Effects of Alcohol, Caffeine and Expectancies on Personal Agency, Impulsivity and
Risk Taking**

BY

ADRIENNE J. HEINZ

B.A., University of North Carolina at Chapel Hill, 2004

M.A., University of Illinois at Chicago, 2008

THESIS

Submitted as partial fulfillment of the requirements
for the degree of Doctor of Philosophy in Psychology
in the Graduate College of the
University of Illinois at Chicago, 2012

Chicago, Illinois

Defense Committee:

Jon Kassel, Chair and Advisor
Robin Mermelstein
Colleen Corte, Nursing
Raul Gonzalez, Psychiatry
Harriet de Wit, University of Chicago

ACKNOWLEDGMENTS

I would especially like to thank my advisor, Jon Kassel. He has been my advocate through thick and thin and his guidance and support have been invaluable. I am grateful to Harriet de Wit who has served as my co-mentor on this project. She has graciously volunteered her time and energies to enhance my research training. I would also like to thank the members of my dissertation committee- Raul Gonzales, Robin Mermelstein, Colleen Corte, and Harriet de Wit- for their insightful feedback. In addition, I would like to thank the army of research assistants who spent many hours assisting me with my data collection. Todd Lilje, Stephanie Monroe and Lindsey Ramirez were particularly instrumental in this regard and they will undoubtedly go on to have stellar graduate careers. Furthermore, I would like to thank my husband, Barrett, my parents, and my brother and sister for their support and encouragement throughout the years.

This project was supported by a University of Illinois at Chicago Provost Award and an F31 Pre-doctoral National Research Service Award from the National Institute on Alcoholism and Alcohol Abuse.

TABLE OF CONTENTS

<u>CHAPTER</u>	<u>PAGE</u>
I. INTRODUCTION	1
A. Background and significance	1
1. Energy drinks	1
2. Caffeine and alcohol	2
3. Caffeine, alcohol and risky behavior	3
4. Why do individuals elect to consume caffeinated alcohol.....	5
B. Inconsistent profile of effects of caffeine and alcohol on performance.....	6
C. Potential mechanisms	9
1. Cognitive disruption and subjective judgments of intoxication and personal agency	9
2. Drug related outcome expectancies	11
D. The current study	13
II. METHODS	13
A. Study design.....	13
B. Participants.....	14
C. Measures	15
D. Procedures.....	26
E. Data Analyses	28
F. Hypotheses	32
III. RESULTS	34
A. Manipulation Checks	34
B. Caffeine, Alcohol and Caffeinated Alcohol Consumption Patterns and Peer Norms and Attitudes	36
D. Correlations with Caffeinated Alcohol Use	37
E. Self-Report Measures: Subjective Intoxication, Biphasic Effects of Alcohol, Perceived Ability to Drive, Desire to Continue Drinking, Mood State, Cognitive Appraisal of Risky Events.....	39
F. Behavioral Tasks.....	46
IV. DISCUSSION	56
V. CITED LITERATURE	86
VI. APPENDIX A.....	100
VII. APPENDIX B	104
VIII. APPENDIX C	108
IX. IRB APPROVAL.....	110
X. VITA	113

LIST OF TABLES

<u>TABLE</u>	<u>PAGE</u>
I. MEANS (AND STANDARD DEVIATIONS) FOR CAFFIENE, ALCOHOL AND CAFFEINATED ALCOHOLIC BEVERAGE USE	72
II. FREQUENCIES FOR ALCOHOL AND CAFFEINATED ALCOHOL USE AND PEER ATTITUDES AND NORMS.....	73
III. CORRELATION MATRIX OF QUANTITY AND FREQUENCY OF CAFFEINATED ALCOHOLIC BEVERAGE CONSUMPTION WITH CAFFEINE AND ALCOHOL CONSUMPTION, RISK MEAURES, PEER NORMS AND IMPULSIVITY	74

LIST OF FIGURES

<u>FIGURE</u>	<u>PAGE</u>
1. Timeline of procedure.....	75
2. Schematic of relationships between impulsive behavior and proposed measures.....	76
3. Mean subjective rating of intoxication by time and caffeine consumption groups	77
4. Mean desire to continue drinking, log transformed, by time and caffeine consumption group.....	78
5. Mean deviation from the mode (square root transformed), an index of inattention and an element of impulsivity, by time and caffeine instruction group	79
6. Mean reaction time (log transformed) on stop signal trials, where participant failed to inhibit response, by time and caffeine consumption group	80
7. Mean percent of correct responses on no-signal trials on the Stop-It task by time and group	81
8. Mean objective performance in the turbulence condition on the Metacognition of Agency Task by time and consumption group.	82
9. Mean objective performance in the magic condition on the Metacognition of Agency Task at post-drink by instruction group.....	83
10. Mean discrepancy between judgments of performance on the normal (control) condition and judgments of performance on the lag (most difficult) condition on the Metacognition of Agency Task by time and instruction group	84
11. Mean subjective-objective performance discrepancy scores for the lag condition on the Metacognition of Agency Task by time and instruction group	85

LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
BAES	Biphasic Alcohol Effects Scale
BART	Balloon Analogue Risk Task
β	Beta
BAC	Breath Alcohol Content
CAB	Caffeinated Alcoholic Beverages
CARE	Cognitive Appraisal of Risky Events
CEOA	Comprehensive Effects of Alcohol Questionnaire
CEQ	Caffeine Expectancy Questionnaire
ED	Energy Drinks
MAT	Metacognition of Agency Task
n	Number in subgroup
p	Probability
η_p^2	Partial Eta Squared, effect size
PANAS	Positive and Negative Affect Schedule
PID	Peer Influences on Drinking Questionnaire
UPPS-P	Impulsive Behavior Scale
SRTT	Simple Reaction Time Task
STAI	State Trait Anxiety Inventory
SIS	Subjective Intoxication Scale

SUMMARY

Concurrent use of caffeine and alcohol is a rapidly growing phenomenon among young adults. Survey research indicates that caffeinated alcohol use is associated with a variety of health-risk behaviors although the mechanisms by which the combination may confer increased risk over alcohol alone are not well understood. Burgeoning research from the laboratory demonstrates that although caffeine only mildly antagonizes the effects of alcohol, individuals nonetheless *feel* less impaired, and therefore may be more likely to drive and to continue to drink alcohol. These findings may be explained by both the pharmacological effects of caffeine and by individuals' expectations for caffeine to counteract the untoward effects of alcohol. The current study examined whether select affective, cognitive and behavioral outcomes, hypothesized to contribute to risk behavior, were modified by caffeinated alcohol or the expectation of receiving caffeinated alcohol. A 2 (caffeine instruction: told yes, told no) by 2 (caffeine consumption: consumed, did not consume) mixed design was employed and 146 male and female social drinkers between the ages of 21 and 30 were randomly assigned to receive either: 1) alcohol, 2) alcohol and caffeine, 3) alcohol and placebo caffeine, 4) alcohol + told no caffeine, get caffeine. Results suggest that the consumption of caffeinated alcohol may elevate risk for continued drinking, reduce sensitivity to intoxication and decrease reaction time without affecting accuracy. Conversely, consumption as well as the expectation of consuming caffeinated alcohol may reduce inattention, protect against some aspects of alcohol-related performance decrements and better preserve judgments of performance and agency. Together these findings indicate that caffeine, when combined with alcohol, has both beneficial and detrimental effects on mechanisms thought to contribute to risky behavior.

I. INTRODUCTION

A. Background and significance

The combined use of alcohol and caffeine has become widely popular, but concurrent use of these beverages may pose an unrecognized danger (Howland, Rohsenow, Calise, MacKillop, & Metrik, 2011; Reissig, Strain, & Griffiths, 2009; Simon & Mosher, 2007). The demand for energy drinks (EDs) has grown exponentially since the introduction of Red Bull in 1997 (Mintel International Group Ltd., 2007; Reissig, et al., 2009; Simon & Mosher, 2007) and sales in the United States exceeded 6.5 billion dollars in 2006 (Zegler, 2007). The corresponding popularity of mixing EDs with alcohol among young adults has been largely capitalized upon by the beverage industry, who market aggressively to this population (Ho, 2006; Simon & Mosher, 2007). Although some pre-mixed caffeinated alcoholic beverages (CABs) were recently removed from the market following legislative action in several states (e.g., Four Loko), others remain available (e.g., P.I.N.K. Vodka and Liquors 100 proof; 1oz contains the equivalent of ½ cup of coffee), and hand-mixing EDs with alcohol continues to be the preferred method (e.g., Red Bull and vodka, Jager Bomb). Importantly, these products are subject to almost no government regulation and some energy drinks contain more than three times the amount of caffeine the FDA allows in sodas (McCusker, Goldberg, & Cone, 2006; Reissig, et al., 2009). Despite growing consumption and burgeoning evidence that use of these products is related to negative health consequences, virtually no studies have evaluated the acute effects of alcohol and caffeine on indices of health-risk behavior. Such research is sorely needed as findings may inform public health efforts and promote education of young adults on the potential risks associated with concurrent use of these substances.

1. Energy Drinks

Recent evidence indicates that ED consumption among young adults is associated with increased risk in multiple health domains, including problem drinking. For instance, ED users consume alcohol more frequently and in greater amounts than low-frequency and non-users (Arria et al., 2010; Arria et al., 2011; O'Brien, McCoy, Rhodes, Wagoner, & Wolfson, 2008). Additionally, a cross-sectional study showed that high-frequency ED consumers (at least weekly) were twice as likely to meet criteria for alcohol dependence compared to low frequency users, even after controlling for several key risk factors (Arria, et al., 2011). Another study of 602 undergraduates reported that frequency of ED consumption was positively associated with 9 of 10 problem behavior outcomes including risky sexual behavior, illicit substance use, and alcohol related problems (Miller, 2008a). Consumption frequency of ED's and ED's combined with alcohol has also been linked with more pronounced "toxic jock identity," defined as a sport-related identity predicated on risk-taking and hypermasculinity (Miller, 2008b). Finally, results from a longitudinal study showed that compared to nonusers, ED users had significantly greater levels of alcohol and drug involvement and were more likely to initiate nonmedical use of prescription stimulants and analgesics one year later (Arria, et al., 2010). Together, these data appear to be consistent with the finding that young adults who are high-frequency/caffeine-dependent users score higher on measures of constructs implicated in risky behavior (e.g., impulsivity and sensation seeking) than low-frequency/non-caffeine-dependent users (Jones & Lejuez, 2005). Hence one explanation for these relationships is that individuals who elect to consume EDs also possess an inherently stronger predisposition towards risky behavior.

2. Caffeine and Alcohol

According to several recent studies of college and medical students a significant proportion (22.6-36.5%) report mixing alcohol with EDs (Arria et al., 2010; Malinauskas, Aeby, Overton, & Carpenter-Aeby, 2007; O'Brien, et al., 2008; Oteri, Salvo, Caputi, & Calapai, 2007). These rates of use, that capture use in the past 30 days to 1 year, have compelled researchers to voice concerns over potential public health problems associated with the conjoint effects of alcohol and caffeine (e.g., Howland, Rohsenow, Calise, et al., 2011; Kaminer, 2010; Reissig, et al., 2009; Simon & Mosher, 2007; Weldy, 2010). For instance, some researchers have cautioned that next-day impairment may be exacerbated by CABs as caffeine can cause sleep disruption which in turn negatively affects job and academic performance (Rohsenow & Howland, 2007). Others posit that consumption of caffeinated alcohol may promote excessive drinking or increase the likelihood of driving under the influence because individuals do not feel as sedated or impaired as they normally would under alcohol alone. Excessive drinking of course increases the risk for other negative consequences including sexual victimization, alcohol poisoning and injury (e.g., Hingson, Heeren, Zakocs, Kopstein, & Wechsler, 2002). Unfortunately, data from experimental research on the conjoint effects of alcohol and caffeine, in this regard, is extremely limited.

3. Caffeine, Alcohol and Risky Behavior

A comprehensive literature search revealed only one laboratory based study ($n = 13$) on the conjoint effects of alcohol and caffeine on “risk-taking behavior” (indexed by the Stop Light Task), examined as a function of sleepiness (Roehrs, Greenwald, & Roth, 2004). Results indicated that alcohol and caffeine combinations decreased psychomotor reaction time relative to alcohol alone, but did not significantly affect amount of money earned on the Stop-Light Task (the primary measure of risk-taking). A handful of *descriptive* studies,

however, have demonstrated a strong association between consumption of caffeinated cocktails and negative alcohol-related consequences that corroborate public health concerns.

According to data from a large multi-site survey, college students who consumed alcohol mixed with EDs reported a significantly higher prevalence of alcohol-related risk behaviors (i.e., riding in a car with a driver under the influence, being hurt or injured, taking advantage of another student sexually, being taken advantage of sexually) compared to students who consumed alcohol alone (O'Brien, et al., 2008). Additionally, students who reported conjoint use of alcohol with ED drank more alcohol during an average drinking session and had twice as many heavy episodic/binge drinking days and episodes of weekly drunkenness as students who reported only drinking alcohol. Another study found that college athletes who combined use of alcohol and EDs consumed significantly more alcohol and had riskier drinking habits than those who consumed alcohol alone (Woolsey, Waigandt, & Beck, 2010). Results from a community survey indicated that the odds of using alcohol plus ED were nearly four times higher for past-year hazardous drinkers compared to nonhazardous drinkers (Berger, Fendrich, Chen, Arria, & Cisler, 2011). Internationally, reports of out of Germany and Ireland have implicated caffeinated alcohol in numerous assaults and automobile accidents, respectively (Riesselmann, Rosenbaum, Roscher, & Schneider, 1999; Tormey & Bruzzi, 2001).

Event-based analyses also suggest that significantly more alcohol is consumed on occasions when it is combined with EDs. One field study, in a college bar district, showed that compared to bar patrons who had only consumed alcohol, those who had consumed alcohol mixed with EDs were three times more likely to leave the bar highly intoxicated (BAC greater than or equal to .08) and were four times more likely to express intentions of

driving out of the bar district (Thombs et al., 2010). Similarly, using a time-line follow back interview to detail use of EDs and alcohol in the previous week, researchers found that ED users from a university community consumed greater quantities of alcohol when using EDs (8.6 drinks) compared to when they were not (4.7 drinks; Price, Hilchey, Darredeau, Fulton, & Barrett, 2010).

4. Why do individuals elect to consume caffeinated alcohol?

Anecdotal explanations for consumption of CABs indicate that individuals use caffeine to offset the untoward effects of alcohol (e.g., drowsiness). Indeed, a survey of Brazilian college students reported that motivations for using caffeinated alcohol included increased happiness (38%), euphoria (30%), uninhibited behavior (27%), and increased physical vigor (24%; Ferreira, Mello, & Olivera, 2004). Another large survey indicated that students used alcohol with EDs so they could drink more and not feel as drunk (15%) and not look as drunk (5%; O'Brien, et al., 2008). A handful of experimental studies have also contributed preliminary evidence supporting the tenets of a compensatory hypothesis.

Caffeine has been found to reduce the intensity of some subjective symptoms of alcohol intoxication such as drowsiness and sedation (Ferreira, de Mello, Pompeia, & de Souza-Formigoni, 2006; Marczinski & Fillmore, 2006; Marczinski, Fillmore, Bardgett, & Howard, 2011). Such effects are likely reinforcing especially among young adults who desire to “keep the party going longer.” Although the relative contributions of caffeine’s pharmacological properties to the effects of alcohol have yet to be disentangled from those associated with a learning history of caffeine-induced antagonism (i.e., negative reinforcement), some studies suggest that repeated coadministration of the two substances can increase tolerance to the performance-disrupting effects of alcohol. More specifically,

following repeated sessions of conjoint caffeine and alcohol administration, caffeine antagonism of the psycho-motor impairing effects of alcohol produced increased tolerance to an alcohol challenge dose. Interestingly however, participants with repeated session exposure history to alcohol or caffeine alone did not demonstrate such tolerance effects (Fillmore, 2003). Similarly, animal studies have shown that moderate doses of caffeine and other adenosine antagonists promote ethanol administration in rats (Arolfo, Yao, Gordon, Diamond, & Janak, 2004; Kunin, Gaskin, Rogan, Smith, & Amit, 2000) and antagonize reduction of alcohol induced locomotor activity in mice (Ferreira et al., 2004).

Importantly, despite some evidence of caffeine antagonism, caffeine consumption itself does not alter the metabolism of alcohol (as indexed by breath alcohol content; Ferreira, et al., 2006). As such, individuals who consume caffeinated alcohol may be just as vulnerable to alcohol-related harms as those who consume alcohol alone. Although burgeoning research suggests that conjoint use of alcohol and caffeine may pose serious implications for health-risk behavior above and beyond the effects of alcohol alone, the addition of caffeine to alcohol does appear to have some potentially beneficial effects.

B. Effects of caffeine and alcohol on performance: An inconsistent profile

The acute conjoint effects of caffeine and alcohol on performance and physiological measures indicate that caffeine reverses alcohol-related performance impairment on a variety of tests including reaction time, psychomotor speed, divided attention, and recall memory (e.g., Azcona, Barbanoj, Torrent, & Jane, 1995; Drake, Roehrs, Turner, Scofield, & Roth, 2003; Franks, Hagedorn, Hensley, Hensley, & Starmer, 1975; Hasenfratz, Bunge, Dalpra, & Battig, 1993; Kerr, Sherwood, & Hindmarch, 1991; Roehrs, et al., 2004; Rush, Higgins, Hughes, Bickel, & Wiegner, 1993). However, other examinations comparing the combined

effects of alcohol and caffeine to the effects of alcohol alone have yielded findings in the opposite direction (e.g., Osborne & Rogers, 1983), as well as no significant differences or inconsistent profiles of performance differences (e.g., Ferreira, et al., 2006; Franks, et al., 1975; Howland et al., 2011; Liguori & Robinson, 2001; Marcziński & Fillmore, 2003; Marcziński & Fillmore, 2006; Marcziński, et al., 2011; Nuotto, Mattila, Seppala, & Konno, 1982). Moreover, other studies have shown that the effects of caffeine and alcohol on performance are strongly influenced by sleepiness (Roehrs, et al., 2004) and individuals' expectancies for the combination of substances (Fillmore & Vogel-Sprott, 1995). Mixed evidence for the antagonistic effects of caffeine on various aspects of performance commonly impaired by alcohol is, in part, due to variable doses of caffeine and alcohol administered, not controlling for caffeine withdrawal, small sample sizes and differences in experimental methodology (Fudin & Nicastro, 1988). Nevertheless, patterns in the data suggest that caffeine may selectively counteract alcohol-induced impairment on some measures of cognitive and motor performance, but not others.

Marcziński and Fillmore (2006) have suggested that the coadministration of caffeine and alcohol may exert a nonuniform effect on various aspects of performance impaired by alcohol. For instance, caffeine has been shown to counter-act alcohol-induced slowing of response time but not the disinhibiting effects of alcohol (Marcziński & Fillmore, 2003; Marcziński, et al., 2011). That is, caffeine antagonized the effects of alcohol on response execution (i.e., decreased response time) but had no effect on inhibitory control as indexed by performance accuracy on a cued go/no-go task. Additionally, compared to alcohol alone, caffeine in combination with alcohol has been found to shorten decision time and N200 latency (orientation to a stimulus) on a choice reaction time task, but simultaneously reduced

N500 area, an index of working memory (Martin & Garfield, 2006). The authors explained that whereas caffeine appeared to counteract alcohol-related slowing of decision time, it also functioned to impair working memory processes. Collectively, these data suggest that caffeinated alcohol may facilitate reduced reaction time to stimuli, though with an important caveat that the accuracy of the response is still no better compared to effects of alcohol alone. Hence, conjoint consumption of alcohol and caffeine may render an individual more prone to making bad decisions more quickly.

Lastly, one of the more important performance indices regarding caffeine antagonism of alcohol-induced impairment is driving. An examination of the conjoint effects of caffeine and alcohol on a driving simulation task showed that caffeine partially counteracted alcohol impairment of brake latency but not body sway or choice reaction time (Liguori & Robinson, 2001). This study highlights the danger of a “wide-awake drunk” in that, despite evidence of increased subjective alertness and slightly improved reaction time, caffeine only modestly antagonized alcohol-induced impairment of driving (9% decrease in response time to brake). Another study, however, found that addition of caffeine to alcohol had no effect on any indices of driving performance or on sustained attention/reaction time and no differences were observed in self-estimated BAC between participants who received alcohol alone versus alcohol with caffeine (Howland, Rohsenow, Arnedt, et al., 2011). Similarly, a review by Fudin and Nicastro (1988) concluded that caffeine does not antagonize alcohol-induced driving impairments. In sum, given the health and safety implications associated with differential patterns of caffeine antagonism on alcohol-induced performance impairment, it is important to delineate a clear profile of the effects of both drugs on impulsive and risky behavior and to characterize potential relationships with reported risk-behaviors.

C. Potential mechanisms

The mechanisms by which alcohol and caffeine may affect impulsive and risky behavior are not well understood. Explanations may be afforded by conducting subjective assessments of alcohol intoxication/impairment and personal agency, the extent to which individuals feel they are their own agents and have control of their thoughts and actions (Metcalfe & Greene, 2007), in conjunction with objective performance measures. Additionally, individuals' expectations for caffeine and alcohol and for their combined effects on mood and performance may also influence subsequent experience.

1. Cognitive disruption and subjective judgment of intoxication and personal agency

It is widely accepted that alcohol consumption engenders risky behavior in part, by disrupting critical cognitive and executive functions (e.g., Giancola, 2000). For instance, it has been suggested that higher order cognitive encoding of self-relevant information necessary to sustain self-awareness is disrupted by alcohol (Hull, 1981). Relatedly, alcohol consumption has been demonstrated to cause a narrowing of attention, a phenomenon termed alcohol myopia, whereby individuals focus on only the most salient information in the environment (Steele & Josephs, 1990). This restriction of attention is thought to render intoxicated individuals more vulnerable to discounting distant negative consequences in favor of immediate rewards.

To date, no studies have determined how alcohol-induced cognitive impairments associated with risk behavior are influenced by coadministration of caffeine. If subjective judgments of intoxication and personal agency become inaccurate as a function of caffeine antagonism, individuals may be more likely to engage in risky behaviors (continuing to drink, opting to drive) because they do not appreciate the extent of their impairment.

Conversely, if caffeine increases the cognitive resources available under alcohol, as some previous research suggests, decisions surrounding risky behavior may be considered with more caution.

Caffeinated alcohol may also engender risky behavior via its effects on sensations (e.g., stimulation, sedation) that help an individual formulate judgments about their physical and cognitive abilities. Briefly, perceived impairment is closely related to personal agency in that when individuals judge themselves “impaired,” they would ostensibly detect a decrease in personal agency (e.g., less control over performance). In the case of caffeinated alcohol, emerging data suggest that compared to alcohol alone, consumption of caffeine and alcohol is associated with lower subjective ratings of intoxication and higher ratings of stimulation (e.g., Marcziński & Fillmore, 2006; Marcziński, et al., 2011). Importantly though, despite these subjective differences, accuracy of responses in these studies did not tend to differ from what was observed under alcohol alone. Accordingly, caffeinated alcohol may facilitate a problematic disconnect between subjective judgments and objective performance. Indeed, in an investigation of the subjective and objective effects of Red Bull and Vodka, perceptions of several symptoms of alcohol intoxication (e.g., headache, weakness, dry mouth, impairment in motor coordination) were less pronounced after combined ingestion of alcohol and energy drink (Ferreira, et al., 2006). Again though, the authors noted no differences in objective measures of motor coordination and visual reaction time between the alcohol alone and alcohol plus energy drink conditions.

Last, a study by Grattan-Miscio and Vogel-Sprott (2005) examined the effects of caffeine versus an environmental incentive (monetary reward) on automatic, unintentional and controlled, intentional cognitive processes (as indexed by performance on word-stem

completion task) under the influence of alcohol. Results indicated that compared to the alcohol alone condition, controlled intentional processes typically weakened by alcohol, were strengthened (significantly) to drug free levels by an environmental incentive and slightly less so by caffeine, although no differences were noted between conditions on automatic processes (Grattan-Miscio & Vogel-Sprott, 2005). The authors concluded that the nonuniform findings suggest that compared to alcohol alone, consumption of caffeine with alcohol significantly improves *intentional* control processes but does not provide the same boost for cognitive processes thought to be more automatic or outside of awareness.

Taken together, it appears that if caffeine does partially counteract the sedating effects of alcohol, the drinker may incorrectly perceive alertness as an indication of the absence of intoxication even when psychomotor impairment under alcohol is objectively evident. Consequently, the individual may opt to drive after heavy drinking or they may continue drinking, resulting in increased drunkenness and other negative outcomes that are associated with severe intoxication. More research is needed to determine whether decreased accuracy coupled with increased speed of performance, in addition to misjudgments of intoxication and personal agency, are key mechanisms by which consumption of caffeinated cocktails can engender poor decision making.

2. Drug outcome expectancies

Social learning theory espouses that individuals develop a set of learned beliefs, termed outcome expectancies (beliefs about the consequences of a particular action), that function as the primary determinant of subsequent behavior and objective experience (Bandura, 1971). Building upon social learning theory, expectancy theory, as it pertains to substance use, indicates that expectancies are learned over the course of several direct and

indirect experiences with a substance and are eventually stored in long term memory (Goldman, Brown, & Christiansen, 1987). More specifically, the positive and negative outcomes of using a substance serve to reinforce expectations for a substance and, in turn, expectancies shape the experience of outcomes. For instance, following consumption of caffeine, performance and subjective experience are likely influenced by the strength of an individual's outcome expectancies for caffeine (e.g., "caffeine will make me more alert"). Indeed, several studies have yielded compelling evidence to suggest that the effects of caffeine on mood, cognition and performance largely depend upon a person's expectations (Smith, 2002). Accordingly, expectancies for caffeine to antagonize alcohol induced impairment may produce similar effects that in turn contribute to risky behavior.

Researchers have also successfully "implanted" expectations for caffeine to influence the effects of alcohol on performance and these expectations in turn, drove performance. Among participants who believed that caffeine would further impair performance under alcohol, consumption of caffeine (relative to no caffeine) appeared to elicit a compensatory response such that it decreased the impairing effects of alcohol (Fillmore & Vogel-Sprott, 1995). Conversely, in another study, participants who were provided with explicit instructions that caffeine would counteract the effects of alcohol on performance actually demonstrated worse performance than participants who were not provided such instructions (Fillmore, Roach, & Rice, 2002). Moreover, a placebo controlled study demonstrated that the expectation of receiving caffeine alone is sufficient to counteract impairment of intentional control (derived from a word-stem completion task) under alcohol (Grattan-Miscio, Wickenden, Crotteau, Ward, & Suggate, 2005). Further research is needed to determine how the expectation of consuming caffeine and alcohol may influence impulsive

and risky behavior as well as subjective experience.

D. **The current study**

Despite mixed evidence regarding the antagonistic effects of caffeine on alcohol, the conjoint effects of alcohol and caffeine on performance are well documented. To date, however, no research has comprehensively examined the combined effects of these substances on subjective intoxication and related sensations, judgments of personal agency, risk behavior, or impulsivity. The aim of the current study is to characterize the conjoint effects of alcohol and caffeine on critical affective, cognitive and behavioral outcomes in young social drinkers. Additionally, the study will function to isolate the conjoint effects of alcohol and caffeine on the proposed outcomes from 1) the effects of alcohol alone and 2) the effects of expecting to receive caffeine with alcohol. It is broadly hypothesized that compared to participants who consume only alcohol, conjoint consumption of caffeine and alcohol will result in more impulsive and risky behavior, increased misjudgments of personal agency, lower perceived levels of intoxication and increased desire to continue drinking. A similar, but less robust pattern of findings is hypothesized to emerge for participants who expect but do not receive caffeine.

II. METHODS

A. **Study Design**

A double-blind 2 (caffeine administration: caffeine, no caffeine) X 2 (caffeine instructions: told getting caffeine, told not getting caffeine) mixed design was employed. Males and females were distributed evenly throughout the experimental conditions. All participants received alcohol and were randomly assigned to one of four conditions: 1)

Alcohol alone, told not receiving caffeine, 2) Alcohol with caffeine, told receiving caffeine, 3) Alcohol alone, told receiving caffeine but do not receive caffeine and 4) Alcohol with caffeine but told not receiving caffeine.

B. Participants

A power analysis was conducted using GPower (Faul, Erdfelder, Lang, & Buchner, 2007) to determine the sample size necessary to achieve a high probability of detecting meaningful changes in the respective dependent variables. In order to detect a medium size effect (f) of .25 with a Type I error protection level set at .05 and power ($1-\alpha$) of approximately .80, it was estimated that each of the four cells required 32 individuals ($N = 128$). A total of 157 participants elected to participate in the study and complete data were collected from 146 participants. Participants were recruited from the Chicago metropolitan area via online advertisements and were screened for eligibility using an electronic screening system. Male and female individuals qualified to participate if they were between the ages of 21 and 30, right-handed, had no psychiatric history, reported no substance use in the past 30 days, had no medical conditions that could be contraindicated by alcohol and/or caffeine use and were not taking any medications that could affect performance or interact with alcohol or caffeine. Individuals were required to demonstrate alcohol and caffeine drinking patterns (i.e., at least four alcoholic beverages at least one day of the week over the previous three-month period, at least one caffeinated beverage at least three times a week, at least one lifetime use of alcohol in combination with caffeine) indicating they could comfortably consume a moderate amount of alcohol and/or caffeine. Individuals were also screened for alcohol use disorders using the short version of the Michigan Alcoholism Screening Test (SMAST; Selzer, Vinokur, & van Rooijen, 1975), and those scoring a 3 or above were

excluded. Finally, male and female individuals less than 120 pounds and over 200 and 180 pounds, respectively, were excluded 1) due to the burden associated with consuming such a large amount of liquid in a short amount of time and 2) to reduce variability in caffeine absorption and metabolism.

C. Measures

1. Single administration self-report measures

State-Trait Anxiety Inventory (STAI) (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). The STAI is one of the most commonly used and psychometrically sound measures of enduring anxiety. Individuals respond to 20 self-descriptive items using a 4-point Likert scale (i.e., 1, “almost never,” and 4, “almost always”) to rate the frequency of how they generally feel (trait). Scores range from 20 to 80 with elevated scores indicating greater endorsement of anxiety. Internal consistency in the current sample was .91.

Beck Depression Inventory (BDI) (Beck, 1967). The BDI is a 21-item measure that provides information about current levels of dysphoria and depression, as expressed in both psychological and neurovegetative symptoms. The BDI and STAI –Trait were administered to determine whether trait anxiety and depressive symptoms were associated with drinking problems as well as quantity and frequency of caffeinated alcohol consumption. The BDI demonstrated high internal consistency in the present sample ($\alpha = .90$).

UPPS-P Impulsive Behavior Scale (Cyders et al., 2007). The UPPS-P is a 58-item Likert-type scale (i.e., 1 = strongly agree, 4 = strongly disagree) that measures five different domains of impulsivity including lacking of planning, lack of perseverance, negative urgency, positive urgency and sensation seeking. The original UPPS Impulsive Behavior Scale was advanced by Whiteside and Lynam (2001) following a factor analysis of available

impulsivity measures. Recently though, a new dimension was added, positive urgency, which is the tendency to act rashly when in a positive mood. This positive urgency measure has been found to explain unique variance in engagement in risky behaviors and demonstrates good discriminate validity from the other UPPS dimensions (Cyders & Smith, 2007; Cyders, et al., 2007). The UPPS-P was administered to assess whether trait impulsivity influenced the magnitude of change in pre-post drinking outcomes. Additionally, relationships between subscales of the UPPS-P and other behavioral and self-report measures of impulsivity and risk taking were explored. Internal consistencies on each of the sub-scales ranged from .77 to .89.

Caffeine Expectancy Questionnaire (CEQ) (Heinz, Kassel, & Smith, 2009). Refined over the course of a 5-stage developmental process, the CEQ is a 37-item instrument designed to assess beliefs concerning the effects of consuming caffeine. The instrument is comprised of four factors representing “withdrawal symptoms,” “positive effects,” “acute negative effects,” and “mood effects.” The CEQ was administered to determine how individuals’ expectancies for caffeine affect subsequent cognitive and behavioral performance and affective state. Internal consistencies on each of the four sub-scales ranged from .75 to .89 in the present sample.

Modified DSM-IV-TR Caffeine Dependence and Withdrawal Checklist CDWC (Heinz, et al., 2009). Although caffeine intoxication is included in the American Psychiatric Association’s Diagnostic and Statistical Manual (DSM-IV-TR; APA, 2000), neither caffeine dependence nor caffeine withdrawal is recognized disorders in the World Health Organization’s International Classification of Disorders (ICD-10; W.H.O., 1992) or the DSM-IV- TR. As such, generic DSM-IV-TR criteria for psychoactive substance dependence

have been modified to apply to caffeine (Fromme, Stroot, & Kaplan, 1993; Hughes, Oliveto, Liguori, Carpenter, & Howard, 1998). Individuals are asked to endorse either the presence or absence of each listed criterion. In order for a criterion to be considered present, the behavior described has to have occurred at least once a month in the past 12 months. In accordance with findings and recommendations from previous research, endorsement of 3 or more criteria is required for participants to be considered “caffeine dependent” (Hughes, et al., 1998). Two additional items employ a 4-point Likert scale to assess “cessation difficulty” and perceived caffeine “addiction.” To assess “caffeine withdrawal” (i.e., symptoms experienced after not drinking caffeine for 24 hours or more during the past year), participants endorse the presence or absence of seven potential symptoms of DSM-IV criteria for substance withdrawal modified for caffeine. The CDWC was used to assess caffeine dependence and withdrawal symptoms in the current sample.

Comprehensive Effects of Alcohol Questionnaire (CEOA) (Fromme, et al., 1993). The abbreviated CEOA is a 15-item scale that measures beliefs concerning the effects of drinking alcohol. The measure consists of two parts. In Part A, using a 4-point scale ranging from disagree to agree, participants rate the extent to which they believe that they would experience particular outcomes while under the influence of alcohol. In Part B, participants rate the desirability of the same effects of alcohol described in Part A using a 5-point scale ranging from bad to good. The 15 items are associated with six subscales: aggression-risk/liquid courage (5 items—e.g., “I would be aggressive”; $\alpha = .76$, $\alpha = .78$), impairment (2 items—e.g., “I would be dizzy”; $\alpha = .69$, $\alpha = .75$), sex (2 items—e.g., “I would enjoy sex more”; $\alpha = .56$, $\alpha = .61$), sociability (2 items—e.g., “It would be easier to talk to people”; $\alpha = .77$, $\alpha = .82$), tension reduction (2 items—e.g., “I would feel calm”; $\alpha = .74$, $\alpha = .85$),

and self-perception (2 items—e.g., ‘‘I would feel moody’’; $\alpha = .34$, $\alpha = .46$). The CEOA and its subscales, excluding self-perception and sex, were used to explore the influence of alcohol expectancies on affective, cognitive and behavioral outcome measures.

Quantity and Frequency of Alcohol, Caffeine, and Caffeinated Alcohol Consumption.

A measure of quantity and frequency of caffeine, alcohol, and caffeinated alcohol consumption was developed for the current study (see Appendix B). Twelve ounces is considered one serving size of caffeine and examples of quantities are provided that reference Starbucks™ size labels (e.g., tall, grande, vente). A serving of alcohol is defined as a 12-ounce can or bottle of beer, a 5-ounce glass of wine, or a shot of liquor straight or in a mixed drink. Name of product brands and varieties of caffeinated alcoholic beverages are provided on the questionnaire to facilitate participant recall. The questionnaire uses a time line follow back (Sobell & Sobell, 1992) to assess consumption of caffeine, alcohol and caffeinated alcohol over the past 3 months to provide estimates of consumption in a typical week. Frequency of consumption is the total number of days the participant consumed the beverage in an average week. Quantity of consumption is the total number of beverages consumed in an average week. Average number of drinks consumed per drinking occasion is generated by dividing the quantity score by the frequency score. A combined quantity frequency score is calculated for each beverage by multiplying number of days beverage consumption is endorsed by the average number of drinks consumed each day (total number of drinks consumed per week divided by 7). Several additional items ask about drinking patterns in the past thirty days to assess for binge drinking and drunkenness. A heavy drinking composite is constructed from the number of times in the past month participants have been high/buzzed, number of times drunk, and the number of binge drinking occasions

(defined as 4 and 5 or more drinks in one occasion for females and males, respectively). In the current study, quantity and frequency measures for each beverage type and combined QF scores for caffeine and alcohol were log transformed when necessary to reduce skewness and kurtosis. In order to address the severe negative skewness observed for caffeinated alcohol QF scores, a constant of 1 was added to all scores and then scores were log transformed.

Peer Influences on Drinking (PID). The PID is borrowed from methods successfully employed in a previous study (Bartholow & Heinz, 2006). Participants answer a number of questions about perceptions of normative drinking patterns, their friends' alcohol involvement and how their friends view drinking. PID are estimated based on responses to items measuring how much close friends drink, how friends feel about drinking, the number of friends who drink regularly, and the number of friends who drink primarily to get drunk. Several questions were modified and added to assess peer influences on consumption of caffeinated alcohol (see Appendix C). The PID was included to determine the influence of perceived peer norms about drinking on participant's alcohol and caffeinated alcohol consumption patterns.

Single Item Risk Queries. Participants answered a series of single item queries to assess past risk behaviors, as described in (Lejuez et al., 2002), and included unsafe sexual practices (past 12 months) and infrequent seatbelt use.

The Cognitive Appraisal of Risky Events (CARE). The CARE questionnaire assesses perceived risks, benefits and likely involvement with six domains of risky activities (sexual behavior, heavy drinking, illicit drug use, aggressive/illegal behaviors, academic/work behaviors and high risk sports). For each of these six subject areas, three composite scores are generated: likelihood of experiencing positive consequences, likelihood of experiencing

negative consequences, and expected involvement in the activities in the next six months. This task has been used with intoxicated participants (Fromme, Katz, & Damico, 1997) and has also been shown to correlate with subsequent risky behavior (Fromme, D'Amico, & Katz, 1999; Fromme, Katz, & Damico, 1997) and thus has predictive validity with reference to in vivo decisions and behavior. The CARE was administered post-drink to determine whether perception of risk and intention of engaging in risk behaviors differed as a function of experimental group. Only the sexual behavior, heavy drinking, illicit drug use, aggressive/illegal behavior subscales were examined in the current study and subscales were combined for analyses. Internal consistencies across the subscales ranged from .75 to .86 for likelihood, from .74 to .85 for positive perception and from .73 to .97 for negative perception.

Post-experimental questionnaire. Participants were asked: (1) if they thought they had consumed caffeine and alcohol (Y or N), (2) the amount of caffeine and/or alcohol they believed they had consumed (mg or oz) and (3) how pleasant the beverage tasted (1 to 4). Information provided by this questionnaire was used to check the effectiveness of the placebo manipulations.

2. **Repeated self-report measures**

Biphasic Alcohol Effects Scale (BAES) (Martin, Earleywine, Musty, Perrine, & Swift, 1993). The BAES consists of two seven-item subscales, stimulation and sedation, that measure the subjective effects of alcohol. To assess subjective stimulation and sedation associated with alcohol intoxication and caffeine administration, participants completed the 14-item BAES during the ascending limb of the blood alcohol curve, and then again during

the descending limb. The stimulation and sedation subscales had strong internal consistency in the present sample post-drink ($\alpha = .85, .93$).

Subjective Intoxication Scale (SIS). Participants estimated their perceived level of intoxication on a scale of 1 (not at all intoxicated) to 10 (as intoxicated as I've ever been) at the beginning of the study, after the drink administration and at the end of the study.

Positive and Negative Affect Schedule (PANAS) (Watson, Clark, & Tellegen, 1988). The PANAS is a widely used 20-item questionnaire that assesses both positive and negative affect. The scales have been shown to be highly internally consistent and largely uncorrelated. The PANAS was administered three separate times over the course of the experiment to determine the effect of experimental group on mood over time. The positive and negative affect subscales had strong reliability in the present sample ($\alpha = .87, .76$).

Perceived ability to drive, Desire to drink more alcohol. Following drink administration, and at the conclusion of the experimental session, participants were asked to rate their desire to continue to drink alcohol and their ability to drive a car. Participants responded to items using a visual analogue scale from 1 to 10 and with opposing anchors labeled “could not drive at all,” “could drive as I normally do” and “no desire at all,” “strongly desire more alcohol,” respectively.

3. Behavioral measures

Balloon Analogue Risk Task (BART) (Lejuez, et al., 2002). The BART is a computerized decision making task that assesses risk-taking behavior. According to published descriptions (i.e., Lejuez, et al., 2002; White, Lejuez, & Wit, 2008) the BART task consists of up to 60 balloon trials, one third of which are Low, Medium, or High payoff value

(0.5 cents, 1.0 cents, and 5.0 cents per pump). Participants are presented with “balloons” on a screen, and subjects are given the opportunity to “pump” the balloon to earn monetary rewards. The number of cents that can be earned per pump varies across trials. On each trial, the number of cents earned increases with each pump until either a) the balloon “pops” and the participant loses their earnings for that trial, or b) the participant collects the accumulated earnings for that trial. Each balloon is programmed to pop between 1 and 128 pumps (average breakpoint of 64 pumps). Participants are informed that the balloon can break anywhere from the 1st pump all the way through enough pumps to make the balloon fill the screen. The dependent variables are total amount earned, number of balloons exploded and average number of pumps on the balloons that did not explode. Performance on the BART has been shown to correlate with trait measures of risk-taking propensity such as sensation seeking and trait impulsivity (Lejuez, et al., 2002) and with real-world risk behavior in adolescents including substance use, gambling, stealing, and unsafe sex (Lejuez, Aklin, Zvolensky, & Pedulla, 2003). Performance on the BART has also been found to successfully differentiate smokers and nonsmokers, whereas another more established gambling task was not (Lejuez et al., 2003). In the current study, participants completed 30 balloon trials with a 1.0 cent pay off per pump and could earn up to \$12. The BART was administered pre and post-drink to examine the acute effects of alcohol and caffeine on risk-taking behavior.

Stop-it Task. Behavioral Inhibition, one dimension of impulsivity, was assessed with the stop-it task to measure participants’ ability to stop a prepotent response. The stop task, one of the most commonly used measures of behavioral inhibition (Logan, 1994), requires participants to “stop” their response after receiving a “go” signal to make the response. Using an algorithm that considers other variables, investigators then calculate the mean stop

signal reaction time (see Verbruggen, Logan, & Stevens, 2008) which is the amount of time following the presentation of stop signal needed to inhibit a response that is already underway. An additional dependent variable is the mean probability of responding on stop signal trials (higher probability reflects poorer inhibition). Other dependent variables include mean reaction time on signal-respond trials (when subject fails to inhibit response in time), mean reaction time on no-signal trials (i.e., no stop signal presented) and percent of correct responses (hits) on no-signal trials. The stop task was administered pre and post-drink to examine the acute effects of alcohol and caffeine on behavioral inhibition.

Simple Reaction Time Task (SRTT) (Kane & Kay, 1992). Newer evidence suggests that inattention is also an index of impulsivity (de Wit, 2009) and that variability in reaction times (RT) on a SRTT, specifically the positive skew in a distribution of SRTs (Leth-Steensen, Elbaz, & Douglas, 2000), can be used to identify lapses in attention. Participants were asked to respond as quickly as possible, via a key press on the computer keyboard with their dominant hand, to *'s presented on a computer screen. The task was comprised of three experimental blocks, each with 15 trials. Response latencies were recorded to the nearest millisecond. Slower RT (i.e., longer response latencies) was interpreted to reflect the allocation of attention elsewhere or the availability of fewer attentional resources (Kramer & Spinks, 1991). Attentional lapses, operationally defined as a high proportion of long reaction times, were calculated by taking the difference between the mean and mode of a RT distribution (de Wit, 2009). This functioned to differentiate attentional lapses from inability to respond quickly. Correspondingly, the larger the average deviation is between the mean and the mode of an RT distribution, the greater the proportion of long reaction times. In the current study, participants completed the SRTT to assess attentional lapses (i.e., devmod) and

available attentional processing capacity (response time) before and after drink administration. Figure 2 provides a schematic representation of relationships between impulsive behavior and the constructs believed to be captured by the SRTT and Stop Task.

Metacognition of Agency Task (MAT) (Metcalfe & Greene, 2007). The MAT is a computerized task designed to assess individuals' metacognitive assessments about when and whether they are in control of their performance. The task and instructions have been thoroughly described by Metcalfe and Greene, (2007). Briefly, the MAT requires participants to use a response manipulandum (mouse) to avoid O's (distracters) and catch X's (targets) that descend from the top of the computer screen. Participants are instructed to catch the X's in a box that they move back and forth across a track on the bottom of the computer screen. In addition to a normal condition, manipulated parameters include turbulence or responsiveness of the mouse, lag of the mouse (i.e., fast, slow), and closeness of the cursor required to hit a target (i.e., magic on, magic off). At the conclusion of each trial, participants are asked to make a judgment of their feeling of control (i.e., judgment of agency; JOA) and their performance (i.e., judgment of performance; JOP). Participants respond to both questions using a 100-mm visual analogue scale labeled "Very Little Control" or "Very Low" at one end and "A Great Deal of Control" or "Very High" at the other end.

Dependent variables on the MAT are mean subjective judgments of agency (JOA) and performance (JOP) as well as objective scores (i.e., the number of X's hit, minus the O's hit, divided by total number of X's and O's; taking into account a penalty for hitting distractors O's) for each of the four conditions. In terms of condition difficulty, which is reflected in sober-state objective performance, the magic condition is the easiest, followed by

the normal (non-manipulated) condition. The lag and turbulence conditions are the most challenging and in the current study, participants had the lowest objective performance in the lag condition.

In order to examine discrepancies between participants' JOP and their actual objective performance, both measures had to be placed on the same scale. Accordingly, a hit rate (number of X's captured divided by total number of X's) was calculated for each condition both pre and post drink and the value of the hit rate could range from 0 to 1. JOP values could range from 0 to 100 and were therefore multiplied by .01. Subjective-objective performance discrepancy scores were calculated by subtracting hit rate scores from JOPs for each condition both at pre and post-drink ($JOP_{condition} - ConditionHitRate$). A positive subjective-objective performance discrepancy score indicates that JOP is higher than objective performance (hit rate) and thus performance is overestimated. A subjective-objective performance discrepancy score closer to zero indicates that JOP and objective performance are more similar in value and finally, a negative subjective-objective performance discrepancy score indicates that the JOP is lower than the hit rate (i.e., JOP is too conservative, underestimated).

The MAT has been used to examine the acute effects of methamphetamine on judgments of agency and was found to be sensitive to drug dosage (Kirkpatrick, Metcalfe, Greene, & Hart, 2008). Specifically, low doses of methamphetamine improved task performance and enhanced judgments of agency whereas moderate and high doses did not affect judgments of agency. The current study employed the MAT to determine whether pre-post differences in 1) in objective scores, 2) judgments of agency, 3) judgments of

performance and 4) subjective-objective performance discrepancy scores, differed as a function of condition.

D. **Procedure**

Participants were contacted by phone and email and were instructed to avoid using alcohol and drugs 24 hours prior to the experiment, and to also refrain from eating food within 4 hours of the experiment. To avoid confounds associated with caffeine withdrawal, participants were instructed to drink caffeine as they normally did up until 2 hours before the study. Participants were also instructed not to drive to the laboratory, but rather to take public transportation or arrange to be driven.

Upon arrival at the experimental session participants were consented to participate in the research study. All women took a pregnancy test in which they provided a urine sample that was analyzed using the Pregnosticon Dri-Dot test (Organon Diagnostics, West Orange, NJ). Participants' weight was recorded to determine the dosage of alcohol and/or caffeine, and the size of a pre-drink snack provided to standardize the amount of food participants had prior to drinking alcohol. Finally, participants provided a breath sample to ensure a Breath Alcohol Content (BAC) of zero. The Data-Master infra-red breath alcohol detector (National Patent Analytical Systems, Inc., Mansfield, OH) was calibrated prior to each experimental session.

Participants meeting the qualification requirements were randomly assigned to one of the four experimental conditions: 1) alcohol alone, told no caffeine (n = 37), 2) alcohol, told caffeine get caffeine (n = 35), 3) alcohol, told caffeine, get no caffeine (n = 35), 4) alcohol, told no caffeine, get caffeine (n = 39). Experimenters informed participants in conditions 1 and 4 that they would receive alcohol only (and no caffeine) and participants in conditions 2

and 3 that they would receive alcohol and caffeine. To increase the success of the placebo manipulation, participants assigned to conditions 2 and 3 were shown the caffeine powder and were educated on how the powder was dissolved in the cranberry mixer. Next, participants were administered a light snack designed to prevent hypoglycemic reactions, and to increase the amount of time that participants remained on the ascending limb of the blood alcohol curve. Participants completed a battery of baseline self-report questionnaires and behavioral tasks on the computer described above in the measures section. Figure 1 illustrates the order in which measures and tasks were administered throughout the experiment.

While participants completed baseline questionnaires and behavioral tasks, the research assistant prepared a drink containing either alcohol or alcohol and caffeine. Participants were administered a dose of 100-proof Smirnoff vodka calibrated by weight and gender on a previously constructed dose table to produce a moderate level of intoxication (.8g/kg dose, and .06 BAC to .08 BAC; Sayette, Breslin, Wilson, & Rosenblum, 1994). Odorless, tasteless, anhydrous caffeine powder was titrated by gender and mixed into a cranberry juice solution by the study coordinator, prior to each experimental session. The amount of mixer administered was determined by weight and females and males randomized to receive caffeine were administered no more than 5.0 mg/kg (250mg) and 5.5 mg/kg (300mg) of anhydrous caffeine powder, respectively. The minimum dose of caffeine administered was approximately 160 mg for females and 190mg for males. Average amount of caffeine administered to males was 246.8 mg (SD = 31.06) and to females, 195.32 mg (SD = 24.81). These doses are roughly equivalent to the caffeine content of 2.5 to 3 cans of Red

Bull (80mg caffeine each) and are likely the amount of caffeine social drinkers might expect to consume on a night out where they opt to drink caffeinated alcoholic beverages.

The beverage was administered to participants in three equal doses. Average milliliters of alcohol administered for males and females was 174.60 (SD = 20.61) and 131.47 (SD = 19.05), respectively. Beginning at time 0, participants received the first third of the drink, and were asked to consume it evenly over a 10-minute period. At 10 and 20 minutes, they received the second and third doses. Following consumption of the final third, participants were instructed to wash their mouths out with water and undergo a breathalyzer test to measure BAC (#2). Participants then completed the SIS (#2), the BAES (#1), the PANAS (#2) and the CARE. Single items questions about perceived ability to drive and desire to drink more were administered post drink consumption and at the end of the study. The same battery of behavioral performance tasks were administered post-drink though the order was counterbalanced to control for the descending alcohol limb that could potentially cause order effects. Participants were randomly assigned to one of six different possible orders for post drink administration behavioral tasks.

Following the post-drink behavioral tasks, participants completed the SIS (#3), BAES (#2), and PANAS (#3). At the conclusion of the experimental session participants provided the final BAC (#3) and completed the post-experiment questionnaire. To keep experimenters blind to condition, participants were only partially debriefed by the experimenter and then handed a sealed letter with more information about their experimental condition and the possible use of deception. After debriefing, participants were compensated \$50 (plus earnings from the BART) for their participation and they remained in the lab until their BAC returned to below .03% (confirmed by two BAC measurements; (NIAAA, 2005)).

E. Data analyses

1. Preliminary Analyses

The normality and range of data distributions were examined, outliers were removed and appropriate data transformations were made when necessary. The data were also screened for violations of assumptions underlying the statistical tests described below. Descriptive statistics for all measures were then calculated and variables were plotted on histograms to confirm a normal distribution.

2. Manipulation Checks

A series of one-way analysis of variance (ANOVA) was carried out to ensure that pre-drink self-report measures and task performance did not differ as a function of group (i.e., randomization was successful). Mean BAC at time two and three was calculated to ensure that participants reached the desired level of alcohol intoxication. A paired-sample t-test was conducted to confirm that drink administration resulted in differences in subjective intoxication ratings between pre-drink and post-drink. Additionally, a two-way (told caffeine, received caffeine) ANOVA was conducted to determine that estimated amount of caffeine consumed, recorded at the end of study questionnaire, significantly differed as a function of instruction (told yes, told no) and caffeine consumption (consumed, did not consume). Chi-Square tests were performed to determine whether belief that caffeine was consumed (yes or no), at the conclusion of the experiment, differed between the four conditions as well as by instruction and caffeine consumption groups. A series of one-way ANOVAs were carried out to determine if groups differed on age or patterns of caffeine,

alcohol or caffeinated alcohol consumption and chi-square tests were used to confirm that groups were equally matched on demographics (race, gender).

3. Primary Analyses

Correlational analyses were conducted to assess relationships between quantity and frequency of caffeinated alcohol consumption and quantity and frequency of caffeine and alcohol consumption, binge drinking behaviors, caffeine and alcohol expectancies, impulsivity, trait anxiety, depressive symptoms, peer norms and attitudes about caffeinated alcohol, and single item measures of risky behavior. Spearman rho correlation coefficients are reported for correlations between quantity, frequency and quantity-frequency scores for caffeinated alcohol use due the large number of zero's. Additional correlational analyses were performed to explore relationships among post-drink and end of experiment stimulation and sedations subscale scores, subjective intoxication, desire to continue drinking and perceived ability to drive a car and several indices of risk including subscales of the Cognitive Appraisal of Risk Evaluation (CARE) and the Balloon Analogue Risk Task (BART).

To answer the most central research questions and to test the proposed hypotheses, a series of 2 (session) by 2 (instruction) by 2 (consumption) mixed design ANOVAs were conducted to assess pre and post-drink differences as well as post-drink (ascending alcohol limb) and end of the experiment (descending alcohol limb) differences as a function of caffeine instruction and caffeine consumption. The Subjective Intoxication Scale (SIS) and Positive and Negative Affect Schedule (PANAS), measures administered three times (pre-drink, post-drink, end of experiment), were assessed in two separate models (pre-post drink, post-drink – end of experiment) in order to isolate the effects of group on the ascending and

descending alcohol limbs. Within-subject, repeated measures variables included the SIS, stimulation and sedation subscale scores of the Biphasic Effects of Alcohol Scale (BEAS), perceived ability to drive, desire to continue drinking alcohol, PANAS subscales, Metacognition of Agency Task (MAT) measures, BART measures, Stop-it Task measures, and Simple Reaction Time Task (SRTT) measures. Between-subject variables included caffeine instruction (told yes, told no) and caffeine consumption (consumed, did not consume).

For each mixed design, ANOVA main effects of session, instruction and consumption were tested along with a caffeine instruction by caffeine consumption group interaction. When an instruction by consumption group interaction emerged as significant, the average of the pre and post outcome variables was calculated (new dependent variable). The data set was then split by a group (e.g. instruction) and a one-way ANOVA was conducted for each group (e.g., told yes, told no) with one between-subject factor (e.g., consumption) entered into both models. Two, two-way interactions of session by between-group variables (caffeine instruction, caffeine consumption) were assessed in the mixed design ANOVAs as well. Session (e.g., pre-post drink) by group (instruction, consumption) interactions were followed up by splitting the data set by a group (e.g. consumption) and conducting two separate repeated measures ANOVAs for each group (e.g., consumed caffeine, did not consume) with no between-subject factor entered in the model. Last, a 3-way interaction of session, caffeine instruction and caffeine consumption was also included in each mixed design ANOVA and when significant, was followed up with the same procedure described for session by group interactions except that one between-subject factor was entered in each model.

In the event that randomization success checks revealed pre-drink group differences, a two-way (instruction by consumption) ANOVA was conducted with the post-drink outcome as the dependent variable and the pre-drink outcome entered as a covariate. To determine whether responses to the CARE subscales, administered post-drink, differed as a function of group, a series of two-way (instruction by consumption) ANOVAs were conducted. A significant instruction by consumption group interaction revealed in a two-way ANOVA was followed up by splitting the data by a group (e.g., instruction) and conducting two separate one-way ANOVAs for each group (e.g., told yes, told no) and entering one between-subject variable (e.g., consumption) into each model.

For all analyses, decisions regarding significance were made based on an alpha level of 0.05. Effects were considered marginally significant if alpha levels were between .051 and .10. Effect sizes are reported as partial eta-squares.

F. Hypotheses

1. Hypothesis 1:

Compared to participants who consume only alcohol, participants who consume alcohol plus caffeine will:

Hypothesis 1a: report feeling less intoxicated on the Subjective Intoxication Scale (SIS)

Hypothesis 1b: report feeling less sedated and more stimulated on the Biphasic Alcohol Effects Scale (BAES)

Hypothesis 1c: report higher positive affect and lower negative affect on the Positive and Negative Affect Schedule (PANAS) following drink administration

Hypothesis 1d: demonstrate an increase in risk-taking propensity as indicated by 1) higher confidence ratings of ability to drive a car post-drink, 2) higher desire to continue drinking, 3)

higher monetary earnings and more explosions on the BART, and 4) higher likelihood of involvement and in and lower perceived consequences of various risk behaviors on the Cognitive Appraisal of Risky Events (CARE)

Hypothesis 1dd: Higher desire to continue drinking (post-drink) will correlate positively with post-drink measures of perceived ability to drive a car and stimulation and negatively with subjective intoxication and sedation.

Hypothesis 1ddd: Higher [risk taking] scores on the Cognitive Appraisal of Risky Events (CARE) and the Balloon Analogue Risk Task (BART) will correlate positively with stimulation and negatively with subjective intoxication.

Hypothesis 1e: demonstrate less sensitivity to manipulations of personal agency, inflated judgments of performance and greater discrepancies between objective and subjective indices of performance on the Metacognition of Agency Task (MAT).

Hypothesis 1f: demonstrate more impulsive behavior as indexed by inattention (i.e., deviation from the mode) on the Simple Reaction Time Task (SRTT) and lower behavioral inhibition on the Stop-It Task (stop-sign reaction time, likelihood of responding on a stop-signal trial, time to respond on a stop-sign trial).

Hypothesis 1g: demonstrate better performance on behavioral tasks that recruit motor skills including reaction time on the SRTT, reaction time and percent of correct responses for no-signal trials on the Stop-it task and objective performance scores on the MAT.

2. **Hypothesis 2:**

Compared to participants who are told they will not receive caffeine, participants who are told they will receive caffeine will demonstrate a profile of effects less robust, but similar to those described in hypothesis 1 for participants who consume caffeine.

3. **Hypothesis 3:**

Quantity and frequency of caffeinated alcoholic beverage consumption will be positively correlated with quantity and frequency of alcohol use, impulsivity (UPPS-P subscales), positive expectancies for caffeine (Caffeine Expectancy Questionnaire) and alcohol (Comprehensive Effects of Alcohol Questionnaire) use, peer attitudes and norms surrounding use of caffeinated alcohol (Peer Influences on Drinking Questionnaire), and engagement in health-risk behaviors (Single Item Measures: seat-belt use, unprotected sex, number of partners, driving while intoxicated).

III. RESULTS

The sample was comprised of 146 individuals (49% male; mean age 24.1 (SD = 2.33)) and was ethnically diverse, consisting of 65% Caucasians, 16% African Americans, 14% Hispanics, 4% Asian/Pacific Islanders and 1% other. Participants' responses to the baseline questionnaire measures regarding quantity and frequency of caffeine, alcohol and caffeinated alcohol consumption along with peer norms about caffeinated alcohol consumption are summarized in Table 1.

A. Manipulation Checks

A series of one-way ANOVA's indicated that groups did not significantly differ at pre-drink on self-report measures or behavioral tasks. Randomization success checks for Metacognition of Agency Task data revealed several pre-drink group differences which are discussed below. Mean peak BAC for the sample was .0879 (SD = .019); mean BAC on the ascending limb was .076 (SD = .023) and .08 (SD = .017) on the descending limb (i.e., end of the experiment). A *t*-test revealed that pre-drink ratings of subjective intoxication were

significantly lower than post-drink ratings ($t = -33.019$, $df = 141$, $p < .001$). Finally, 98% of the sample believed they had consumed alcohol when asked at the end of the experiment. Taken together, it was concluded that participants successfully reached the desired BAC level of .08 and that subjective ratings were sensitive to alcohol administration.

A chi-square test revealed that percent of participants who believed they had consumed caffeine in the experiment was higher among participants who were told they would receive caffeine (68%) compared to participants who were told they would *not* receive caffeine (17%; $\chi^2(1) = 36.79$, $p < .001$). Percentage of participants who believed they had consumed caffeine did not differ as a function of actual caffeine consumption ($\chi^2(1) = .173$, *ns*). Percent of participants who believed that had received caffeine also differed by specific condition ($\chi^2(3) = 37.34$, $p < .001$; 15% told no caffeine and received no caffeine, 64% told caffeine and received caffeine, 71% told caffeine and received no caffeine and 19% told no caffeine and received caffeine). Additionally, a 2-way ANOVA indicated a main effect of caffeine instruction on participant's estimated number of caffeine milligrams received ($F(1, 131) = 10.51$, $p < .001$, $\eta_p^2 = .07$). More specifically, participants who were told they would receive caffeine had higher estimates of caffeine consumption ($M = 105.07$, $SD = 99.13$) than participants who were told they would not receive caffeine ($M = 52.35$, $SD = 87.7$). Neither a main effect of consuming caffeine nor an instruction by consumption group interaction emerged for estimated amount of caffeine consumed. No main effects of consumption or instruction and no consumption by instruction interaction were found for how participants rated the taste (pleasantness) of their cocktails. Thus, instructional set was determined to have the intended effect as participants who were told they would receive caffeine had higher

estimates of caffeine consumption and were more likely to endorse caffeine consumption compared to participants who were told they would not receive caffeine.

Finally, results from a series of one-way ANOVAs indicated that groups did not differ in age or patterns of caffeine, alcohol or caffeinated alcohol consumption (i.e., quantity, frequency, quantity-frequency, number of drinks consumed per drinking occasion, heavy drinking index). Additionally, chi-square analyses confirmed that groups were equally matched on gender and ethnicity.

B. Caffeine, Alcohol and Caffeinated Alcohol Consumption Patterns and Peer Norms and Attitudes

On average, over the past three months, participants reported drinking caffeinated beverages (independent of CABs) 5.44 (SD = 2.04) days a week and consuming an average of 10.86 (SD = 8.04) caffeinated beverages per week. Mean number of caffeinated beverages consumed per drinking occasion was 1.86 (SD = .96). Forty-two percent of the sample met criteria for caffeine dependence (endorsed three or more criterion). Mean number of withdrawal symptoms (i.e., 7 potential symptoms experienced after not drinking caffeine for 24 hours) experienced by participants in the past year was 1.43 (SD = 1.59).

When asked about alcohol consumption over the past three months, participants reported drinking alcohol an average of 3.97 (SD = 1.64) days a week and consuming an average of 14.31 (SD = 9.03) drinks a week. Mean number of alcoholic beverages consumed per drinking occasion was 3.63 (SD = 1.65). The majority of the sample (93%) indicated they had engaged in binge drinking (i.e., consumed 4 (female) 5 (male) or more drinks in one sitting) one or more times in the past month and 79% reported they had been drunk at least once in the past month. With regard to peer norms for drinking, 60% of participants reported

that half to all of their close friends drink primarily to get drunk. Additionally, 52% of participants reported they drink as much or more than their friends when out at parties or bars.

Use of caffeinated alcoholic beverages (CABs) in the past month was reported by 66% of the sample. When asked about the past three months, seventy-three percent of participants indicated they had, on average, consumed CABs one day a week or more. Participants reported drinking CABs an average of 1.91 (SD = 1.98) days a week and consuming an average of 3.18 (SD = 4.19) CABs a week. For those who reported CAB consumption in the past three months, mean number of CABs consumed per drinking occasion was 1.65 (SD = .92). Twenty percent of participants indicated they had consumed 4 (female) 5 (male) or more CABs in one sitting at least once in the past thirty days. Frequency analyses of variables from the Peer Influences on Drinking measure suggested that participants perceived their close friends have having lower approval of and engagement in CAB use relative to alcohol use. Tables 1 and 2 provide descriptive statistics for caffeine, alcohol and CAB use as well peer norms and attitudes regarding alcohol and caffeinated alcohol use.

C. Correlations with Caffeinated Alcohol Use

Alcohol and Caffeine Use. Nonparametric Spearman Rho correlations indicated that Quantity frequency (QF) scores for CAB consumption were positively related with alcohol QF scores and the heavy drinking index ($r = .368, p < .001$; $r = .242, p < .01$) but not caffeine QF scores ($r = .014, ns$). The latter result likely reflects that participants (correctly) reported caffeine use independent of CAB use. Of note, caffeine QF scores demonstrated a positive relationship with alcohol QF scores and the heavy drinking index ($r = .246, p < .01$; $r = .184, p < .05$).

Single Item Risk Measures. Frequency and QF CAB scores, but not quantity scores, were inversely related to participants' estimated percent of time they wore a seat belt while driving/riding in a car over the past 12 months ($r = -.210, p < .05$; $r = -.174, p < .05$). No relationships between CAB quantity, frequency or QF scores emerged with single item risk measures that assessed number of times drove while feeling drunk or buzzed, number of times had unprotected sex and number of partners had unprotected sex with in the past 12 months. However, among participants who consumed CABs regularly in the past three months (73%), frequency of CAB consumption (but not quantity or QF) was positively related to number of times over the past year participants reported driving while feeling drunk or "buzzed" ($r = .194, p < .05$).

Impulsivity. CAB QF scores correlated with the positive urgency and lack of premeditation subscales on the UPPS-P impulsivity measure ($r = .170, p < .05$; $r = .169, p < .05$) but not the other three subscales. The positive urgency subscale was also positively correlated with individual quantity and frequency scores for CABs ($r = .172, p < .05$; $r = .182, p < .05$) and quantity of CABs was correlated with lack of premeditation ($r = .177, p < .05$). No other relationships were noted between individual quantity and frequency scores for CAB and subscales of the UPPS-P. Among participants who had regularly consumed CABs in the past three months, positive relationships were noted between the negative urgency subscale of the UPPS-P and CAB quantity, frequency and QF scores ($r = .228, p < .05$; $r = .234, p < .05$; $r = .237, p < .05$, respectively).

Anxiety, Depression, Caffeine and Alcohol Expectancies, Peer Norms and Attitudes. No associations emerged between CAB use variables and trait anxiety (State-Trait Anxiety Inventory), depressive symptoms (Beck Depression Inventory) or any of the subscales on the

Caffeine Expectancy Questionnaire or the Comprehensive Effects of Alcohol Questionnaire. Finally, CAB quantity, frequency and QF scores were positively correlated with participant's estimated number of close friends who drink CABs ($r = .208, p < .05$; $r = .213, p < .05$; $r = .205, p < .05$, respectively) and ratings of their friends' approval of drinking CABs ($r = .207, p < .05$; $r = .215, p < .01$; $r = .210, p < .05$, respectively). Select correlations with CAB consumption variables are presented in Table 3.

D. Self-Report Measures: Subjective Intoxication, Biphasic Effects of Alcohol, Perceived Ability to Drive, Desire to Continue Drinking, Mood State, Cognitive Appraisal of Risky Events

Subjective Intoxication. A 2 (between subjects: caffeine consumed, caffeine not consumed) by 2 (between subjects: told receiving caffeine, told not receiving caffeine) by 2 (repeated measures within-subjects: pre-drink, post-drink) mixed design ANOVA was conducted to determine the effect of caffeine instruction and consumption on changes in subjective intoxication from pre to post-drink as well as between groups. As anticipated, the analysis revealed a main effect of time indicating that subjective ratings of intoxication increased from pre to post-drink $F(1, 138) = 1103.67, p < .001, \eta_p^2 = .89$. A main effect of caffeine consumption trended towards significance ($F(1, 138) = 4.63, p = .057, \eta_p^2 = .03$) and suggested that participants who consumed caffeine had lower overall subjective ratings of intoxication compared to participants who did not receive caffeine. Neither a main effect of caffeine instruction nor an instruction by consumption group interaction was found for subjective intoxication ratings at pre and post-drink. However, a session (pre, post-drink) by caffeine consumption interaction was noted ($F(1, 138) = 5.10, p < .05, \eta_p^2 = .03$). Follow up analyses with two separate repeated measures ANOVAs for each group (consumed, did not

consume) showed no differences between groups pre-drink though at post-drink, participants who consumed caffeine had lower ratings of subjective intoxication than participants who did not consume caffeine $F(1, 141) = 4.18, p < .05, \eta_p^2 = .03$). Neither a session by instruction interaction nor a time by instruction by consumption group interaction was detected for changes in subjective intoxication on the ascending alcohol limb.

The same analysis was also employed to determine whether changes in subjective intoxication ratings from the ascending limb (post-drink) to the descending limb (end of the experiment) differed by group. A main effect of time indicated that subjective ratings of intoxication significantly decreased from the ascending to the descending alcohol limb ($F(1, 133) = 9.31, p < .005, \eta_p^2 = .07$). Additionally, a main effect of caffeine consumption revealed that participants who consumed caffeine had lower overall ratings of intoxication compared to participants who did not consume caffeine ($F(1, 133) = 4.27, p < .05, \eta_p^2 = .03$). No main effect of caffeine instruction on ratings of intoxication was noted. No other two or three-way interactions were found. Figure 3 shows subjective intoxication as a function of caffeine consumption (consumed, did not consume) across all three time points.

Stimulation and Sedation. Briefly, ratings of subjective intoxication were positively correlated with the stimulation and sedation subscale scores of the Biphasic Alcohol Effects Scale (BAES) post drink on the ascending alcohol limb ($r = .341, p < .001; r = .444, p < .001$) as well as at the end of the experiment on the descending alcohol limb ($r = .361, p < .001; r = .425, p < .001$). These relationships suggest that the BAES was sensitive to perceived levels of intoxication across the ascending and descending alcohol limbs.

A 2 (between subjects: caffeine consumed, caffeine not consumed) by 2 (between subjects: told receiving caffeine, told not receiving caffeine) by 2 (repeated measures within-

subjects: post-drink, end of experiment) mixed design ANOVA was conducted to determine whether group (instruction, consumption) influenced changes in sedation and stimulation subscale scores (of the BAES) from the ascending (post-drink) to descending (end of the experiment) alcohol limb. A main effect of time indicated that stimulation scores decreased from the ascending to descending alcohol limb ($F(1, 135) = 23.66, p < .001, \eta_p^2 = .15$). No main effects for group and no two or three-way interactions emerged for stimulation subscale scores. No main effect of time was found for the sedation subscale indicating that participants' subjective ratings of sedation did not change. Additionally, no main effect of group and no two or three-way interactions were noted for sedation subscale scores. The hypothesis that caffeine consumption, and to a lesser extent caffeine instruction, would increase stimulation and decrease sedation was not supported.

Perceived Ability to Drive. As anticipated, perceived ability to drive was negatively associated with subjective intoxication and sedation subscale scores on both the ascending ($r = -.508, p < .001; r = -.346, p < .001$) and descending alcohol limbs ($r = -.363, p < .001; r = -.264, p < .01$). Ratings of perceived ability to drive were examined with a 2 (between subjects: caffeine consumed, caffeine not consumed) by 2 (between subjects: told receiving caffeine, told not receiving caffeine) by 2 (repeated measures within-subjects: post-drink, end of experiment) mixed design ANOVA. A main effect of time emerged indicating that perceived ability to drive decreased from the ascending to the descending alcohol limb ($F(1, 137) = 7.52, p < .01, \eta_p^2 = .05$). No main effects of group (instruction or consumption) and no two or three-way interactions were found for perceived ability to drive and gender did not emerge as a significant covariate. The hypothesis that caffeine consumption and instruction would inflate judgments of perceived ability to drive was not supported. Previous research

demonstrates that males tend to be more optimistic than females when judging driving skills and competency (e.g., Dejoy, 1992; Rosenbloom, Beigel, Perlman, & Eldror, 2010). As such, a 2-way (instruction by consumption) ANOVA was conducted with post-drink (ascending alcohol limb) ability to drive as the dependent variable and gender was entered as a covariate. Analyses revealed that males had higher ratings of ability to drive than females ($F(1, 138) = 4.06, p < .05, \eta_p^2 = .03$) on the ascending alcohol limb though not on the descending alcohol limb. No gender differences in perceived ability to drive were noted in a 2-way ANOVA on the descending alcohol limb.

Desire to Continue Drinking. The desire to continue drinking variable at both time points was log transformed to reduce skewness and kurtosis. As anticipated, desire to continue drinking, assessed post-drink on the ascending alcohol limb, was positively and negatively correlated with post-drink stimulation and sedation subscale scores of the Biphasic Alcohol Effects Scale (BAES), respectively ($r = .253, p < .01; r = -.224, p < .01$). Desire to continue drinking immediately following drink administration was not related to post-drink subjective intoxication ($r = -.132, p = ns$) but was positively associated with perceived ability to drive a car post-drink ($r = .270, p < .01$). Similarly, at end the end of the experiment, on the descending alcohol limb, desire to continue drinking was positively correlated with stimulation and negatively correlated with sedation subscale scores of the BAES administered at the end of the experiment ($r = .256, p < .01; r = -.236, p < .05$). Desire to continue drinking on the descending alcohol limb was not related to post-drink subjective intoxication ($r = -.007, p = ns$) but was positively associated with perceived ability to drive a car post-drink ($r = .245, p < .01$).

A 2 (between subjects: caffeine consumed, caffeine not consumed) by 2 (between subjects: told receiving caffeine, told not receiving caffeine) by 2 (repeated measures within-subjects: post-drink, end of experiment) mixed design ANOVA was conducted with desire to continue drinking as the dependent variable. A main effect of time was found showing that desire decreased from the ascending to the descending alcohol limb ($F(1, 134) = 19.63, p < .001, \eta_p^2 = .14$). No main effect of group (instruction or consumption) or an instruction by consumption group interaction was noted though a time (post-drink, end of the experiment) by caffeine consumption interaction did emerge ($F(1, 134) = 6.38, p < .05, \eta_p^2 = .05$). Follow-up analyses with two separate repeated measures ANOVA for each consumption group (consumed, did not consume) showed that whereas participants who did not consume caffeine had a significant reduction in desire to continue drinking from the ascending to the descending alcohol limb ($F(1, 67) = 20.74, p < .001, \eta_p^2 = .24$), participants who consumed caffeine did not ($F(1, 69) = 2.86, p = .095, \eta_p^2 = .04$). This finding, illustrated in Figure 4, is consistent with the hypothesis that consumption of caffeine would influence desire to continue drinking from the ascending to descending alcohol limb. Although desire to continue drinking decreased for everyone, (as was expected in a lab setting where one is drinking alone), the magnitude of decrease was only significant for participants who did not consume caffeine. Finally, no other two or three-way interactions were found for desire to continue drinking.

Negative Affect. The negative affect subscale variables at all three time points were log transformed to reduce positive skew and kurtosis. Two separate 2 (time: pre, post-drink) or (time: post-drink, end of the experiment) x 2 (caffeine instruction) x 2 (caffeine consumption) mixed design ANOVAs were conducted to assess change in negative affect

from pre to post drink and from post-drink to the end of the experiment as a function of group (instruction, consumption). Results from the first model indicated no main effects and no two or three-way interactions for the negative affect subscale scores from pre to post-drink. Analyses of negative affect from post-drink to the end of the experiment yielded the same pattern of results. Finally, negative affect ratings were lower at the end of the session relative to pre-drink ratings ($F(1, 121) = 5.04, p < .05, \eta_p^2 = .04$).

Positive Affect. The same analyses described for negative affect were employed with positive affect subscales. No main effects of group emerged and no main effect of time was found indicating that positive affect ratings did not differ from pre to post drink. Additionally no two or three-way interactions were noted for positive affect from pre to post-drink.

Analyses examining change in positive affect from post-drink to the end of the experiment revealed that positive affect decreased from post-drink to the end of the experiment ($F(1, 133) = 21.57, p < .001, \eta_p^2 = .14$). [Pre-drink positive affect ratings were also significantly higher than positive affect ratings at the end of the session ($F(1, 136) = 20.79, p < .001, \eta_p^2 = .13$].] No main effects of group and no two of three-way interactions were found for positive affect from post-drink to end of the experiment. The hypothesis that caffeine consumption, and to a lesser extent caffeine instruction, would increase positive affect and decrease negative affect was not supported.

Cognitive Appraisal of Risky Events (CARE). A two-way (instruction by consumption) ANOVA was conducted for each of the three ratings (likelihood of engaging in the behavior, likelihood of positive and negative consequences) of risky behaviors. Gender was entered as a covariate in all models as it was hypothesized to influence risk appraisal based on the findings of Fromme and colleagues (1997).

Results indicated no main effect of instruction or consumption for likelihood of engaging in risky behaviors and no instruction by consumption group interaction was noted. However, gender emerged as a significant covariate ($F(1, 133) = 15.41, p < .001, \eta_p^2 = .10$) whereby females reported they would be less likely to engage in risky behavior than males. No main effects or interactions were observed for ratings regarding the likelihood of positive consequences resulting from risky behaviors. Again, gender emerged as a significant covariate revealing that males endorsed a higher likelihood of positive consequences resulting from risky behaviors than females ($F(1, 125) = 17.73, p < .01, \eta_p^2 = .12$). Finally, no main effects or interactions emerged for likelihood of negative consequences resulting from risky behavior. No gender differences in ratings for the likelihood of negative consequences of risky behaviors were noted. In all, the hypothesis that caffeine consumption, and to a lesser extent caffeine instruction, would increase likelihood of engagement in risky behaviors and diminish the perceived severity of consequences associated with those behaviors, was not supported.

Correlational analyses were conducted to explore the hypothesized relationships between self-reported stimulation and intoxication and measures of risk-taking (BART outcomes – reported below, CARE subscales) administered post-drink. Amount of money earned and number of explosions on the Balloon Analogue Risk Task (BART) following drink administration were not correlated with subjective intoxication on the ascending alcohol limb ($r = .110, p = \text{ns}; r = .105, p = \text{ns}$) or the descending alcohol limb ($r = .161, p = .067; r = .021, p = \text{ns}$). Number of explosions on the BART following drink administration was correlated at trend-level with post-drink stimulation but amount of money earned was not ($r = .155, p = .069; r = .125, p = \text{ns}$). No correlations were observed between subjective

intoxication (on either the ascending or descending alcohol limbs) and scores for likelihood of engagement in or likelihood of positive or negative consequences resulting from risk behaviors on the CARE. Stimulation on the descending, but not ascending, alcohol limb was positively associated with likelihood of involvement in risky behaviors as well as likelihood of positive consequences resulting from risky behaviors ($r = .210, p < .05$; $r = .342, p < .01$) but not with likelihood of negative consequences. Overall, stimulation, but not subjective intoxication, correlated rather consistently with likelihood of participant's engagement in and appraisal of a variety of risk behaviors.

E. Behavioral Tasks

Simple Reaction Time Task. All reaction time variables were first square root transformed to reduce positive skewness and kurtosis. Mean reaction time on the SRTT was assessed with a 2 (between subjects: caffeine consumed, caffeine not consumed) by 2 (between subjects: told receiving caffeine, told not receiving caffeine) by 2 (repeated measures within-subjects: pre, post-drink) mixed design ANOVA. A main effect of time indicated that reaction time significantly increased pre to post drink ($F(1, 123) = 19.7, p < .001, \eta_p^2 = .14$). No main effects of group and no two or three-way interactions emerged for reaction time. The hypothesis that participants who consumed caffeine would have a smaller post-drink increase in reaction time than participants who consumed alcohol alone was not supported.

The deviation from the mode (Devmod), an index of inattention, was calculated with data from the SRTT, square root transformed to reduce skewness and kurtosis and assessed with the same mixed design ANOVA employed for reaction time. No main effects of time or group (instruction, consumption) nor an instruction by consumption group interaction were

noted however, a time by instruction interaction was revealed ($F(1, 128) = 4.32, p < .05, \eta_p^2 = .03$). Follow-up analyses with two separate repeated measures ANOVA for each group (told yes, told no) showed that whereas participants who were told they had not consumed caffeine had a significant increase in deviation from the mode (increased inattention) from pre to post-drink ($F(1, 66) = 4.60, p < .05, \eta_p^2 = .07$), participants who were told they had consumed caffeine did not demonstrate this increase ($F(1, 64) = .601, p = .441$). As illustrated in Figure 5, instruction that caffeine would be consumed appeared to protect participants from increases in inattention following drink administration. No other two or three-way interactions emerged for this measure of inattention.

Stop-It Task. A 2 (between subjects: caffeine consumed, caffeine not consumed) by 2 (between subjects: told receiving caffeine, told not receiving caffeine) by 2 (repeated measures within-subjects: pre, post-drink) mixed design ANOVA was conducted to assess the influence of group (instruction, consumption) on all stop task measures from pre to post-drink. The first outcome variable, stop sign reaction time, an index of ability to inhibit a potentiated response, was square root transformed to reduce positive skewness and kurtosis. No main effects of time or group and no two or three-way interactions were noted for stop sign reaction time. Ability to inhibit a potentiated response did not differ from pre to post drink or as a function of instruction or consumption.

A main effect of time for mean probability of responding on a stop-signal trial, where a response was to be withheld, indicated that the probability of responding increased from pre to post-drink ($F(1, 130) = 14.61, p < .001, \eta_p^2 = .10$). No main effects of time or group and no two or three-way interactions were observed for probability of responding on stop-signal trials.

Mean reaction time on signal-respond trials (trials where participants failed to inhibit their response) was log transformed to reduce positive skewness and kurtosis. A main effect of time indicated that reaction time on these trials increased from pre to post drink ($F(1, 134) = 31.46, p < .001, \eta_p^2 = .19$). No main effect of group (instruction, consumption) or an instruction by consumption group interaction was detected though a time by consumption interaction was observed ($F(1, 134) = 5.17, p < .05, \eta_p^2 = .04$). Follow up analyses with two separate repeated measures ANOVAs for each group (consumed, did not consume) showed that participants who did not consume caffeine had a more robust increase in response time on signal respond trials ($F(1, 66) = 34.46, p < .001, \eta_p^2 = .34$) than participants who consumed caffeine ($F(1, 70) = 4.95, p < .05, \eta_p^2 = .07$). In other words, although participants who consumed caffeine also demonstrated an increased response time post-drink on trials where inhibition of a response was unsuccessful, the increase was significantly smaller compared to participants who did not consume caffeine. Accordingly, as illustrated in Figure 6, consuming caffeine with alcohol was associated with a smaller post-drink increase in response time on trials where the response was to be inhibited (i.e., less hesitation to inhibit a response). Finally, no other two or three-way interactions were found for mean reaction time on signal respond trials.

Reaction time on trials in which no stop signals were presented (normal trials) was square root transformed to reduce positive skewness. Analyses indicated that reaction time increased from pre-drink to post-drink ($F(1, 140) = 30.81, p < .001, \eta_p^2 = .18$). No main effect of group (instruction, consumption) was noted and there was no instruction by consumption, time by instruction, or time by instruction by consumption interaction for reaction time on no-signal trials. A marginally significant time by caffeine consumption interaction did

emerge ($F(1, 140) = 3.11, p = .08, \eta_p^2 = .022$). Follow up analyses with two separate repeated measures ANOVAs for each group (consumed, did not consume) showed that participants who did not consume caffeine had a larger increase in response time on no-signal trials ($F(1, 69) = 27.89, p < .001, \eta_p^2 = .39$) compared to participants who did consume caffeine ($F(1, 73) = 6.84, p < .05, \eta_p^2 = .09$). Accordingly, participants who consumed caffeine had a marginally smaller increase in the time it took them to respond on normal trials (no stop signals presented) compared to participants who did not consume caffeine.

Mean percent of correct responses on no-signal, normal trials (hitting the appropriate key when presented with visual stimuli) was severely negatively skewed both pre and post-drink. As such, the variable was first reflected (1+highest value – each participant’s value) and then log transformed to adjust for the non-normal distribution. Results indicated a main effect of time such that percent of correct responses decreased from pre to post-drink ($F(1, 134) = 13.08, p < .001, \eta_p^2 = .09$). No main effects of group (instruction, consumption) were detected nor were any two-way interactions. A time by instruction by consumption group interaction emerged for mean percent of correct responses ($F(1, 134) = 4.64, p < .05, \eta_p^2 = .03$). The interaction was followed up by conducting two separate 2 (time: pre, post-drink) by 2 (Consumption: consumed, did not consume) mixed design ANOVAs for each caffeine instruction group (told no, told yes).

The first mixed design ANOVA, conducted with only participants who were informed they would not receive caffeine, revealed a main effect of time whereby mean percent of correct responses decreased from pre to post-drink ($F(1, 71) = 4.72, p < .05, \eta_p^2 = .06$). No main effect of consumption and no two-way interaction were noted.

The second mixed design ANOVA, conducted with only participants who were informed they would receive caffeine, also revealed a main effect of time ($F(1, 63) = 9.53, p < .01, \eta_p^2 = .13$) indicating that percent of correct responses decreased from pre to post-drink. No main effect of caffeine consumption emerged but a time by consumption interaction was observed among participants who were informed they would receive caffeine ($F(1, 63) = 7.0, p < .05, \eta_p^2 = .10$). Follow up analyses included two separate repeated measures ANOVAs; one for participants who were told they would receive caffeine and consumed caffeine (TYCY) and one for participants who were told they would receive caffeine but did not consume caffeine (TYCN). Results indicated that whereas mean percent of correct responses did not differ from pre to post-drink for participants in the TYCY condition ($F(1, 31) = .100, p = .754$), mean percent of correct responses significantly decreased from pre to post-drink for participants in the TYCN condition ($F(1, 32) = 16.01, p < .001, \eta_p^2 = .33$). In other words, among those who were told they would consume caffeine, participants who did not consume caffeine demonstrated a significant decrease in percent of correct response from pre to post drink whereas those who consumed caffeine, did not. Importantly though, caffeine consumption had no effect on pre-post changes in percent correct responses among participants who were told they would not receive caffeine. Group differences in mean percent of correct responses are presented in Figure 7.

BART. A 2 (within-in subjects: pre, post-drink) x 2 (between subjects: instructions) x 2 (between subjects: consumed caffeine) mixed design ANOVA for each of the BART outcome measures. Analyses yielded a main effect of time on number of adjusted pumps (number of pumps on trials where the balloon did not explode) such that average number of adjusted pumps increased from pre to post drink, indicating more risk taking following drink

consumption ($F(1, 134) = 45.19, p < .001, \eta_p^2 = .25$). No main effect of group and no two or three-way interactions were found for number of adjusted pumps. The same analysis was conducted with number of balloon explosions as the dependent variable and yielded no main effect of time or group (instruction, consumption) and no two or three-way interactions for balloon explosions. A main effect of time was found for money earned on the BART indicating that participants earned more money at post-drink compared to pre-drink ($F(1, 132) = 47.68, p < .001, \eta_p^2 = .27$). No main effects of caffeine instruction or consumption were noted and two or three-way interactions emerged for average monetary earnings on the BART. Finally, because men generally tend to exhibit higher levels of risk-taking than females (Byrnes, Miller, & Schafer, 1999) and meta-analytic analysis suggests that men continue to pursue reward despite increasing risk on the BART (Cross, Copping, & Campbell, 2011), the same analysis was conducted with gender entered as a covariate. As expected, a main effect of gender emerged indicating that males earned a higher overall amount of money ($F(1, 131) = 6.36, p < .05, \eta_p^2 = .05$) and had a greater number of adjusted pumps ($F(1, 134) = 7.08, p < .01, \eta_p^2 = .04$), than females.

Metacognition of Agency Task (MAT). Pre to post-drink change in mean objective performance (the number of X's hit, minus the O's hit, divided by total number of X's and O's), Judgments of Agency (JOA), Judgments of Performance (JOP) and subjective-objective performance discrepancies (JOP – hit rate) were assessed with a series of 2 (between subjects: caffeine consumed, caffeine not consumed) by 2 (between subjects: told receiving caffeine, told not receiving caffeine) by 2 (repeated measures within-subjects: pre, post-drink) mixed design ANOVAs. Separate analyses of MAT outcome variables were

conducted for each of the four MAT conditions: normal (no mouse manipulations), turbulence (more difficult), lag (most difficult), and magic (easiest, easier than normal).

Objective performance. No main effects of time or group and no two or three-way interactions were found for objective performance in the normal condition. The same pattern of results was noted for objective performance in the lag condition, with the exception of a main effect of time which indicated that participants' objective performance in the lag condition improved pre to post-drink ($F(1, 120) = 6.16, p < .05, \eta_p^2 = .05$).

No main effects of time or group (instruction, consumption) were observed for objective performance in the turbulence condition. However, a time by consumption interaction was found ($F(1, 121) = 4.42, p < .05, \eta_p^2 = .04$) and followed up with two separate repeated measures ANOVA for each consumption group (consumed, did not consume). Results indicated that whereas there was no change in objective performance in the turbulence condition for participants who did not consume caffeine ($F(1, 65) = .661, p = .42$), participants who consumed caffeine demonstrated increased objective performance from pre to post-drink ($F(1, 58) = 5.20, p < .05, \eta_p^2 = .08$; see Figure 8). No other two or three-way interactions were noted for objective performance in the turbulence condition.

A randomization success check indicated that participants who were assigned to consume caffeine had lower objective performance pre-drink in the magic condition compared to participants who were not assigned to receive caffeine ($F(1, 131) = 6.37, p < .05, \eta_p^2 = .05$). To account for these pre-drink group differences, a 2 by 2 (instruction by consumption) ANOVA was conducted with post-drink objective performance as the dependent variable and pre-drink objective performance entered as a covariate. A main effect of instruction indicated that participants who were told they would receive caffeine had higher objective

performance in the magic condition at post-drink than participants who were told they would not receive caffeine ($F(1, 118) = 4.17, p < .05, \eta_p^2 = .03$; see Figure 10). Results showed no main effect of consumption and no instruction by consumption group interaction for objective performance in the magic condition.

Judgments of Agency (JOA). A randomization success check indicated that participants who were assigned to consume caffeine had lower JOA pre-drink in the normal condition compared to participants who were not assigned to receive caffeine ($F(1, 133) = 4.59, p < .05, \eta_p^2 = .03$). To control for pre-drink differences a 2-way (instruction by consumption) ANOVA was conducted with post-drink JOA for the normal condition as the dependent variable and pre-drink JOA entered as a covariate. No main effects of instruction or consumption were found and no caffeine instruction by consumption group interaction emerged for post-drink JOA in the normal condition.

Both pre and post JOA for the turbulent condition were square root transformed to reduce skewness and kurtosis. A main effect of time indicated that participant's JOA for the turbulence condition increased from pre to post-drink ($F(1, 119) = 12.48, p < .01, \eta_p^2 = .10$). Whereas no main effect of caffeine instruction emerged, a main effect of caffeine consumption revealed that participants who received caffeine had lower overall JOA in the turbulence condition than participants who did not consume caffeine ($F(1, 119) = 4.17, p < .05, \eta_p^2 = .03$). No two or three-way interactions were revealed for JOA in the turbulence condition.

A main effect of time indicated that JOA for the lag condition increased from pre to post-drink ($F(1, 117) = 7.94, p < .01, \eta_p^2 = .06$). No main effect of instruction was noted though similar to the turbulence condition, a marginally significant main effect of consumption

suggested that participants who consumed caffeine had lower overall JOA in the lag condition compared to participants who did not consume caffeine ($F(1, 117) = 3.86, p = .052, \eta_p^2 = .03$). No two or three-way interactions emerged for JOA in the lag condition.

JOA in the magic condition were severely negatively skewed both pre and post-drink. As such, the variable was first reflected (1+highest value minus raw value) and then inversed (1/reflected value) to adjust for the non-normal distribution. A randomization success check indicated that participants who were assigned to receive caffeine had lower JOA pre-drink in the magic condition compared to participants who were not assigned to receive caffeine ($F(1, 132) = 5.33, p < .05, \eta_p^2 = .04$). Accordingly, a two-way (instruction by consumption) ANOVA was conducted with post-drink JOA as the dependent variable and pre-drink JOA entered as a covariate. No main effect of consumption was observed though a marginally significant main effect of instruction ($F(1, 115) = 3.58, p = .06, \eta_p^2 = .03$) indicated that participants who were told they would receive caffeine evidenced marginally lower post-drink JOA in the magic condition compared to participants who were told they would not receive caffeine.

Judgments of Performance (JOP). A main effect of time for JOP in the normal condition indicated that JOP decreased from pre to post-drink ($F(1, 125) = 7.83, p < .01, \eta_p^2 = .06$). No main effects of group and no two or three-way interactions were noted for JOP in the normal condition. Pre and post-drink JOP in the turbulence condition were square root transformed to reduce skewness and kurtosis and pre and post-drink JOP in the magic condition were reflected and inversed to reduce severe negative skew. No main effects of time or group and no two-way or three-way interactions were noted for JOP in the turbulence, lag or magic conditions.

JOP Condition Contrasts. JOP scores from the most difficult condition (the lag condition) were subtracted from JOP scores for the control condition (the normal condition) to determine whether participants' ratings were sensitive to differences in performance demands and to assess whether sensitivity of JOP scores was affected by drink condition. A 2 (between subjects: caffeine consumed, caffeine not consumed) by 2 (between subjects: told receiving caffeine, told not receiving caffeine) by 2 (repeated measures within-subjects: pre, post-drink) mixed design ANOVA revealed a main effect of time ($F(1, 123) = 12.13, p < .01, \eta_p^2 = .09$) showing the difference between JOPs for normal and lag conditions decreased from pre to post-drink. This effect appeared to be driven by a post-drink increase in JOP for the lag condition coupled with a post-drink decrease in JOP in the normal condition. No main effect of caffeine consumption and no caffeine instruction by consumption group interaction were observed though a main effect of caffeine instruction did emerge ($F(1, 123) = 5.95, p < .01, \eta_p^2 = .05$). As illustrated in Figure 11, participants who were told they would receive caffeine had larger overall discrepancies between JOP on the lag and normal conditions (JOP for the normal condition was higher than JOP for the lag condition) than participants who were told they would not receive caffeine. This discrepancy suggests that participants, who believed they were consuming caffeine, demonstrated more sensitivity to condition difficulty when providing judgments of performance than participants who did not believe they would receive caffeine. No other two or three-way interactions were observed for JOP discrepancies between the normal and lag conditions.

Subjective-Objective Performance Discrepancies. (JOPcondition- ConditionHitRate) A main effect of time for the normal condition was noted indicating that subjective-objective performance discrepancy scores became more negative (JOP lower relative to actual

performance) from pre to post drink ($F(1, 119) = 17.09, p < .001, \eta_p^2 = .13$). No main effects of group and no two or three-way interactions emerged for subjective-objective performance discrepancy scores in the normal condition.

No main effects of time, instruction or consumption and no two or three-way interactions were found for subjective-objective performance discrepancy scores in the turbulence condition. The same pattern of results was noted for subjective-objective performance discrepancy scores in the magic condition, with the exception of a main effect of time which indicated that participants' subjective-objective performance discrepancy scores in the magic condition became more negative (objective performance was higher relative to JOP) from pre to post-drink ($F(1, 118) = 11.54, p < .01, \eta_p^2 = .09$).

In the lag condition, the most difficult condition, no main effect of time or consumption was observed on subjective-objective performance discrepancy scores. However, a main effect of instruction indicated that participants who were told they would receive caffeine had more negative subjective-objective performance discrepancy scores (objective performance higher relative to JOP) than participants were told they would not receive caffeine ($F(1, 125) = 4.29, p < .05, \eta_p^2 = .03$). This finding, illustrated in Figure 12, suggests that the belief that caffeine has been consumed may contribute to deflated judgments of performance relative to actual performance. No two or three-way interactions were found for subjective-objective performance discrepancy scores in the lag condition.

IV. DISCUSSION

Conjoint consumption of caffeine and alcohol has become extremely popular among young adults (CDC, 2010) and correlational studies suggest that combined use of these

substances is associated with numerous health-risk behaviors (e.g., O'Brien, et al., 2008). Despite growing concerns over the safety of caffeinated alcoholic beverages (e.g., Howland, Rohsenow, Calise, et al., 2011; Reissig, et al., 2009; Simon & Mosher, 2007) and recent federal action to regulate these products (e.g., Blumenthal, Shurtleff, & Limtiaco, 2009; FDA, 2010), no research has comprehensively examined the acute effects of caffeine and alcohol on the cognitive and affective processes that underlie these health-risk behaviors. As such, the goal of the present study was to assess the effects of caffeine and alcohol, and the expectation of receiving caffeine, on several objective indices of performance, risk-taking and impulsivity as well as subjective ratings of mood, arousal, personal agency, performance and impairment. A secondary aim of the study was to explore relationships between patterns of caffeinated alcohol use and select individual differences (e.g., impulsivity, caffeine and alcohol outcome expectancies, psychopathology), peer influences and norms surrounding CAB use and frequency of engagement in risky behaviors.

Based upon results of previous studies showing that caffeine counteracts some of the untoward effects of alcohol on performance and on subjective experience (e.g., sedation), it was hypothesized that compared to participants who consumed only alcohol, those who consumed both substances would exhibit better performance on behavioral tasks, report lower ratings of sedation, negative affect, impaired ability to drive, and intoxication, and report higher ratings of stimulation, positive affect, desire to continue drinking, personal agency and performance. Additionally, to the extent that caffeine interferes with the ability to accurately judge impairment, participants who consumed caffeine and alcohol were expected to evidence more risky and impulsive behavior as well as larger disconnects between objective and subjective measures of performance. Finally, given that the mere

expectation of consuming caffeine can shape subsequent experience and behavior (see Heinz, et al., 2009), we predicted that participants who were told they would receive caffeine would demonstrate a profile of effects similar to that anticipated for participants who consumed both caffeine and alcohol, though to a lesser extent.

Examination of alcohol and caffeine use in this sample of young adults suggested moderate to heavy consumption of both substances. Almost half of the sample met modified DSM-IV-TR criteria for caffeine dependence and well over three quarters reported being drunk at least once in the past thirty days. It is likely that frequent use of EDs with alcohol promotes caffeine dependence. In terms of combined use of caffeine and alcohol, almost three quarters of the sample reported consumption of caffeinated alcohol at least once a week on average over the past three months. Patterns of caffeinated alcohol use tended to positively correlate with subscales of impulsivity, number of close friends who consumed caffeinated alcoholic beverages (CABs), friends' level of approval concerning CABs, percent of time not wearing a seat belt and number of times driven drunk or buzzed in the past twelve months. No subscales of the Caffeine Expectancy Questionnaire or the Comprehensive Effects of Alcohol expectancy questionnaire correlated with patterns of caffeinated alcohol use. Additionally CAB use was not related to measures of anxiety and depression.

Mood, Arousal and Perceived Impairment

Perceived level of intoxication did not differ as a function of caffeine instruction. However, compared to participants who consumed alcohol alone, participants who consumed alcohol and caffeine reported lower levels of perceived intoxication and this was true both on the ascending and descending alcohol limbs. These results are consistent with those reported by Marczinski and Fillmore (2006).

Whereas negative affect did not change from pre to post-drink or from post-drink to the end of the experiment, pre-drink negative affect was significantly higher than ratings at the end of the session on the descending alcohol limb. Negative affect was not influenced by caffeine consumption or the expectation of caffeine consumption. For the sample as a whole, positive affect was significantly lower at the end of the experiment, on the descending alcohol limb, compared to pre and post-drink ratings. Similar to negative affect, positive affect was not altered by caffeine consumption or expectancy. These results do not align with survey data showing that individuals' motivation to consume caffeine with alcohol included increased happiness and euphoria (Ferreira, Mello, et al., 2004). Accordingly, the hypothesis that caffeine consumption, as well as the expectation of caffeine consumption, would increase positive affect and decrease negative affect was not supported. Potential moderators of the relationship between caffeine consumption and expectancy and affect should be tested.

Ratings of stimulation associated with the effects of alcohol were found to decrease from the ascending to the descending alcohol limb though no changes were noted for sedation. Counter to expectations and to previous research employing a similar design (Marczinski, et al., 2011), no main or interactive effects of time or condition were revealed for either the stimulation or sedation subscales. Of note, stimulation scores tended to be correlated with desire to continue drinking, perceived intoxication, explosions on the BART, and increased likelihood of involvement in, and likelihood of positive consequences associated with, risky behavior. To determine whether stimulation associated with caffeine can explain differences in risk-taking behavior, future studies should be powered to assess for interactive effects between stimulation ratings and drink condition on these outcome variables.

Performance

Performance on measures capturing response time, the Simple Reaction Time Task (SRTT) and the Stop-it Task, indicated that reaction time slowed from pre to post-drink. The addition of caffeine partially counteracted the alcohol-related slowing of choice reaction time on the Stop-it task, which is somewhat consistent with previous studies (Kerr, Sherwood, & Hindmarch, 1991; Marczinski & Fillmore, 2003; Marczinski, et al., 2011), though not on the SRTT. Next, percent of correct responses was higher among participants who both expected and consumed caffeine. This interaction suggests that caffeine consumption in combination with the expectation of receiving caffeine protected against the impairing effects of alcohol on accuracy on the no-signal (normal) trials. In other words, caffeine consumption did not offset alcohol-related decrements in accuracy unless participants were also told they would receive caffeine.

Counter to expectations, objective performance on the MAT did not appear sensitive to the impairing effects of alcohol. In fact, objective performance did not change from pre to post-drink for three of the four conditions, and actually improved in the most difficult (lag) condition. The absence of alcohol-induced performance decrements coupled with evidence of practice effects brings into question the appropriateness of the task for assessment of performance under alcohol. Nevertheless, caffeine consumption was associated with a pre to post-drink improvement in objective performance in the turbulence condition, suggesting that caffeine facilitated participants' ability to hit more targets (X's) and avoid more distracters (O's) when control of the mouse was compromised.

Under the assumption that alcohol did not impair objective performance, this finding would be consistent with results from a study on the effects of variables doses of

methamphetamine on MAT performance showing that compared to placebo, low doses (but not moderate or high doses) improved performance (Kirkpatrick, et al., 2008). Additionally, participants who were told they would receive caffeine performed better post-drink in the easiest condition even though no difference in performance was noted as a function of actual caffeine consumption. The latter result suggests that the expectation of receiving caffeine may improve performance when performance demands are lower. In all, these data appear to lend support to the hypothesis that caffeine consumption as well as the expectation of caffeine consumption would result in better objective performance relative to alcohol alone or the expectation of receiving alcohol alone.

Perceived Agency, Judgments of Performance and Objective-Subjective Performance Discrepancies

For the two most difficult conditions, Judgments of agency (JOA), a subjective judgment about the amount of personal control exercised, increased post-drink for all groups but not for the two easier conditions of the Metacognition of Agency Task (MAT). This pattern may be indicative of a practice effect such that participants felt more in control after practicing the two most difficult conditions. Additionally, practice may not have influenced personal agency in the normal condition where control of the mouse was not manipulated and in the magic condition where control of the mouse was enhanced. It may also suggest that alcohol consumption disrupted participants' ability to formulate accurate JOAs when performance demands were higher. Interestingly, participants who consumed caffeine tended to have lower overall (pre and post-drink) JOAs for the two most difficult conditions compared to participants who did not consume caffeine. One potential explanation might be that caffeine consumption guarded against alcohol-induced inflations of JOA when performance demands

were higher. In the easiest condition, where performance demands were the lowest, participants who were told they would receive caffeine had marginally lower post-drink JOA than participants who were told they would not receive caffeine. Therefore, the expectation of receiving caffeine may help people remain more in tune with their personal agency when performance demands are lower.

JOA findings from the turbulent and magic conditions oppose those noted for objective performance in these conditions. More specifically, even though participants who consumed caffeine showed increased objective performance pre to post-drink in the turbulence condition, and participants who were told they would receive caffeine had higher post-drink objective performance in the magic condition, these same individuals tended to evidence lower overall JOAs for each respective condition. The observed relationship between objective performance and JOA may be protective such that under alcohol, caffeine consumption or the expectation of consuming caffeine may reduce perceived control which in turn elicits a compensatory response that enhances performance. Compensatory responses of this nature have been documented in past studies where caffeine expectancies have been manipulated by the experimenter (Fillmore & Vogel-Sprott, 1995; Fillmore, Roach & Rice, 2002) and suggest that individual expectations for how caffeinated alcohol will affect performance (e.g., enhanced, impaired), should be taken into account.

Following each trial on the MAT, participants were asked to judge their performance. Results indicated that judgments of performance (JOP) decreased from pre to post-drink in the normal (control) condition but did not change in the other three conditions. Accordingly, in MAT conditions where control of the mouse was manipulated, participants did not judge

their performance as different from pre-drink levels. Additionally, no effects of caffeine consumption or caffeine instruction were observed for JOP regardless of condition.

Discrepancies between JOP in the control (normal) condition versus JOP for the most difficult condition (lag) revealed that the discrepancy decreased from pre to post-drink (difference between JOPs in each condition became smaller). However, participants who were told they would receive caffeine had higher overall discrepancies (JOP for normal was higher than JOP for lag) than participants who were told they would not receive caffeine. This finding suggests that the expectation of consuming caffeine may increase sensitivity to differences in performance demands.

Data from the MAT were also used to identify potential discrepancies between subjective and objective performance as a function of drink condition. For the two easiest conditions, estimates of performance (JOP), relative to objective performance, became more conservative from pre to post drink (JOP were lower than objective performance). No pre to post-drink changes in objective-subjective discrepancy scores were observed for the two most difficult conditions. Additionally no main or interactive effects were noted for caffeine consumption in any condition. As such, the hypothesis that combined caffeine and alcohol consumption would increase the discrepancy between objective and subjective performance (i.e., subjective higher than objective) was not supported. However, in the most difficult condition, participants who were told they would receive caffeine gave more conservative estimates of their performance (relative to their objective performance) than participants who were told they would not receive caffeine. In other words, participants who were told they had consumed caffeine were more critical of their overall performance under the most challenging circumstances. Although subjective judgments of performance were less accurate

for this group, the direction of the discrepancy may actually function to reduce risk-taking behavior.

Risk Taking

Although perceived ability to drive decreased from the ascending to the descending alcohol limb, ratings did not differ as a function of group. This is inconsistent with field research by Thombs (2010) showing that bar patrons who had consumed caffeinated alcohol were four times more likely to express intentions of driving out of the bar district than patrons who had consumed only alcohol. Interestingly though, males reported higher ability to drive than females post drink on the ascending alcohol limb. Future studies may want to include a more comprehensive measure of perceived ability to drive rather than a single item assessment. Additionally, assessment of perceived driving ability prior to alcohol consumption may better capture group differences following beverage consumption.

Desire to continue drinking also decreased from the ascending to the descending alcohol limb, as was expected in a laboratory environment. No effect of caffeine instruction emerged. However, participants who did not consume caffeine experienced a reduction in desire to continue drinking from the ascending to descending alcohol limb whereas participants who consumed caffeine did not. Additionally, desire to continue drinking was positively correlated with post-drink ratings of stimulation. These findings lend support to the idea that conjoint consumption of caffeine and alcohol promotes heavier drinking because individuals interpret stimulation as a lack of intoxication. Moreover, this finding may provide insight into data showing that individuals who consumed alcohol and caffeine were at three times greater risk of leaving the bar highly intoxicated than individuals who had consumed alcohol alone (Thombs, 2010).

Results from the Balloon Analogue Risk Task (Lejuez, et al., 2002), a behavioral task that measures risk-taking propensity, revealed that participants demonstrated more risky behavior following drink administration as evidenced by increased number of adjusted pumps and higher monetary earnings. No pre to post-drink changes were found for money earned, balloon explosions (trials in which participants lost all money earned for that balloon) or number of adjusted pumps (number of pumps on trials where the balloon did not explode) as a function of caffeine consumption or instruction.

Despite evidence that the BART is sensitive to sex differences associated with acute sleep deprivation (Acheson, Richards, & de Wit, 2007), stress induction (Lighthall, Mather, & Gorlick, 2009) and d-amphetamine consumption (Acheson & de Wit, 2008), no published studies have described the acute effects of alcohol or caffeine or both on this measure. The current study represents one of the first attempts to do so though results should be interpreted with caution until further evidence emerges for the sensitivity of the BART to such pharmacological challenges. Females earned less money than males on the BART in the current study and this is consistent with the above research and with recent meta-analytic findings (Cross, et al., 2011). Hence, males were less likely than females to discontinue the task and settle for smaller earnings in the face of increasing risk. Follow up analyses should determine how gender may interact with drink condition to influence performance on the BART. Finally, the BART data may be more amenable to a process oriented analysis using hierarchical linear modeling with random effects which provides a slope (e.g., rate at which money is earned) estimate for each individual. This approach is likely more informative than the mean as individuals who consume or expect to consume caffeine may manifest different patterns of risk-taking throughout the thirty-plus trials.

Assessment of participants' cognitive appraisals of risky events following drink administration yielded no evidence of group effects. However, in line with past findings (Fromme et al., 1997), males reported a higher likelihood of involvement in and positive consequences resulting from risky behaviors. The CARE was only administered post-drink consumption in the current study due to time constraints. Given that the measure has demonstrated sensitivity to the acute effects of alcohol in previous studies (e.g., lower perceived harm, Fromme, Katz, & D'Amico, 1997; Maisto, Carey, Carey, Gordon, & Schum, 2004; Testa, Livingston, & Collins, 2000) future research on the conjoint effects of caffeine and alcohol may benefit from administration of the measure both pre and post-drink consumption as it would allow for detection of within-subject changes in risk assessment associated with condition.

Impulsivity

Consistent with previous studies (Marczinski & Fillmore, 2003; Marzinski, et al., 2011), no differences in inhibition (as indexed by stop-sign reaction time and probability of responding on a stop-signal trial) were found between participants who consumed alcohol and participants who consumed both alcohol and caffeine. Although the latter measure of impulsivity was shown to increase post-drink, stop-sign reaction time was surprisingly, not impaired by drink consumption. Importantly though, compared to participants who consumed caffeine, those who did not evidenced a much greater increase in response time on trials where the response was unsuccessfully inhibited. This pattern indicates that caffeine consumption was associated with less hesitation when executing a response that was supposed to have been suppressed. In other words, the wrong decision (executing a response instead of

withholding one) was made more quickly. Taken together, these findings suggest that caffeine does not antagonize the effects of alcohol on inhibition and may even potentiate them.

Inattention, another index of impulsivity (calculated as the deviation from the mode on the Simple Reaction Time Task) was also not affected by drink administration. Interestingly though, individuals who were told they would not receive caffeine demonstrated an increase in inattention from pre to post drink whereas participants were told they would receive caffeine did not. As such, the belief that caffeine has been consumed may protect against lapses in attention that are frequently associated with impulsivity.

Limitations

One important limitation of the present study was that expectancies for the combined effects of caffeine and alcohol were not assessed. As previously mentioned, separate expectancies for caffeine and alcohol were not correlated with quantity and frequency of caffeinated alcohol consumption. This suggests that individuals may hold expectancies unique to just caffeinated alcohol that cannot be captured with separate measures for each substance (e.g., I will feel less drunk, I will have more fun, I can stay out drinking longer...when I consume alcohol with caffeine). Moreover, these expectancies for combined use of caffeine and alcohol may moderate risky behavior as well as subjective indices of mood, arousal, intoxication and perceived agency. Development and validation of a new measure to assess strength of expectancies for caffeinated alcohol seems warranted. This is especially true in light of research demonstrating that social drinkers who were led to believe that caffeine would counter-act alcohol induced impairment actually performed worse than participants who were not (Fillmore, et al., 2002). Additionally, analyses not reported in the current study, indicate that subjective measures of affect and stimulation are moderated by

experience with caffeine and caffeine dependence in particular. Indeed, caffeine dependent individuals may hold stronger beliefs about the consequences of caffeine use that may heavily influence their experience.

Relatedly, several impulsivity subscales were positively correlated with patterns of caffeinated alcohol use. Follow-up analyses, not reported in the current write-up, also revealed several relationships between impulsivity subscales and frequency of engagement in various risk behaviors. Such a pattern begs the question of whether individuals who choose to drink CABs are inherently more impulsive and risky [than individuals who opt not to] and thus are more likely to experience alcohol-related harms independent of the added effects of caffeine. As articulated by Howland and colleagues (2011), documented correlations in the literature between CAB use and risk-taking may be explained by a third-variable to which both outcomes are related (i.e., impulsivity). In the absence of sufficient experimental data to refute this claim, CAB use may be just an “epiphenomenon” of other related risk factors rather than a direct, causal factor of risky behavior. For instance Arria and colleges (2010) found that ED users had significantly higher impulsive sensation seeking scores than non ED users. Future studies with adequate power for detecting the influence of individual differences set should test for a synergistic relationship whereby individuals higher in trait impulsivity demonstrate riskier behavior when consuming caffeinated alcohol versus alcohol alone.

Due to the rather exploratory nature of the study, power was not sufficient to comprehensively evaluate gender differences or gender by condition interactions for risk-taking measures. However, several notable gender differences emerged for measures of risky behavior administered post-drink (BART, CARE, perceived ability to drive) and suggested

that males were more prone to engagement in risky behavior post-drink, than females. This pattern is consistent with the literature showing that under alcohol, men may experience less motor impairment (rotary pursuit task Dougherty, Bjork, & Bennett, 1998), lower blood alcohol content (faster alcohol metabolism Lieber, 1997) and increased propensity for aggressive and violent behavior (Giancola et al., 2009; Giancola & Zeichner, 1995). Additionally, women have been found to exert more caution in their sexual responses and related decision-making when drinking than men (see Nolen-Hoeksema, 2004). These findings bear on the importance of determining whether vulnerability to caffeinated-alcohol related harms differs based upon gender. Finally, as with all controlled laboratory studies, participants' experience in the lab lacked ecologically validity and was likely far different from the context in which they normally consume caffeinated alcoholic beverages (e.g., with friends, at clubs, at parties). Future studies should assess the effect of these substances in labs designed to look like bars and conduct sessions with groups of participants to determine the extent to which interpersonal interactions and shared experience explain variance in key outcomes.

Future Directions

Much remains to be studied concerning the relationship between caffeinated alcohol and health-risk behaviors. Given the robust relationship between alcohol consumption and sexual victimization and assault (Collins & Messerschmidt, 1993) and sexual risk-taking (e.g., condom negotiation, condom use, multiple partners; Weinhardt & Carey, 2000), it is important to determine if caffeinated alcohol consumption differentially influences risky sexual decision making and behavior. Additionally, although the acute effects of alcohol on aggression are well established (see Heinz, Beck, Meyer-Lindenberg, Sterzer, & Heinz,

2011), no research has addressed whether caffeinated alcohol increases the likelihood of eliciting aggressive behavior under provocation. If caffeine offsets alcohol-related decrements in reaction time but does not alter accuracy or inhibition, individuals may be more prone to react quickly and aggressively without first processing critical contextual details (e.g., intentionally versus accidentally being bumped into someone at a bar). Correspondingly, conjoint consumption of caffeinated alcohol may also influence impulsive acts of sexual coercion and aggression. These negative alcohol-related consequences, which transpire in interpersonal contexts, may be best studied using experimental paradigms that more closely simulate real-world circumstances or even outside the laboratory with ecological assessments and field studies.

Finally, new methodological developments in the field of behavioral economics have yielded valid and reliable measures of one's demand for a substance (see Heinz, Lilje, Kassel, & De Wit, Under Review). More specifically, tasks such as the Alcohol Purchase Task (Murphy & MacKillop, 2006), where participants are asked a series of questions about how many drinks they would purchase at varying prices, and the Alcohol versus Money Task, in which hypothetical money can be exchanged for alcohol (De Wit & Chutuape, 1993), could be employed to assess whether caffeinated alcohol increases desire to continue drinking more so than alcohol alone. Quantification of what individuals are willing to spend in order to continue drinking will help assess the validity of this concern.

In summary, this study represents the first attempt to comprehensively characterize the combined effects of alcohol and caffeine and expectancies for receiving caffeine on critical affective, cognitive and behavioral outcomes that pose potential public health implications. Results demonstrated that caffeinated alcohol, and to a lesser extent, the

expectation of receiving caffeine exercised a non-uniform profile of effects on variables associated with risk-behavior. This patterning of data suggests that the consumption of caffeinated alcohol may elevate risk for continued drinking, reduce sensitivity to intoxication and decrease reaction time without affecting accuracy. Conversely, consumption as well as the expectation of caffeinated alcohol may reduce inattention, protect against some aspects of alcohol-related performance decrements and preserve subjective judgments of performance and personal agency.

TABLE 1

MEANS (AND STANDARD DEVIATIONS) FOR CAFFIENE, ALCOHOL AND
CAFFEINATED ALCOHOLIC BEVERAGE (CAB) USE

	Mean	SD
Number days consumed caffeinated beverages in an average week in past 3 months**	5.44	2.04
Number caffeinated beverages consumed in an average week in past 3 months **	10.86	8.01
Average number of caffeinated drinks consumed per drinking occasion**	1.86	0.96
How addicted are you to caffeine (1 not at all, 4 very addicted)	1.77	0.82
Number years been consuming caffeine at this quantity and frequency	5.89	4.12
Number days in an average week in past 3 months consumed alcoholic beverages	3.97	1.64
Number alcoholic beverages consumed in an average week in past 3 months	14.31	9.03
Average number of drinks consumed per drinking occasion in past 3 months	3.63	1.65
Number days in an average week in past 3 months consumed CABs	1.91	1.98
Number CABs consumed in an average week in past 3 months	3.18	4.19
Average number of CABs consumed per drinking occasion in past 3 months*	1.65	0.92
Max number of drinks had in one sitting in the past 30 days	7.24	3.34
Max number of CABs in one sitting in the past 30 days	1.7	1.74

Note. *For participants who reported recent CAB use. **Independent of CAB use.

TABLE II

FREQUENCIES FOR ALCOHOL AND CAFFEINATED ALCOHOL USE AND PEER ATTITUDES AND NORMS

	n	%
Number of times drank alcohol in past 30 days		
2 to 3 times a month	52	35
Once or twice a week	8	6
3 to 4 times a week	75	51
Nearly every day	11	8
Number of times in the past 30 days got drunk		
Didn't get drunk in the past 30 days	31	21
Once during the past 30 days	42	29
2 to 3 times during the past 30 days	51	35
Once or twice a week	15	10
3 to 4 times a week	7	5
Number times in the past 30 days had 4/5 (f/m) more drinks in a single sitting		
Didn't drink 4/5 or more drinks at a single setting in the past 30 days	11	8
Once during the past 30 days	40	27
2 to 3 times during the past 30 days	42	29
Once or twice a week	31	21
3 to 4 times a week	22	15
Number of days in the past 30 had a CAB		
I didn't drink a CAB in the past thirty days	50	34
About once a month	37	32
2 to 3 times a month	45	31
Once or twice a week or more	4	3
Meet criteria for caffeine dependence	61	42
Drank a CAB at least once week on average in past 3 months	106	73
Had 4/5 (f/m) or more CABs in a single sitting one or more times in past 30 days	25	20
Peer Attitudes and Norms for CAB and Alcohol Consumption		
	CABs	Alcohol
How do most of your friends feel about drinking		
	n (%)	n (%)
Disapprove	8 (5)	0 (0)
Neither approve nor disapprove	55 (38)	17 (12)
Approve	62 (43)	69 (47)
Strongly approve	21 (14)	60 (41)
How many of your close friends drink		
	CABs	Alcohol
None	11 (7)	0 (0)
Some	62 (43)	1 (1)
Half	19 (13)	3 (2)
Most	31 (21)	35 (24)
Nearly all or all	23 (16)	107 (73)

TABLE III

CORRELATION MATRIX OF QUANTITY AND FREQUENCY OF CAFFEINATED ALCOHOLIC BEVERAGE CONSUMPTION WITH CAFFEINE AND ALCOHOL CONSUMPTION, RISK MEASURES, PEER NORMS AND IMPULSIVITY

	Quantity Frequency Score CAB	Frequency CAB	Quantity CAB
Alcohol Quantity Frequency Score	0.368 **	0.379 **	0.368 **
Caffeine Quantity Frequency Score	0.014	0.006	0.025
Heavy Drinking Index	0.242 **	0.267 **	0.253 **
Number of close friends who drink CAB	0.205 *	0.213 **	0.208 *
Friends' approval of CAB	0.210 *	0.215 **	0.207 *
Percent of time wear seat belt	-0.174 *	-0.210 *	-0.162 ^
Number of times driven buzzed or drunk	.129	0.146 ^	.128
UPPS-P Impulsivity Scale			
Positive Urgency	0.170 *	0.182 *	0.172 *
Negative Urgency	.110	.121	.112
Lack of Premeditation	0.169 *	0.158 ^	0.177 *
Sensation Seeking	.036	-.010	.050
Lack of Perseverance	-.058	-.044	-.054

Note. ** $p < .01$; * $p < .05$; ^ $p < .08$

Time	Event	Measures
0-10	Participant arrives, signs consent form, eats bagel	weight, pregnancy test for women
11-15	Baseline qualifications assessment	BAC#1
16-36	Self Report Questionnaires: Subjective Intoxication Scale (SIS #1), Positive and Negative Affect Schedule (PANAS #1), Caffeine Expectancy Questionnaire, State-Trait Anxiety Inventory - Trait, Peer Influences on Drinking, Alcohol Expectancy Questionnaire, Quantity & Frequency of Alcohol, Caffeine, & Caffeinated Alcohol Consumption, Caffeine Dependence & Withdrawal, UPPS-P Impulsivity Scale, Risk Behavior Single-Item Queries, Beck Depression Inventory	
37-47	Measure of Agency	Metacognition of Agency Task #1
48-58	Impulsivity Assessments	Inattention: Simple Reaction Time Task #1
		Inhibitory Behavior: Stop Task #1
59-69	Risk Task	Balloon Analogue Risk Task (BART #1)
70	Begin drink administration, 70 2 nd part of drink administered, 81 3 rd part of drink administered, 92 wash out mouth	
100-104	Post Drink Assessments	BAC#2, SIS#2, BAES#1, PANAS#2
105	Perceived Ability to Drive, Desire to Drink More	Single item question #1, Single item question #1
106-116	Measure of Agency	Metacognition of Agency Task #2
117-127	Impulsivity Assessments	Inattention: Simple Reaction Time Task #2
		Inhibitory Behavior: Stop Task #2
128-138	Risk Task	Balloon Analogue Risk Task (BART #2)
139-145	Risk Perception Questionnaire	Cognitive Appraisal of Risky Events (CARE)
146	Perceived Ability to Drive, Desire to Drink More	Single item question #2, Single item question #2
147- 157	Debriefing	PANAS#3,BAC#3, SIS#3, BAES#2, Post-experiment Questionnaire

Figure 1. Procedure timeline.

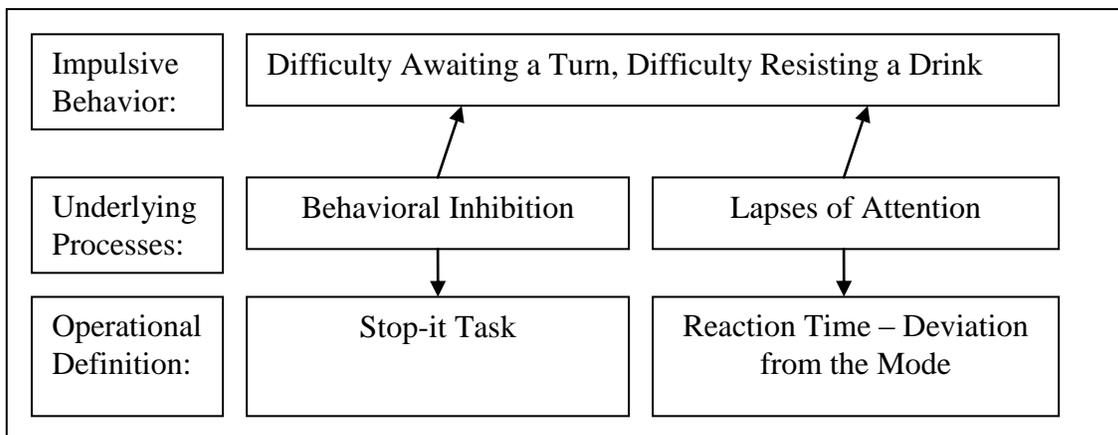


Figure 2. Schematic of relationships between impulsive behavior and administered measures.

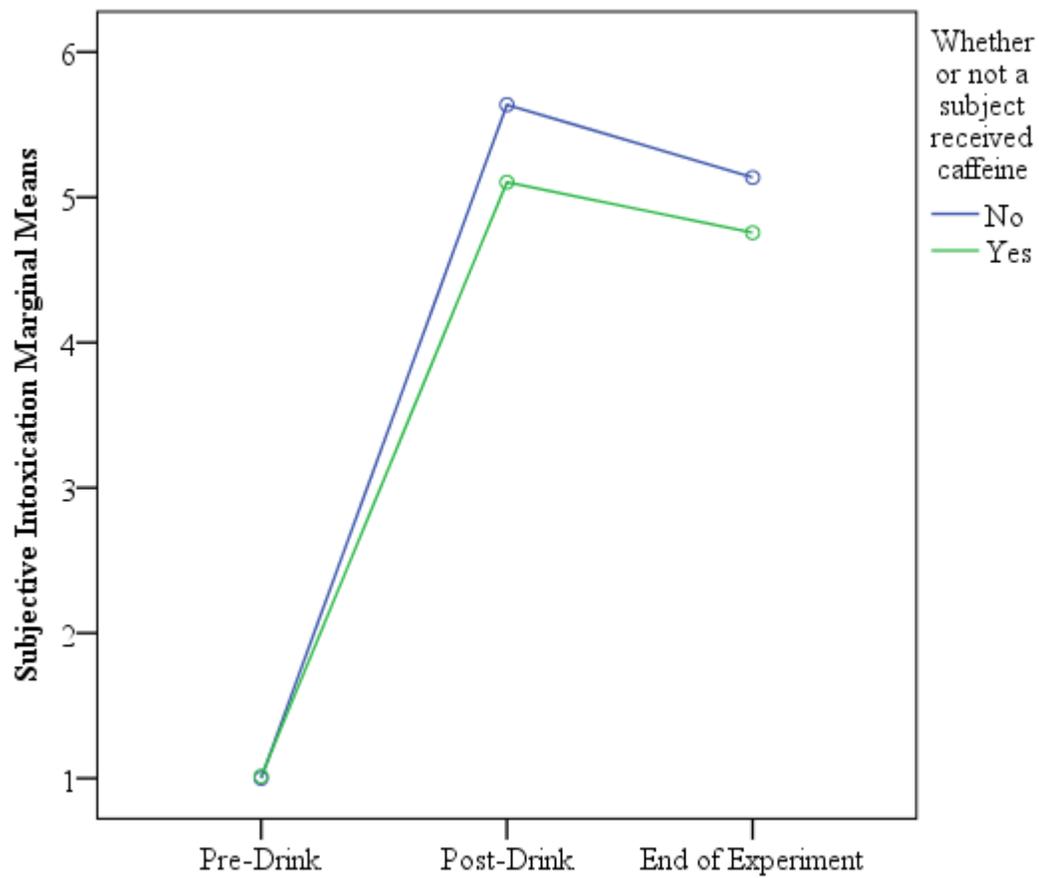


Figure 3. Mean subjective rating of intoxication by time and caffeine consumption group.

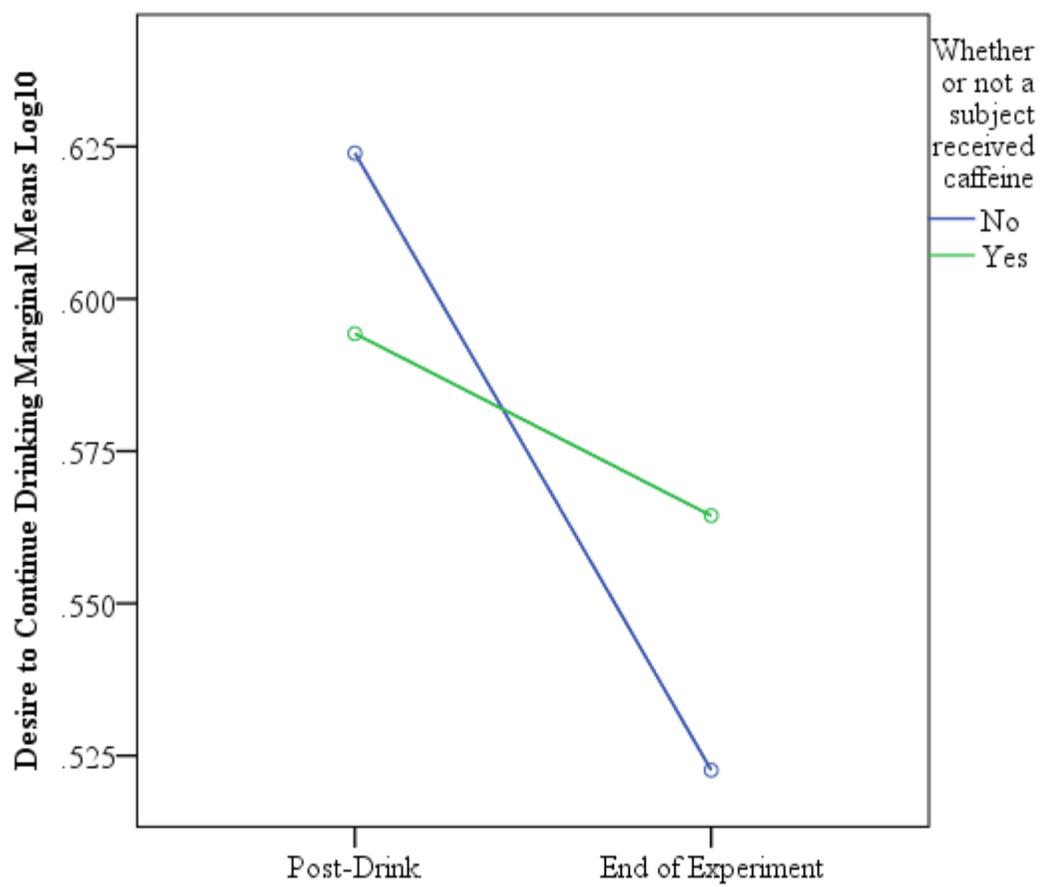


Figure 4. Mean desire to continue drinking, log transformed, by time and caffeine consumption group.

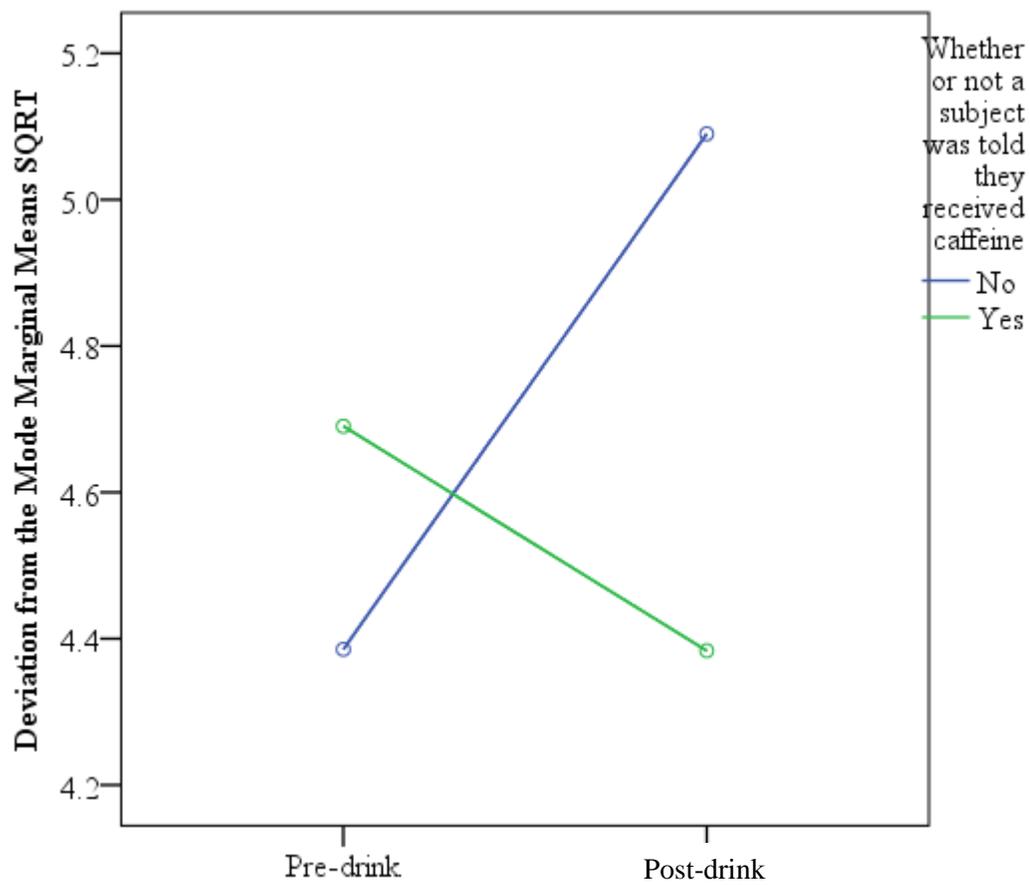


Figure 5. Mean deviation from the mode (square root transformed), an index of inattention and an element of impulsivity, by time and caffeine instruction group.

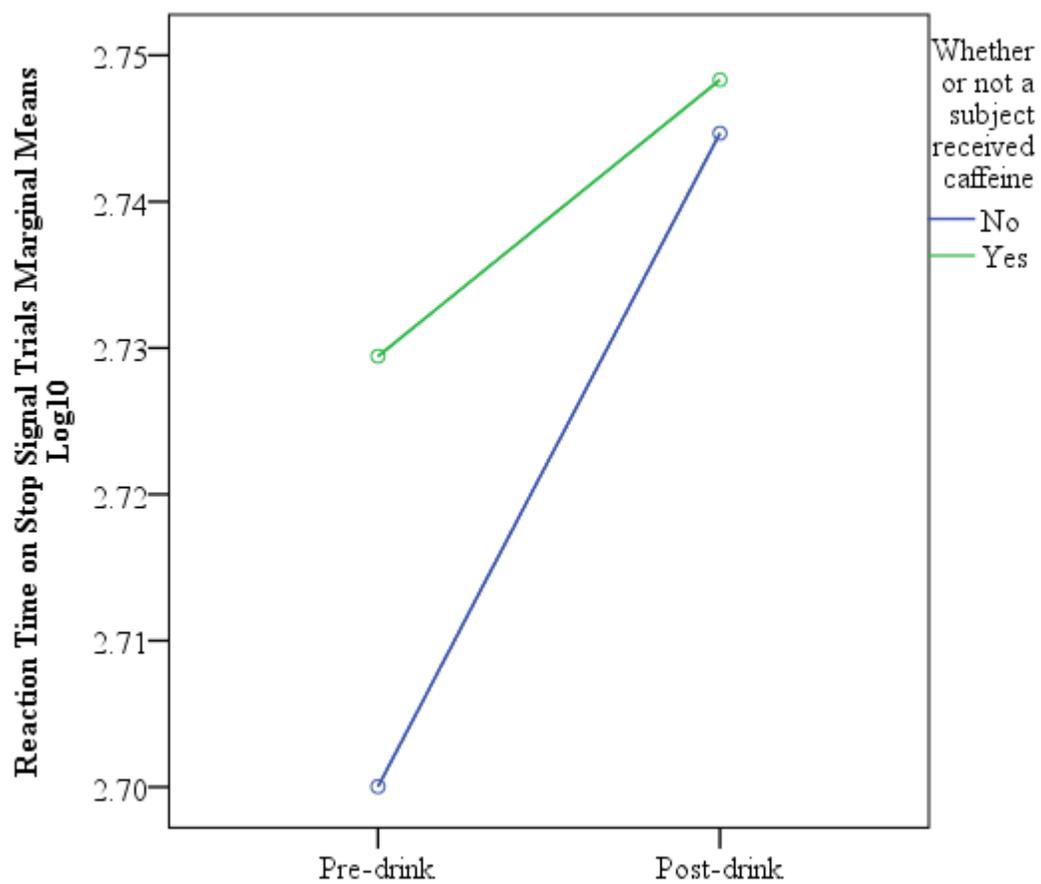


Figure 6. Mean reaction time (log transformed) on stop signal trials, where participant failed to inhibit response, by time and caffeine consumption group.

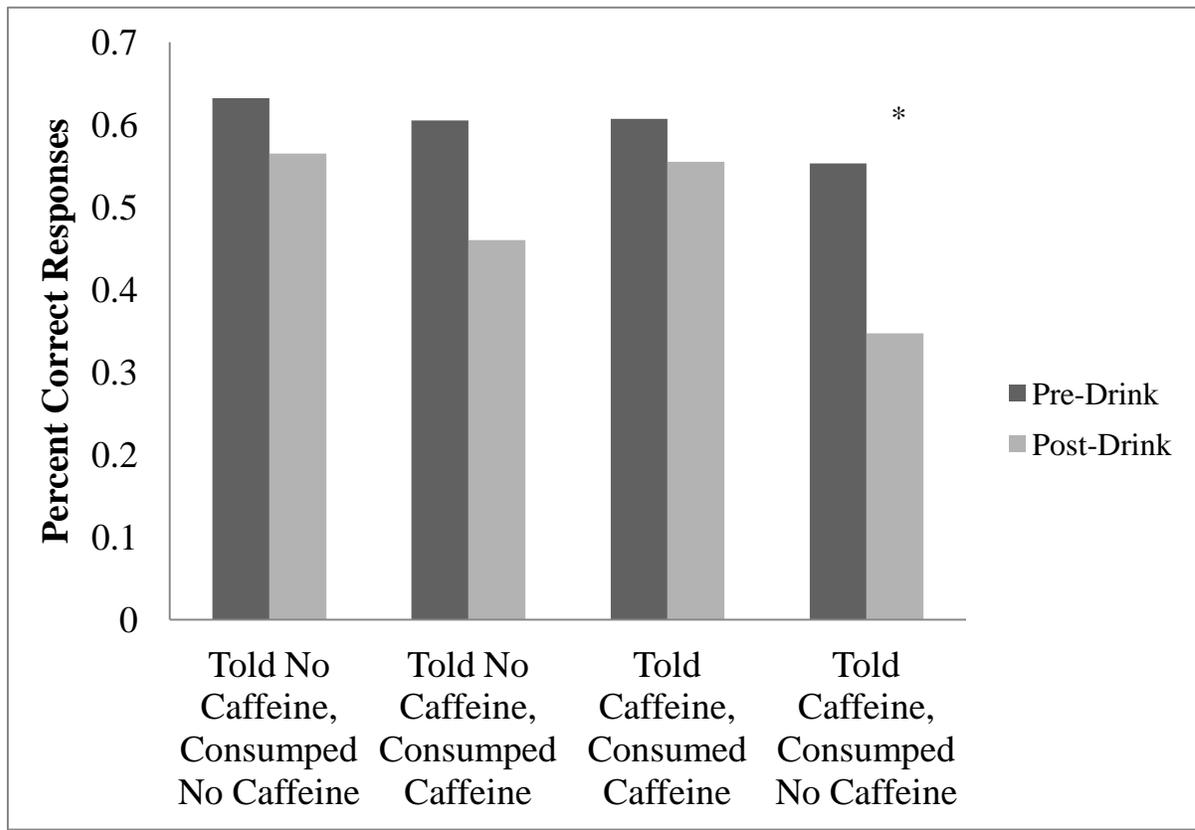


Figure 7. Mean percent of correct responses on no-signal trials on the Stop-It task by time and consumption.

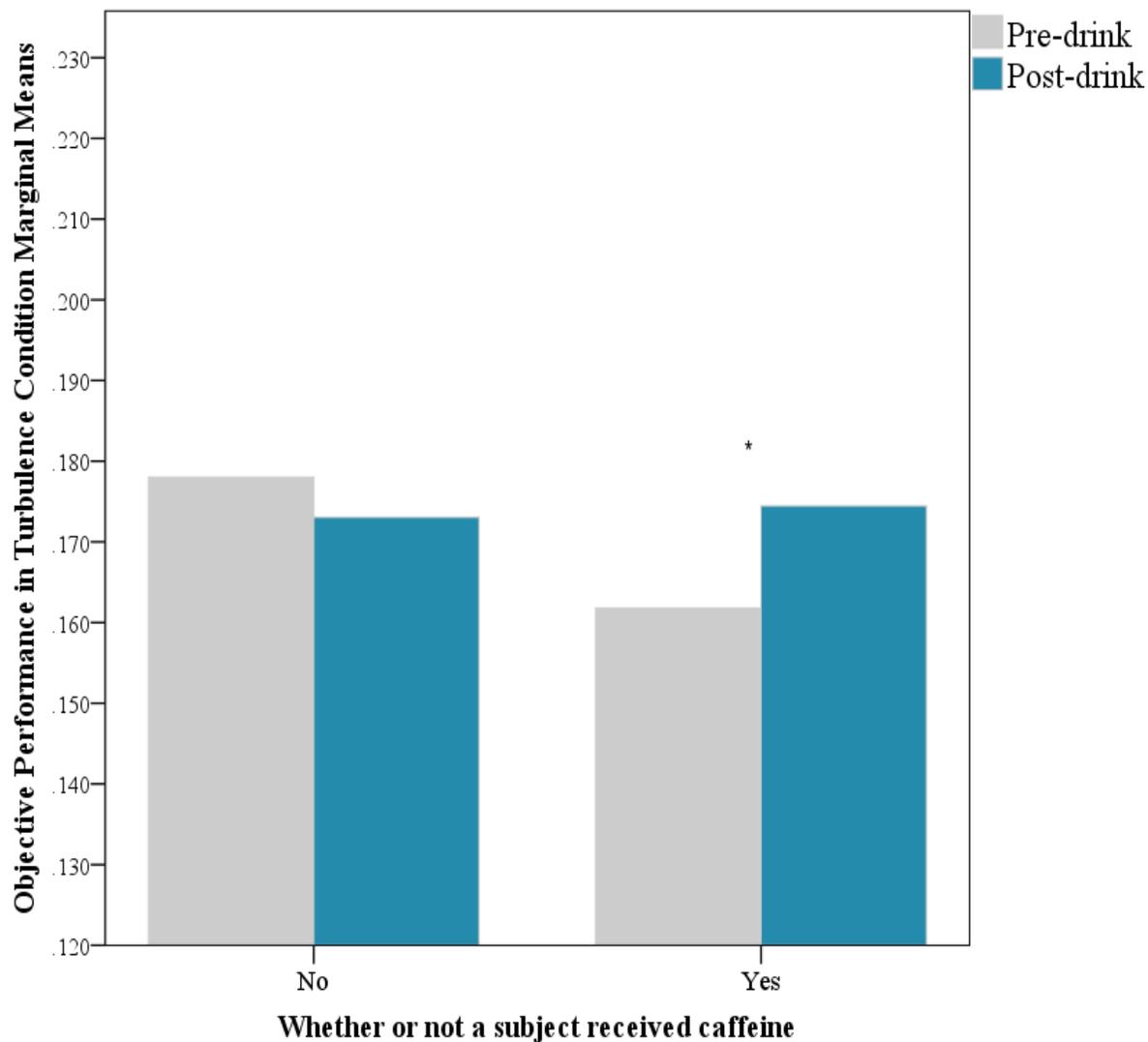


Figure 8. Mean objective performance in the turbulence condition on the Metacognition of Agency Task by time and consumption group.

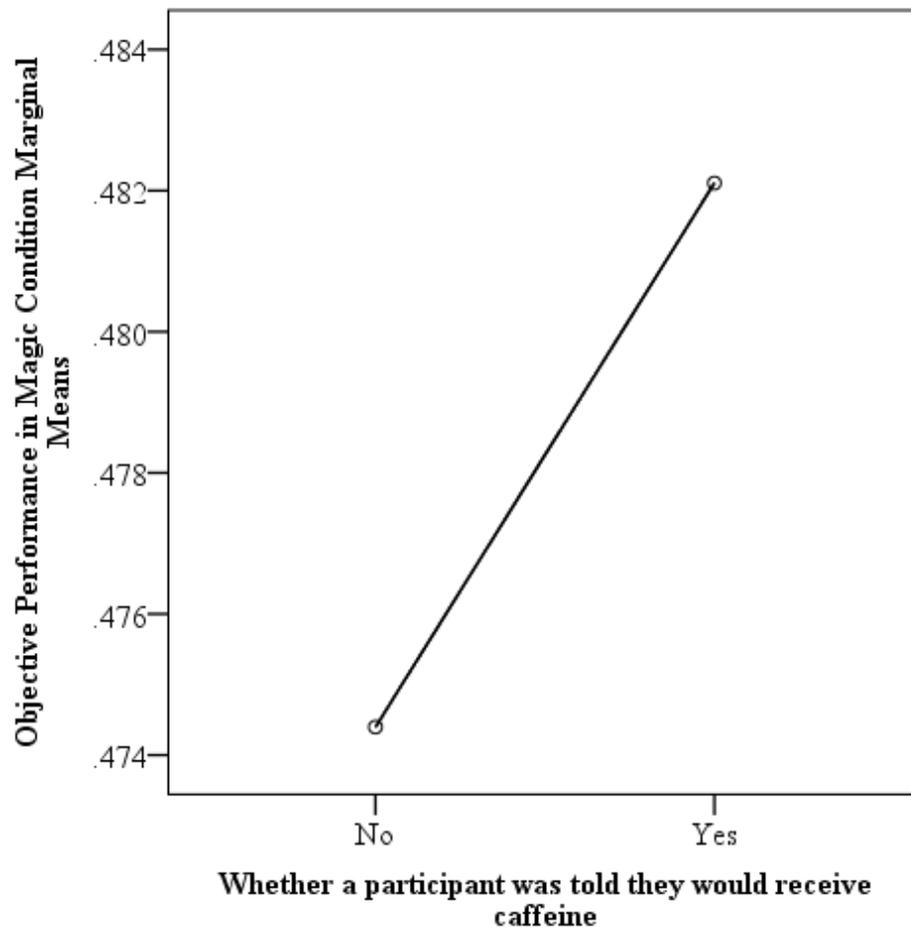


Figure 9. Mean objective performance in the magic condition on the Metacognition of Agency Task at post-drink by instruction group.

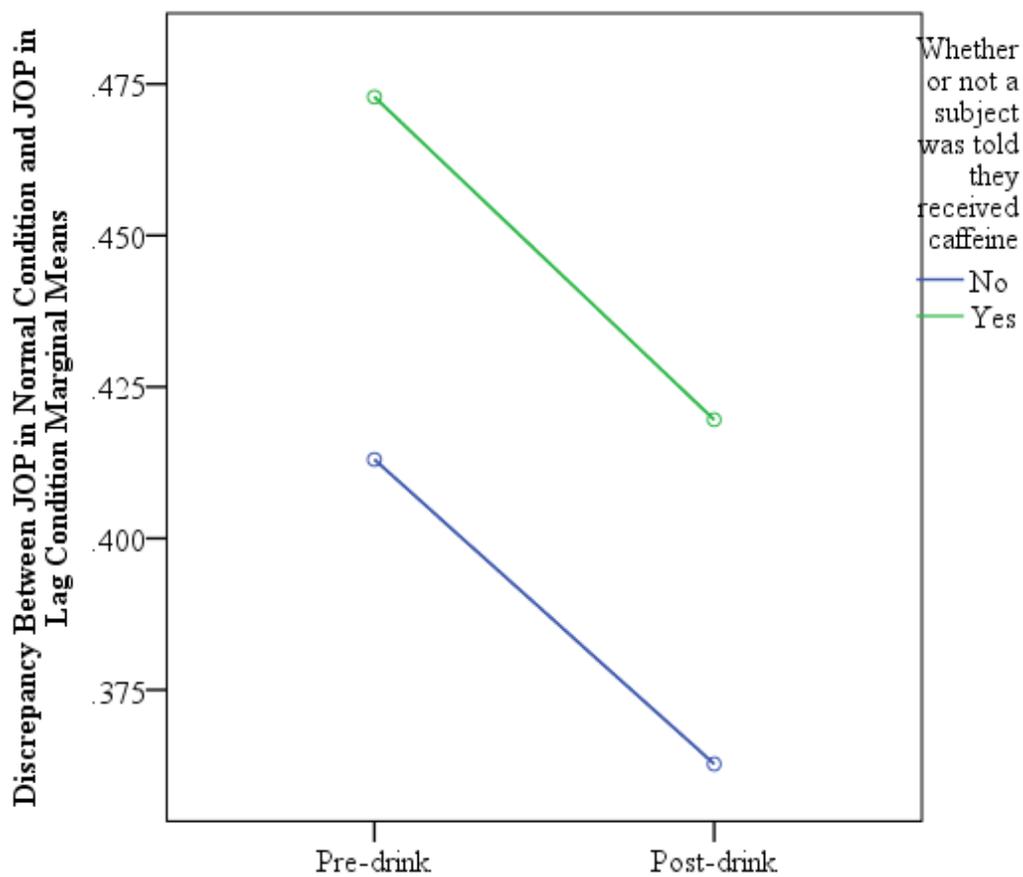


Figure 10. Mean discrepancy between judgments of performance on the normal (control) condition and judgments of performance on the lag (most difficult) condition on the Metacognition of Agency Task by time and instruction group.

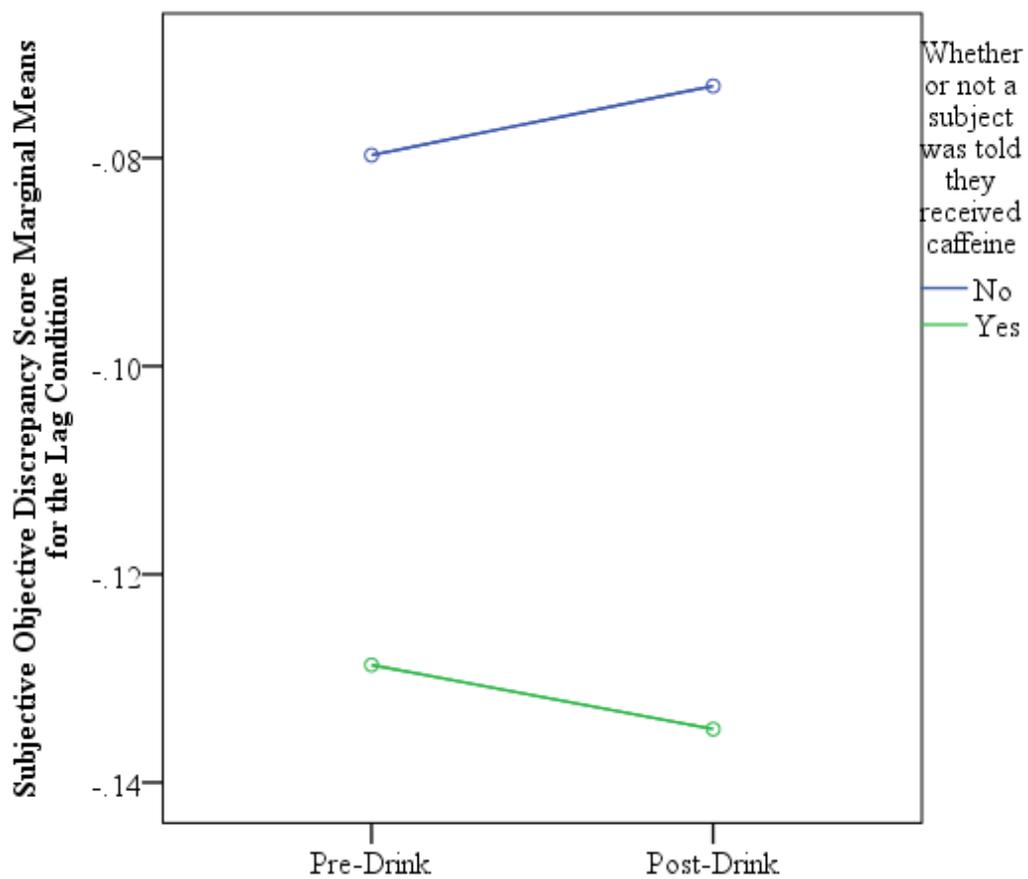


Figure 11. Mean subjective-objective performance discrepancy scores for the lag condition on the Metacognition of Agency Task by time and instruction group.

V. CITED LITERATURE

- Acheson, A., & de Wit, H. (2008). Bupropion improves attention but does not affect impulsive behavior in healthy young adults. *Experimental and Clinical Psychopharmacology, 16*(2), 113.
- Acheson, A., Richards, J. B., & de Wit, H. (2007). Effects of sleep deprivation on impulsive behaviors in men and women. *Physiology & behavior, 91*(5), 579-587.
- APA. (2000). *Fourth Diagnostic and Statistical Manual of Mental Disorders, Test Revision DSM-IV-TR* Washington, DC: American Psychiatric Association.
- Arolfo, M. P., Yao, L., Gordon, A. S., Diamond, I., & Janak, P. H. (2004). Ethanol Operant Self Administration in Rats Is Regulated by Adenosine A2 Receptors. *Alcoholism: Clinical and Experimental Research, 28*(9), 1308-1316.
- Arria, A. M., Caldeira, K. M., Kasperski, S. J., O'Grady, K. E., Vincent, K. B., Griffiths, R. R., & Wish, E. D. (2010). Increased alcohol consumption, nonmedical prescription drug use, and illicit drug use are associated with energy drink consumption among college students. *Journal of Addiction Medicine, 4*(2), 74-80.
- Arria, A. M., Caldeira, K. M., Kasperski, S. J., Vincent, K. B., Griffiths, R. R., & O'Grady, K. E. (2011). Energy Drink Consumption and Increased Risk for Alcohol Dependence. *Alcoholism-Clinical And Experimental Research, 35*(2), 365-375.
- Azcona, O., Barbanoj, M. J., Torrent, J., & Jane, F. (1995). Evaluation Of The Central Effects Of Alcohol And Caffeine Interaction. *British Journal Of Clinical Pharmacology, 40*(4), 393-400.
- Bandura, A. (1971). *Social learning theory*. New York: General Learning Press.

- Bartholow, B. D., & Heinz, A. (2006). Alcohol and aggression without consumption - Alcohol cues, aggressive thoughts, and hostile perception bias. *Psychological Science, 17*(1), 30-37.
- Beck, A. T. (1967). *Depression: Clinical, experimental, and theoretical aspects*. New York: Hoeber.
- Berger, L. K., Fendrich, M., Chen, H. Y., Arria, A. M., & Cisler, R. A. (2011). Sociodemographic correlates of energy drink consumption with and without alcohol: Results of a community survey. *Addictive Behaviors, 36*, 516-519.
- Blumenthal, R., Shurtleff, M., & Limtiaco, A. G. (2009). *The use of caffeine in alcoholic beverages*. Retrieved from <http://www.fda.gov/downloads/Food/FoodIngredientsPackaging/UCM190372.pdf>.
- Byrnes, J. P., Miller, D. C., & Schafer, W. D. (1999). Gender differences in risk taking: A meta-analysis. *Psychological bulletin, 125*(3), 367.
- CDC. (July 20th, 2010). Fact sheet of caffeinated alcoholic beverages Retrieved June 16th, 2011, from <http://www.cdc.gov/alcohol/fact-sheets/cab.htm>
- Collins, J. J., & Messerschmidt, P. M. (1993). Epidemiology of alcohol-related violence. *Alcohol Health & Research World*.
- Cross, C. P., Copping, L. T., & Campbell, A. (2011). Sex Differences in Impulsivity: A Meta-Analysis. *Psychological Bulletin, 137*(1), 97-130.
- Cyders, M. A., & Smith, G. T. (2007). Mood-based rash action and its components: Positive and negative urgency. *Personality And Individual Differences, 43*(4), 839-850.
- Cyders, M. A., Smith, G. T., Spillane, N. S., Fischer, S., Annus, A. M., & Peterson, C. (2007). Integration of impulsivity and positive mood to predict risky behavior:

- Development and validation of a measure of positive urgency. *Psychological Assessment, 19*(1), 107-118.
- de Wit, H. (2009). Impulsivity as a determinant and consequence of drug use: a review of underlying processes. *Addiction Biology, 14*(1), 22-31.
- De Wit, H., & Chutuape, M. (1993). Increased ethanol choice in social drinkers following ethanol preload. *Behavioural Pharmacology, 4*(1), 29-36.
- Dejoy, D. M. (1992). An examination of gender differences in traffic accident risk perception. *Accident Analysis and Prevention, 24*(3), 237-246.
- Dougherty, D. M., Bjork, J. M., & Bennett, R. H. (1998). Effects of alcohol on rotary pursuit performance: a gender comparison. *Psychological Record, 48*, 393-406.
- Drake, C. L., Roehrs, T., Turner, L., Scofield, H. M., & Roth, T. (2003). Caffeine reversal of ethanol effects on the multiple sleep latency test, memory, and psychomotor performance. *Neuropsychopharmacology, 28*(2), 371-378.
- Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*, 175-191.
- FDA. (November 19th, 2010). FDA Warning Letters issued to four makers of caffeinated alcoholic beverages Retrieved June 16th, 2011, from <http://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/2010/ucm234109.htm>
- Ferreira, S. E., de Mello, M. T., Pompeia, S., & de Souza-Formigoni, M. L. O. (2006). Effects of energy drink ingestion on alcohol intoxication. *Alcoholism-Clinical And Experimental Research, 30*(4), 598-605.

- Ferreira, S. E., Mello, M., & Olivera, M. (2004). O efeito das bebidas alcoólicas pode ser afetado pela combinação com bebidas energéticas: um estudo com usuários. *Rev Assoc Med Bras*, 50(1), 48-51.
- Ferreira, S. E., Quadros, I. M. H., Trindade, A. A., Takahashi, S., Koyama, R. G., & Souza-Formigoni, M. L. O. (2004). Can energy drinks reduce the depressor effect of ethanol? An experimental study in mice. *Physiology & Behavior*, 82(5), 841-847.
- Fillmore, M. T. (2003). Alcohol tolerance in humans is enhanced by prior caffeine antagonism of alcohol-induced impairment. *Experimental And Clinical Psychopharmacology*, 11(1), 9-17.
- 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(6), 745-754.
- Fillmore, M. T., & Vogel-Sprott, M. (1995). Behavioral effects of combining alcohol and caffeine: Contribution of drug related expectancies. *Experimental And Clinical Psychopharmacology*, 3, 33-38.
- Franks, H. M., Hagedorn, H., Hensley, V. R., Hensley, W. J., & Starmer, G. A. (1975). Effect Of Caffeine On Human Performance, Alone And In Combination With Ethanol. *Psychopharmacologia*, 45(2), 177-181.
- Fromme, K., D'Amico, E. J., & Katz, E. C. (1999). Intoxicated sexual risk taking: An expectancy or cognitive impairment explanation? *Journal Of Studies On Alcohol*, 60(1), 54-63.

- Fromme, K., Katz, E., & D'Amico, E. (1997). Effects of alcohol intoxication on the perceived consequences of risk taking. *Experimental and Clinical Psychopharmacology*, 5(1), 14-23.
- Fromme, K., Katz, E., & Damico, E. (1997). Effects of alcohol intoxication on the perceived consequences of risk taking. *Experimental And Clinical Psychopharmacology*, 5(1), 14-23.
- Fromme, K., Stroot, E., & Kaplan, D. (1993). Comprehensive effects of alcohol: Development and psychometric assessment of a new expectancy questionnaire. *Psychological Assessment*, 1993, 19-26.
- Fudin, R., & Nicastro, R. (1988). Can Caffeine Antagonize Alcohol-Induced Performance Decrements In Humans. *Perceptual And Motor Skills*, 67(2), 375-391.
- Giancola, P. R. (2000). Executive functioning: A conceptual framework for alcohol-related aggression. *Experimental And Clinical Psychopharmacology*, 8(4), 576-597.
- Giancola, P. R., Levinson, C. A., Corman, M. D., Godlaski, A. J., Morris, D. H., Phillips, J. P., & Holt, J. C. D. (2009). Men and women, alcohol and aggression. *Experimental and Clinical Psychopharmacology*, 17(3), 154-164.
- Giancola, P. R., & Zeichner, A. (1995). An investigation of gender differences in alcohol-related aggression. *Journal of studies on alcohol*, 56(5), 573-579.
- Goldman, M. S., Brown, S. A., & Christiansen, B. A. (1987). Expectancy Theory: Thinking about drinking. In H.T. Blane & K. E. Leonard (Eds.), *Psychological theories of drinking and alcoholism* (pp. 181-226). New York: Guilford Press.

- Grattan-Miscio, K. E., & Vogel-Sprott, M. (2005). Alcohol, intentional control, and inappropriate behavior: Regulation by caffeine or an incentive. *Experimental And Clinical Psychopharmacology*, *13*(1), 48-55.
- Grattan-Miscio, K. E., Wickenden, M., Crotteau, P., Ward, A., & Suggate, K. (2005). Intentional control of behaviour under alcohol: Effects of caffeine expectancy. *Alcoholism-Clinical And Experimental Research*, *29*(5), 27A-27A.
- Hasenfratz, M., Bunge, A., Dalpra, G., & Battig, K. (1993). Antagonistic Effects Of Caffeine And Alcohol On Mental Performance Parameters. *Pharmacology Biochemistry And Behavior*, *46*(2), 463-465.
- Heinz, A. J., Beck, A., Meyer-Lindenberg, A., Sterzer, P., & Heinz, A. (2011). Cognitive and neurobiological mechanisms of alcohol-related aggression. *Nature Reviews Neuroscience*, *12*, 400-413.
- Heinz, A. J., Kassel, J. D., & Smith, E. V. (2009). Caffeine expectancy: instrument development in the Rasch measurement framework. *Psychology of Addictive Behaviors*, *23*(3), 500.
- Heinz, A. J., Lilje, T., Kassel, J. D., & De Wit, H. (Under Review). A review of behavioral economic approaches to quantifying reinforcement value and demand for psychoactive substances in humans.
- Hingson, R. W., Heeren, T., Zakocs, R. C., Kopstein, A., & Wechsler, H. (2002). Magnitude of alcohol-related mortality and morbidity among US college students ages 18-24. *Journal of studies on alcohol*, *63*(2), 136-144.
- Ho, M. (2006, August 23rd, 2006). Red Bull, it's here, there, and everywhere: Energy drink maker corners the market, *The Washington Post*.

- Howland, J., Rohsenow, D. J., Arnedt, J. T., Bliss, C. A., Hunt, S. K., Calise, T. V., & Gottlieb, D. J. (2011). The acute effects of caffeinated versus non-caffeinated alcoholic beverage on driving performance and attention/reaction time. *Addiction, 106*(2), 335-341.
- Howland, J., Rohsenow, D. J., Calise, T. V., MacKillop, J., & Metrik, J. (2011). Caffeinated Alcoholic Beverages: An Emerging Public Health Problem. *American Journal of Preventive Medicine, 40*(2), 268-271.
- Hughes, J. R., Oliveto, A. H., Liguori, A., Carpenter, J., & Howard, T. (1998). Endorsement of DSM-IV dependence criteria among caffeine users. *Drug And Alcohol Dependence, 52*(2), 99-107.
- Hull, J. (1981). A self-awareness model of the causes and effects of alcohol consumption. *Journal of Abnormal Psychology, 90*, 586-600.
- Jones, H. A., & Lejuez, C. (2005). Personality correlates of caffeine dependence: the role of sensation seeking, impulsivity, and risk taking. *Experimental and Clinical Psychopharmacology, 13*(3), 259.
- Kaminer, Y. (2010). Problematic Use of Energy Drinks by Adolescents. *Child and Adolescent Psychiatric Clinics of North America, 19*(3), 643-650.
- Kane, R. L., & Kay, G. G. (1992). Computerized assessment in neuropsychology: A review of tests and test batteries. *Neuropsychology Review, 3*, 1-117.
- Kerr, J., Sherwood, N., & Hindmarch, I. (1991). Separate and combined effects of the social drugs on psychomotor performance. *Psychopharmacology, 104*(1), 113-119.
- Kerr, J. S., Sherwood, N., & Hindmarch, I. (1991). Separate And Combined Effects Of The Social Drugs On Psychomotor Performance. *Psychopharmacology, 104*(1), 113-119.

- Kirkpatrick, M. G., Metcalfe, J., Greene, M. J., & Hart, C. L. (2008). Effects of intranasal methamphetamine on metacognition of agency. *Psychopharmacology*, *197*(1), 137-144.
- Kramer, A., & Spinks, J. (1991). Capacity views of human information processing. In J. R. Jennings & M. G. H. Coles (Eds.), *Handbook of cognitive psychophysiology: Central and autonomic nervous system approaches* (pp. 179-249). New York: John Wiley.
- Kunin, D., Gaskin, S., Rogan, F., Smith, B. R., & Amit, Z. (2000). Caffeine promotes ethanol drinking in rats - Examination using a limited-access free choice paradigm. *Alcohol*, *21*(3), 271-277.
- Lejuez, C. W., Aklin, W. M., Jones, H. A., Richards, J. B., Strong, D. R., Kahler, C. W., & Read, J. P. (2003). The Balloon Analogue Risk Task (BART) differentiates smokers and nonsmokers. *Experimental And Clinical Psychopharmacology*, *11*(1), 26-33.
- Lejuez, C. W., Aklin, W. M., Zvolensky, M. J., & Pedulla, C. M. (2003). Evaluation of the Balloon Analogue Risk Task (BART) as a predictor of adolescent real-world risk-taking behaviours. *Journal Of Adolescence*, *26*(4), 475-479.
- Lejuez, C. W., Read, J. P., Kahler, C. W., Richards, J. B., Ramsey, S. E., Stuart, G. L., & Brown, R. A. (2002). Evaluation of a behavioral measure of risk taking: The Balloon Analogue Risk Task (BART). *Journal Of Experimental Psychology-Applied*, *8*(2), 75-84.
- Leth-Steensen, C., Elbaz, Z. K., & Douglas, V. I. (2000). Mean response times, variability and skew in the responding of ADHD children: A response time distributional approach. *Acta Psychologica*, *104*, 167-190.
- Lieber, C. S. (1997). Gender differences in alcohol metabolism and susceptibility.

- Lighthall, N. R., Mather, M., & Gorlick, M. A. (2009). Acute stress increases sex differences in risk seeking in the balloon analogue risk task. *PloS one*, *4*(7), e6002.
- Liguori, A., & Robinson, J. H. (2001). Caffeine antagonism of alcohol-induced driving impairment. *Drug And Alcohol Dependence*, *63*(2), 123-129.
- Logan, G. D. (1994). On the ability to inhibit thought and action: A users guide to the Stop Signal Paradigm. In D. Dagenbach & T. H. Carr (Eds.), *Inhibitory processes in attention, memory and language* (pp. 189-239). San Diego, CA: Academic Press.
- Ltd., M. I. G. (2007). Energy drinks Chicago, IL: Mintel International Group Ltd.
- Maisto, S. A., Carey, M. P., Carey, K. B., Gordon, C. M., & Schum, J. L. (2004). Effects of alcohol and expectancies on HIV-related risk perception and behavioral skills in heterosexual women. *Experimental and Clinical Psychopharmacology*, *12*(4), 288.
- Malinauskas, B. M., Aeby, V. G., Overton, R. F., & Carpenter-Aeby, T., Barber-Heidal, K. (2007). A survey of energy drink consumption patterns among college students. *Journal of Nutrition*, *6*, 35.
- Marczinski, C. A., & Fillmore, M. T. (2003). Dissociative antagonistic effects of caffeine on alcohol-induced impairment of behavioral control. *Experimental And Clinical Psychopharmacology*, *11*(3), 228-236.
- Marczinski, C. A., & Fillmore, M. T. (2006). Clubgoers and their trendy cocktails: Implications of mixing caffeine into alcohol on information processing and subjective reports of intoxication. *Experimental And Clinical Psychopharmacology*, *14*(4), 450-458.
- Marczinski, C. A., Fillmore, M. T., Bardgett, M. E., & Howard, M. A. (2011). Effects of Energy Drinks Mixed with Alcohol on Behavioral Control: Risks for College

- Students Consuming Trendy Cocktails. *Alcoholism: Clinical and Experimental Research*, 35(7), 1282-1292.
- Martin, C. S., Earleywine, M., Musty, R. E., Perrine, M. W., & Swift, R. M. (1993). Development And Validation Of The Biphasic Alcohol Effects Scale. *Alcoholism-Clinical And Experimental Research*, 17(1), 140-146.
- Martin, F. H., & Garfield, J. (2006). Combined effects of alcohol and caffeine on the late components of the event-related potential and on reaction time. *Biological Psychology*, 71(1), 63-73.
- McCusker, R. R., Goldberg, B. A., & Cone, E. J. (2006). Caffeine content of energy drinks, carbonated sodas, and other beverages. *Journal of Analytical Toxicology*, 30, 112-114.
- Metcalfe, J., & Greene, M. J. (2007). Metacognition of agency. *Journal Of Experimental Psychology-General*, 136(2), 184-199.
- Miller, K. E. (2008a). Energy Drinks, Race, and Problem Behaviors Among College Students. *Journal Of Adolescent Health*, 43(5), 490-497.
- Miller, K. E. (2008b). Wired: Energy drinks, jock identity, masculine norms, and risk taking. *Journal Of American College Health*, 56(5), 481-489.
- Murphy, J. G., & MacKillop, J. (2006). Relative reinforcing efficacy of alcohol among college student drinkers. *Experimental and Clinical Psychopharmacology*, 14(2), 219.
- NIAAA. (2005). Recommended Council Guidelines on Ethyl Alcohol Administration in Human Experimentation *National Advisory Council on Alcohol Abuse and Alcoholism*. : Available from National Institute of Alcohol and Alcoholism Web site, <http://niaaa.nih.gov>.

- Nolen-Hoeksema, S. (2004). Gender differences in risk factors and consequences for alcohol use and problems. *Clinical Psychology Review, 24*(8), 981-1010.
- Nuotto, E., Mattila, M. J., Seppala, T., & Konno, K. (1982). Coffee And Caffeine And Alcohol Effects On Psychomotor Function. *Clinical Pharmacology & Therapeutics, 31*(1), 68-76.
- O'Brien, M. C., McCoy, T. P., Rhodes, S. D., Wagoner, A., & Wolfson, M. (2008). Caffeinated cocktails: Energy drink consumption, high-risk drinking, and alcohol-related consequences among college students. *Academic Emergency Medicine, 15*(5), 453-460.
- Oborne, D. J., & Rogers, Y. (1983). Interactions Of Alcohol And Caffeine On Human Reaction-Time. *Aviation Space And Environmental Medicine, 54*(6), 528-534.
- Oteri, A., Salvo, F., Caputi, A. P., & Calapai, G. (2007). Intake of energy drinks in association with alcoholic beverages in a cohort of students of the School of Medicine of the University of Messina. *Alcoholism-Clinical And Experimental Research, 31*(10), 1677-1680.
- Price, S. R., Hilchey, C. A., Darredeau, C., Fulton, H. G., & Barrett, S. P. (2010). Energy drink co administration is associated with increased reported alcohol ingestion. *Drug and Alcohol Review, 29*(3), 331-333.
- Reissig, C. J., Strain, E. C., & Griffiths, R. R. (2009). Caffeinated energy drinks-A growing problem. *Drug And Alcohol Dependence, 99*(1-3), 1-10.
- Riesselmann, B., Rosenbaum, F., Roscher, S., & Schneider, V. (1999). Fatal caffeine intoxication. *Forensic Science International, 103*, S49-S52.

- Roehrs, T., Greenwald, M., & Roth, T. (2004). Risk-taking behavior: Effects of ethanol, caffeine, and basal sleepiness. *Sleep*, 27(5), 887-893.
- Rohsenow, D. J., & Howland, J. (2007). Caffeinated alcohol beverages: Attractive misunderstood danger for young adults. *The Brown University Digest of Addiction Theory and Application*, November, 8.
- Rosenbloom, T., Beigel, A., Perlman, A., & Eldror, E. (2010). Parental and offspring assessment of driving capability under the influence of drugs or alcohol: Gender and inter-generational differences. *Accident Analysis and Prevention*, 42(6), 2125-2131.
- Rush, C. R., Higgins, S. T., Hughes, J. R., Bickel, W. K., & Wiegner, M. S. (1993). Acute Behavioral And Cardiac Effects Of Alcohol And Caffeine, Alone And In Combination, In Humans. *Behavioural Pharmacology*, 4(6), 562-572.
- Sayette, M. A., Breslin, F. C., Wilson, G. T., & Rosenblum, G. D. (1994). An evaluation of the balanced placebo design in alcohol administration research. *Addictive Behaviors*, 19, 333-342.
- Selzer, M. L., Vinokur, A., & van Rooijen, L. (1975). A Self-Administered Short Michigan Alcoholism Screening Test (SMAST). *Journal of Studies on Alcohol*, 36, 117-126.
- Simon, M., & Mosher, J. (2007). Alcohol, energy drinks, and youth: a dangerous mix. San Rafael, CA: Marin Institute
- Smith, A. (2002). Effects of caffeine on human behavior. *Food And Chemical Toxicology*, 40(9), 1243-1255.
- Sobell, L. C., & Sobell, M. B. (1992). Timeline followback: A technique for assessing self-reported alcohol consumption. In R. Z. Litten & J. P. Allen (Eds.), *Measuring alcohol*

- consumption: Psychosocial and biochemical methods* (pp. 41-72). Totowa, NJ: Humana Press.
- Spielberger, C. D., Gorsuch, R. L., Lushene, R., Vagg, P. R., & Jacobs, G. A. (1983). *Manual for the state-trait anxiety inventory (Form Y)*. Palo Alto, CA: Consulting Psychologists Press.
- Steele, C. M., & Josephs, R. A. (1990). Alcohol Myopia - Its Prized And Dangerous Effects. *American Psychologist*, *45*(8), 921-933.
- Testa, M., Livingston, J. A., & Collins, R. L. (2000). The role of women's alcohol consumption in evaluation of vulnerability to sexual aggression. *Experimental and Clinical Psychopharmacology*, *8*(2), 185.
- Thombs, D. L., O'Mara, R. J., Tsukamoto, M., Rossheim, M. E., Weiler, R. M., Merves, M. L., & Goldberger, B. A. (2010). Event-level analyses of energy drink consumption and alcohol intoxication in bar patrons. *Addictive behaviors*, *35*(4), 325-330.
- Tormey, W. P., & Bruzzi, A. (2001). Acute psychosis due to the interaction of legal compounds: Ephedra alkaloids in "Vigueur Fit" tablets, caffeine in "Red Bull," and alcohol. *Medical Science Law*, *41*, 331-336.
- Verbruggen, F., Logan, G. D., & Stevens, M. A. (2008). STOP-IT: Windows executable software for the stop-signal paradigm. *Behavior research methods*, *40*(2), 479.
- W.H.O. (1992). *The ICD-10 Classification of Mental and Behavioral Disorders*. Geneva: World Health Organization.
- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect *Journal of Personality and Social Psychology*, *54*, 1063-1070.

- Weinhardt, L. S., & Carey, M. P. (2000). Does alcohol lead to sexual risk behavior? Findings from event-level research. *Annual Review of Sex Research, 11*, 125-157.
- Weldy, D. L. (2010). Risks of Alcoholic Energy Drinks for Youth. *The Journal of the American Board of Family Medicine, 23*(4), 555-558.
- White, T. L., Lejuez, C. W., & Wit, H. (2008). Test-Retest Characteristics of the Balloon Analogue Risk Task (BART). *Experimental And Clinical Psychopharmacology, 16*(6), 565-570.
- 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*(4), 669-689.
- Woolsey, C., Waigandt, A., & Beck, N. C. (2010). Athletes and Energy Drinks: Reported Risk-Taking and Consequences from the Combined Use of Alcohol and Energy Drinks. *Journal Of Applied Sport Psychology, 22*(1), 65-71.
- Zegler, J. (2007). State of the industry: Beverage blockbusters. *Beverage Industry, 98*(7), 16-29.

VI. APPENDIX A: ELECTRONIC SCREENING QUESTIONNAIRE AND SCHEDULING SCRIPT

Hello and thank you for contacting us about participating in our research study about how alcohol and caffeine affect performance on certain tasks.

Our study has two parts to it. The first is a brief electronic screening, in which you will answer several questions on your computer. If you qualify based on our criteria, we will invite you to our lab here at the University of Illinois at Chicago for an experimental session. During the session, you will be asked to consume three alcoholic beverages that may or may not contain caffeine. You will be asked to do some tasks as well. The tasks that we use include filling out questionnaires and playing games on a computer. You will then be asked to remain in the lab until your blood alcohol level returns to a safe level. The entire procedure, including waiting for your blood alcohol to return to a safe level, typically takes between 6 and 7 hours. You are welcome to bring books, movies and other sources of entertainment while you wait for your blood alcohol content to return to a safe level. We will compensate you \$50 dollars for the session. Does this still sound like something you might be interested in?

YES or NO

If you do not qualify for the study or decide not to participate in the study after the screening, your screening information will be destroyed in a confidential manner. If you understand and accept what is being asked of you please proceed to the questionnaire by clicking "yes I understand the purpose of this screening questionnaire and I agree to participate." After completing the entire questionnaire you will be notified of your eligibility status.

Screening:

Name?: _____ Sex?: M F Ethnicity?: _____

Alternate Phone Number(s)?: _____ Best times to call?: _____

E-mail address?: _____

1. Age? : _____ [21-50] 2. DOB: _____

3. Weight?: _____ [M 120-200, F 100-180] Height? _____

4. Are you currently under the regular care of a physician?

No / Yes [For what conditions? _____] [If serious, DQ]

Do you have any allergies? _____

If you're unsure about a condition or allergies, please make a note in the comment box for the senior project staff member who will review your information for medical safety and contact you within a week.

5. If female: Are you pregnant, or is there any possibility that you are pregnant? Are you planning to get pregnant right now?

No / Yes [DQ]

If female, would you be willing to take a pregnancy test?

No[DQ] / Yes

6. What is your dominant hand?

Left [DQ if mouse can't be rearranged] Right Ambidextrous

7. Additional health history:

- a) *Have you ever had a heart attack or stroke?* **No / Yes:**
- b) *Have you ever had any indication of heart trouble?* **No / Yes:**
- c) *Have you ever had high blood pressure?* **No / Yes:**
- d) *Do you have diabetes?* **No / Yes:**
- e) *Have you ever had liver disease?* **No / Yes:**
- f) *Have you ever had a neurological disorder or injury?* **No / Yes:**

For items answered YES, please provide a brief description of the disorder & dates in the comment box below.

[If any clear “Yes” in question 8, DQ, possible medical complications.]

8. *Please describe any medications that you currently use:*

Medication	Dosage	Frequency	Purpose

[If takes daily, for example: antidepressants, anxiolytics, antipsychotics, meds for neuro probs (e.g., seizures) or cardio probs, or insulin; or takes antibiotics for extended period; or regularly takes pain meds → DQ, not medically safe]

If you're unsure about a medication, please make a note in the comment box for the senior project staff member who will review your information for medical safety and contact you within a week.

9. *Have you used any substances in the past 30 days? Y N*

If yes, please list _____

[DQ if list any drug use because it presents a safety hazard]

10. *“We’d like to ask you a few questions about your typical drinking habits. Think about the past 3 months, for a typical week in the past 3 months, please indicate the number of alcoholic drinks you drank on each day. One drink means either 12 oz. of beer, 5 oz. of wine, or a 1 ½ oz. shot of liquor, either straight or in a mixed drink. On a typical Sunday, how many drinks did you have? A typical Monday? ...”*

Typical Week Alcohol Consumption (in past 3 months)

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday

[Must have at least one day where they consume 4 drinks or d/q]

11. *As a reaction to alcoholic beverages, have you ever had...*

- a) *An experience of fainting or a seizure after drinking alcohol?....* **No / Yes:**
- b) *Unusual flushing of the skin? [other than rosy glow; uncomfortable]* **No / Yes:**
- c) *Problems with your liver?* **No / Yes:**
- d) *Severe or unusual psychological reactions* **No / Yes:**

For items answered YES, please provide a brief description of the disorder & dates in the comments box below.

[If any clear “Yes” in question 6, DQ, possible medical complications.]

12. Short MAST

- a. Do you feel you are a normal drinker?
(by normal we mean you drink less than or as much as most other people.) [No = 1]
- b. Does your wife, husband, a parent or other near relative ever worry or complain about your drinking? [Yes = 1]
- c. Do you ever feel guilty about your drinking? [Yes = 1]
- d. Do friends or relatives think you are a normal drinker? [No = 1]
- e. Are you able to stop drinking when you want to? [No = 1]
- f. Have you ever attended a meeting of Alcoholics Anonymous? [Yes = 1]
- g. Has drinking ever created problems between you and your wife, husband, a parent, or other near relative? [Yes = 1]
- h. Have you ever gotten into trouble at work because of drinking? [Yes = 1]
- i. Have you ever neglected your obligations, your family or your work for two or more days in a row because of your drinking? [Yes = 1]
- j. Have you ever gone to anyone for help about your drinking? [Yes = 1]
- k. Have you ever been in a hospital because of drinking? [Yes = 1]
- l. Have you ever been arrested for drunken driving, driving while intoxicated or driving under the influence of alcoholic beverages? [Yes = 1]
- m. Have you ever been arrested, even for a few hours, because of other drunken behavior? [Yes = 1]
- [3 or more points = DQ]**

13. In an average week, how many days do you consume caffeinated beverages?

a = 0 b = 1 c = 2 d = 3 e = 4 f = 5 g = 6 h = 7
[Must consume 3 or more times a week on average or d/q]

14. In an AVERAGE WEEK, approximately how many servings do you consume of each of the following **CAFFEINATED** beverages? Remember, 12 ounces is considered 1 serving size. (e.g., 12 oz = starbucks "tall" coffee or can of soda, 16 oz. = starbucks "grande", 20 oz. starbucks "vente" or plastic bottle of soda).

Coffee _____
 Tea _____
 Soda _____
 Energy Drinks _____

15. Have you ever consumed energy drinks with alcohol like Red Bull and Vodka and Yaeger Bombs or caffeinated alcohol such as PINK vodka or caffeinated beer?

Yes

No

If no, they do not qualify

16. In the past MONTH, approximately how many **days** did you consume of each of the following **CAFFEINATED Alcoholic** beverages? _____

Energy Drinks with Alcohol (e.g., Red Bull and Vodka, Jaeger Bomb) _____

Caffeinated Alcohol (e.g., caffeinated beer, caffeinated liquor (P.I.N.K)) _____

17. In the past MONTH, approximately how many **servings** of the following **CAFFEINATED Alcoholic Beverages** did you consume?

Energy Drinks with Alcohol (e.g., Red Bull and Vodka, Yaeger Bomb) _____

0 1 2-3 4-6 7-9 10-15 16-20 21-25 26-30 30 or more

Caffeinated Alcohol (e.g., caffeinated beer, caffeinated liquor (P.I.N.K)) _____

0 1 2-3 4-6 7-9 10-15 16-20 21-25 26-30 30 or more

17. Do you smoke cigarettes? **Yes or No**

If Yes:

On average, how many cigarettes do you typically smoke per day? _____
per week? _____

Do you primarily smoke when drinking? **Yes or No**

Final Determination: Q DQ Not Sure

DQ = “Unfortunately, you do not qualify for this particular study. Thank you for your time and interest. However, if we find that you do qualify for the study after reviewing your application, a second time, will contact you no later than one week from today.”

OR

Not Sure = “A staff member will be calling you back within a few days to let you know if you qualify for the study.”

OR

Q = “Congratulations, based upon your responses you are eligible to participate in the study. A staff member will contact you within 48 hours to schedule a laboratory session.”

To be done over the phone two days before the scheduled session

“There are a few things we ask our participants to do before they come in, so I’ll just run through those with you now and make sure they’re okay. We ask our participants not to have...

- any alcohol for 24 hours in advance, any drugs or other substances for 24 hours in advance.
- any food for four hours in advance, but you will receive a snack when you arrive at the lab
- any caffeine (like coke or coffee) for two hours in advance.
- any cigarettes for one hour in advance

- don’t drive yourself, because we do administer alcohol. Arrange to take public transit or be picked up from the lab.

- only 3 hours of the 6-7 hour time is actual tasks in the study, the rest is waiting for your blood alcohol to come back down. We have videos for you to watch, but if you want to bring a book or some work to help kill the time, that might be a good idea. You are also welcome to bring your laptop for entertainment purposes. Snacks are available downstairs, but bringing your own lunch is also a good idea, esp. on weekends when the cafeteria is closed.

FOR WEEKENDS – if the building is closed, the experimenter will meet you at the Harrison St. entrance outside

FOR WOMEN – because of the risks associated with administering alcohol to pregnant women, we also ask all women participating in the study to take a pregnancy test upon arriving at the lab.

Give directions to lab.

Questions about restrictions can usually be answered in one of two ways: a. because it affects alcohol absorption, or b. for liability reasons.

VII. APPENDIX B: QUANTITY AND FREQUENCY OF CAFFEINE, ALCOHOL, AND CAFFEINATED ALCOHOL CONSUMPTION

The following questions ask about how much you drink. A “drink” means any of the following:

A 12-ounce can or bottle of beer

A 5-ounce glass of wine

A 12-ounce bottle or can of wine cooler

A 12-ounce bottle of an alternative (for example: Doc Otis Hard Lemonade™)

A 1.5 ounce shot of liquor straight or in a mixed drink

1. Think of all the times in **the past 30 days** when you had something to drink. How often did you have some kind of beverage containing alcohol?

I didn't drink in past thirty days

Less than once a month

About once a month

2 to 3 times a month

Once or twice a week

3 to 4 times a week

Nearly every day

Everyday

2. In the **past 30 days**, when you were drinking alcohol, how many drinks did you usually have on any one occasion?

Did not drink in the past thirty days

1 drink

2 drinks

3 drinks

4 drinks

5 drinks

6 drinks

7 drinks

8 to 11 drinks

12 or more drinks

3. How many times in the **past 30 days** did you get a little high, buzzed, or light-headed on alcohol?

Didn't get high or light-headed in the past 30 days

Once during the past 30 days

2 to 3 times during the past 30 days

Once or twice a week

3 to 4 times a week

5 to 6 times a week

Every day

4. How many times in the **past 30 days** did you get drunk (e.g., speech was slurred or unsteady on your feet) on alcohol?

Didn't get drunk in the past 30 days

Once during the past 30 days

2 to 3 times during the past 30 days

Once or twice a week

3 to 4 times a week

5 to 6 times a week

Every day

5. In the **past 30 days**, how many times have you had four (4) or more drinks at a single sitting?
(If you are a **MALE** – how many times have you had five (5) or more drinks at a single sitting?)

Didn't drink 4/5 or more drinks at a single setting in the past 30 days

Once during the past 30 days

2 to 3 times during the past 30 days

Once or twice a week

3 to 4 times a week

5 to 6 times a week

Every day

6. What is the maximum number of drinks you have had in one sitting in the **past 30 days**? _____

7. In the **PAST THREE MONTHS**, how many drinks did you drink on a typical day? Use any applicable number, starting with 0, and please note that each space must be filled in.

Day of the Week	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Typical Number of Drinks (Based on <u>PAST 3 MONTHS</u>)							

*The following questions ask about how much **CAFFEINATED** alcohol you drink. Caffeinated alcoholic beverages include:*

- *energy drinks with alcohol (e.g., Red Bull and Vodka, Yaeger Bomb)*
- *prepackaged caffeinated alcohol (e.g., caffeinated beer – Sparks, Rockstar; caffeinated liquor - P.I.N.K)*
- *coffee with alcohol (e.g., Irish coffee)*

8. In the **PAST THREE MONTHS**, how many **caffeinated** alcoholic drinks did you drink on a typical day? Use any applicable number, starting with 0, and please note that each space must be filled in.

Day of the Week	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Typical Number of caffeinated Drinks (Based on <u>PAST 3 MONTHS</u>)							

9. Think of all the times in **the past 30 days** when you had something to drink. How often did you have some kind of alcoholic beverage containing caffeine?

I didn't drink caffeinated alcohol in the past thirty days

Less than once a month

About once a month

2 to 3 times a month

Once or twice a week

3 to 4 times a week

Nearly every day

Everyday

10. In the **past 30 days**, on days when you drank, how many drinks usually contained caffeine combined with alcohol?

Did not drink caffeinated alcohol in the past thirty days

- 1 drink
- 2 drinks
- 3 drinks
- 4 drinks
- 5 drinks
- 6 drinks
- 7 drinks
- 8 to 11 drinks
- 12 or more drinks

11. In the **past 30 days**, how many times have you had four (4) or more caffeinated alcoholic drinks at a single sitting?
 (If you are a **MALE** – how many times have you had five (5) or more caffeinated alcoholic drinks at a single sitting?)

Didn't drink 4/5 or more caffeinated drinks at a single setting in the past 30 days

- Once during the past 30 days
- 2 to 3 times during the past 30 days
- Once or twice a week
- 3 to 4 times a week
- 5 to 6 times a week
- Every day

12. What is the maximum number of caffeinated alcoholic drinks you have had in one sitting in the **past 30 days**?

*The following questions ask about how much **CAFFEINE** you drink. Caffeinated beverages can include:*

- *Tea (hot or cold), Coffee, Soda, Energy Drinks*
 - *12 ounces is considered 1 serving size.*
- 12 oz = starbucks "tall" coffee or can of soda**
16 oz. = starbucks "grande"
20 oz. = starbucks "vente" or plastic bottle of soda

DO NOT INCLUDE CAFFEINATED ALCOHOL

13. In the **PAST THREE MONTHS**, how many **caffeinated** beverages did you drink on a typical day? Use any applicable number, starting with 0, and please note that each space must be filled in.

Day of the Week	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Typical Number of caffeinated Drinks (<u>Based on PAST 3 MONTHS</u>)							

14. How many days in an **AVERAGE WEEK** do you consume caffeinated beverages? 0-7

15. Think of all the times in **the past 30 days** when you had something to drink. How often did you have some kind of caffeinated beverage? **DO NOT INCLUDE CAFFEINATED ALCOHOL**

I didn't drink caffeinated beverages in the past thirty days

Less than once a month

About once a month

2 to 3 times a month

Once or twice a week

3 to 4 times a week

Nearly every day

Everyday

16. Approximately how many years have you been consuming caffeine at this quantity and frequency? _____ years

VIII. APPENDIX C: PEER INFLUENCES ON DRINKING

1. How do most of your friends feel about drinking? (Circle one response.)

Strongly disapprove
Disapprove
Neither approve nor disapprove
Approve
Strongly approve

2. How do most of your friends feel about drinking caffeinated alcohol? (Circle one response.)

Strongly disapprove
Disapprove
Neither approve nor disapprove
Approve
Strongly approve

3. How do most of your friends feel about getting drunk? (Circle one response.)

Strongly disapprove
Disapprove
Neither approve nor disapprove
Approve
Strongly approve

4. How many of your close friends drink alcohol?

None Some Half Most Nearly All All

5. How many of your close friends drink caffeinated alcohol?

None Some Half Most Nearly All All

6. When your close friends drink, how much (on average) does each person drink?

They don't drink
1 or 2 drinks
3 or 4 drinks
5 or 6 drinks
More than six drinks

7. How many of your close friends get drunk on a regular basis (at least once a month)?

None Some Half Most Nearly All All

8. How many of your close friends drink primarily to get drunk?

None Some Half Most Nearly All All

9. How many alcoholic drinks, on average, do you think each of the following groups typically consumes at parties and bars? (Indicate one answer per row.)

	Number of Drinks
Yourself	
Your friends	
College Students	
Males	
Females	
Fraternity members	
Sorority members	
Young professionals	

UNIVERSITY OF ILLINOIS
AT CHICAGO

Office for the Protection of Research Subjects (OPRS)
Office of the Vice Chancellor for Research (MC 672)
203 Administrative Office Building
1737 West Polk Street
Chicago, Illinois 60612-7227

**Approval Notice
Initial Review (Response To Modifications)**

September 22, 2009

Adrienne Heinz, MA
Psychology
1007 W. Harrison St., Suite 1009
M/C 285
Chicago, IL 60607
Phone: (312) 996-8251 / Fax: (312) 413-4122

RE: **Protocol # 2009-0654**
“The Effects of Alcohol, Caffeine and Expectancies on Judgments of Personal Agency, Impulsivity, and Risk Taking Behavior”

Dear Ms. Heinz:

Your Initial Review application (Response To Modifications) was reviewed and approved by the Expedited review process on September 17, 2009. You may now begin your research.

Please note the following information about your approved research protocol:

Please note that the Board has determined this research will remain at convened review for future continuing review and all substantive amendments due to the inclusion of deception in the research design and to monitor the safety of the research, which requires a BioMedical ad hoc consultant to review the effects of the administration of the alcohol and caffeine intervention.

Please remember to revise consent documents to reflect the inclusion of NIH funding as that funding is secured. Revised consent documents must be accompanied by an Amendment form when submitted to the UIC IRB.

Protocol Approval Period: September 17, 2009 - September 2, 2010
Approved Subject Enrollment #: 100
Additional Determinations for Research Involving Minors: These determinations have not been made for this study since it has not been approved for enrollment of minors.

Performance Site: UIC
Sponsor: NIH-National Institutes of Health
PAF#: 2009-05155
Grant/Contract No: 1F31AA0189-01
Grant/Contract Title: Combined Effects of Alcohol and Caffeine on Agency Judgment, Impulsivity, and Risk

Research Protocol:

- a) The Effects of Alcohol, Caffeine, and Expectancies on Judgments of Personal Agency, Impulsivity, and Risk Taking Behavior, Thesis

Recruitment Materials:

- a) Craigslist Ad, to be posted at <http://chicago.craigslist.org/etc/>, Alcohol and Caffeine; Version 1; 07/01/2009
b) Electronic Screening Questionnaire and Scheduling Script; Version 2.0; 08/18/2009

Informed Consents:

- a) Consent to Participate, Alcohol, Caffeine and Task Performance; Version 3.0; 09/11/2009
b) A waiver of documentation has been granted under 45 CFR 46.117 for the telephone/online screening for recruitment purposes only (no subject signature on recruitment/consent document)

Please note the Review History of this submission:

Receipt Date	Submission Type	Review Process	Review Date	Review Action
07/22/2009	Initial Review	Convened	08/06/2009	Deferred
08/19/2009	Response To Deferred	Convened	09/03/2009	Modifications Required
09/14/2009	Response To Modifications	Expedited	09/17/2009	Approved

Please remember to:

→ Use your **research protocol number** (2009-0654) on any documents or correspondence with the IRB concerning your research protocol.

→ Review and comply with all requirements on the enclosure,
"UIC Investigator Responsibilities, Protection of Human Research Subjects"

Please note that the UIC IRB has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

Please be aware that if the scope of work in the grant/project changes, the protocol must be amended and approved by the UIC IRB before the initiation of the change.

We wish you the best as you conduct your research. If you have any questions or need further help, please contact OPRS at (312) 996-1711 or me at (312) 996-2014. Please send any correspondence about this protocol to OPRS at 203 AOB, M/C 672.

Sincerely,

Sandra Costello
Assistant Director, IRB # 2
Office for the Protection of Research

Subjects

Enclosures:

- 1. UIC Investigator Responsibilities, Protection of Human Research Subjects**
- 2. Informed Consent Document:**
 - a) Consent to Participate, Alcohol, Caffeine and Task Performance; Version 3.0; 09/11/2009
- 3. Recruiting Materials:**
 - a) Craigslist Ad, to be posted at <http://chicago.craigslist.org/etc/>, Alcohol and Caffeine; Version 1; 07/01/2009
 - b) Electronic Screening Questionnaire and Scheduling Script; Version 2.0; 08/18/2009
- 4. Protection of Human Subjects, Assurance Identification/Certification/Declaration (formerly Form 310)**

cc: Gary E. Raney, Psychology, M/C 285
Jon D. Kassel, Psychology, M/C 285
OVCR Administration, M/C 672

CURRICULUM VITAE

Adrienne J. Heinz, M.A.

EDUCATION

Clinical Pre-Doctoral Internship July 2011- Present
San Francisco Veteran Affairs Medical Center

University of Illinois at Chicago, Clinical Psychology Doctoral Program August 2006 - Present
Minor Area: Statistics, Methods and Measurement
Dissertation: The Effects of Alcohol, Caffeine, and Expectancies on Judgments of Personal Agency, Impulsivity and Risk Taking Behavior

University of Illinois at Chicago, Masters of Arts August 2006-December 2007
Thesis: Caffeine Expectancy: Instrument Development in the Rasch Measurement Framework

University of North Carolina at Chapel Hill August 2000 - May 2004
B.A. Psychology with Honors; **Minor:** Cognitive Science

GRANTS ACTIVITIES AND FUNDED RESEARCH AWARDS

- National Institutes of Health, National Research Service Award (F-31 NRSA), National Institute on Alcoholism and Alcohol Abuse, Dec. 2009 – Sept. 2011 (*Direct costs \$72,987*)
- Provost Award for Graduate Research, May, 2009 (*\$2,500*)
- UIC Psychology department Masters and Dissertation Research Awards, 2007 (*\$300*), 2009 (*\$500*)

HONORS, AWARDS AND SCHOLARSHIPS

- Leonard D. Eron Award for outstanding scholarly accomplishment, 2010, (*\$500*)
- Graduate College Travel Award, Psychology Department Graduate Student Travel Award, Graduate Student Counsel Travel Award (2006 – 2010), (*\$3,500*)
- Society for a Science of Clinical Psychology, Student Poster Award, May, 2009, (*\$100*)
- Commendation for Excellence, UIC, Department of Psychology, November, 2008
- Christopher B. Keys Award for early outstanding research achievement, 2008, (*\$500*)
- National Institutes of Health Intramural Research Training Awardee, May 2004 - August 2006
- Dashielle-Thurstone Award for outstanding undergraduate honors research, 2004
- University of North Carolina at Chapel Hill Honors Psychology Program, Jan. 2003 - May 2004
- Psi Chi National Psychology Honor Society, 2002-2004 (Treasurer)
- University of North Carolina at Chapel Hill Dean's List of Academic Excellence, 2001 - 2004

PEER REVIEWED PUBLICATIONS

- Newcomb, M., **Heinz**, A.J. & Mustanski, B. (*In Press*). Longitudinal analysis of predictors of alcohol use in a diverse sample of LGBT youth. *Journal of Studies on Alcohol and Drugs*.
- Kassel, J.D., Veilleux, J.C., **Heinz**, A.J. Braun, A.R., Conrad, M., & Weber, S. (*In press*). Understanding the acute aftereffects of drug administration and the role of withdrawal in addiction. In de Wit, H. & Mackillop, J., *The Wiley-Blackwell Handbook of Addiction Psychopharmacology*. Hoboken, NJ: John Wiley and Sons.
- Kassel, J.D., Veilleux, J.C., **Heinz**, A. J., Braun, A. & Conrad, M. (*In Press*). Emotions and addictive processes. *Encyclopedia of Addictive Behaviors*. Oxford, UK: Elsevier Ltd.**Heinz**, A.J., Beck, A., Meyer-Lindenberg P., Sterzer, P., Heinz, A. (2011). Cognitive and neurobiological mechanisms of alcohol-related aggression. *Nature Reviews Neuroscience*, 12, 400-413.
- Braun, A.R., **Heinz**, A.J., Kassel, J.D., Conrad, M., Veilleux, J., Evatt, D., Greenstein, J., Wardle, M. & Drobos, D. (2011). The separate and combined effects of alcohol and nicotine on anticipatory anxiety: A multidimensional approach. *Addictive Behaviors*, 37, 485-491.
- Veilleux, J. C., Kassel, J. D., **Heinz**, A. J., Braun, A., Wardle, M., Greenstein, J., & Evatt, D. (2011). Predictors of smoking topography across a single cigarette in light adolescent smokers. *Journal of Adolescent Health*, 48, 176-181.
- Kassel, J.D., **Heinz**, A.J., Braun, A., & Evatt, D. (2010). Treatment models for comorbid psychiatric and addictive disorders. In Miller, N.S. & Gold, M.S., *Addictions in medicine: Principles and practices* (pp. 541-556). Hoboken, NJ: John Wiley and Sons.
- Heinz**, A.J., Kassel, J.D., Berbaum, M., & Mermelstein, R. (2010). Adolescents' expectancies for smoking to regulate affect predict smoking behavior and nicotine dependence over time. *Drug and Alcohol Dependence*, 111, 128-135.
- Greenstein, J.E., Kassel, J.D., Wardle, M.C., Veilleux, J.C., Evatt, D.P., **Heinz**, A.J., Roesch, L., & Yates, M.C. (2010). The separate and combined effects of nicotine and alcohol on working memory capacity in nonabstinent smokers. *Experimental and Clinical Psychopharmacology*, 18, 120-128.
- Heinz**, A. J, Epstein, D. H., Disney, E., Clark, P., & Preston, K. L. (2010). A focus-group study on spirituality and substance-user treatment. *Substance Use and Misuse*, 45, 134-153.
- Veilleux, J.C., Colvin, P.J., Anderson, J., York, K., & **Heinz**, A.J. (2009). A review of opioid dependence treatment: Pharmacological and psychosocial interventions to treat opioid addiction. *Clinical Psychology Review*, 30, 155-166.
- Kassel, J.D., Hussong, A.M., Wardle, M.C., Veilleux, J., **Heinz**, A.J., Greenstein, J., & Evatt, D. (2009). Affective influences in drug use etiology. In Scheier, L.M. (Ed.), *Handbook of drug use etiology* (pp. 183-205). New York: American Psychological Association.
- Heinz**, A.J., Smith, E.V., & Kassel, J.D. (2009). Caffeine Expectancy: Instrument Development in the Rasch Measurement Framework. *Psychology of Addictive Behaviors*, 23, 500-511.

- Kassel, J.D., Wardle, M.C., **Heinz**, A.J., & Greenstein, J. (2009). Cognitive theories of drug effects on emotion. In Kassel, J.D. (Ed.), *Substance abuse and emotion* (pp. 61-82). New York: American Psychological Association.
- Heinz**, A.J., Wu, J., Witkiewitz, K., Epstein, D.H., & Preston, K.L. (2009). Marriage and Relationship Closeness as Predictors of Cocaine and Heroin Use. *Addictive Behaviors*, *34*, 258-263.
- Heinz**, A.J., Veilleux, J.C., & Kassel, J.D. (2009). The role of cognitive structure in college student drinking. *Addictive Behaviors*, *34*, 212-218.
- Heinz**, A., Epstein, D. H., & Preston, K. L. (2007). Spiritual/Religious experiences and in-treatment outcome in an inner-city program for heroin and cocaine dependence. *Journal of Psychoactive Drugs*, *39*, 41-49.
- Heinz**, A., Waters, A., Taylor, R., Myers, C., Singleton, E., & Heishman, S. (2007). Effect of tobacco deprivation on the attentional blink in rapid serial visual presentation. *Human Psychopharmacology: Clinical and Experimental*, *22*, 89-96.
- Heinz**, A.J., Schroeder, J., Epstein, D.H., Singleton, E., Heishman, S., Preston, K.P., (2006). Craving and cocaine and heroin use during treatment: Measurement validation and potential relationships. *Journal of Substance Abuse Treatment*, *31*, 355-364.
- Bartholow, B., & **Heinz**, A. (2006). Alcohol and aggression without consumption: Alcohol cues, aggressive thoughts, and hostile perception bias. *Psychological Science*, *17*, 30-37.

MANUSCRIPTS UNDER REVIEW OR IN PREPARATION

- Heinz**, A.J., Lilje, T.*, Kassel, J.D., & de Wit, H. (*Revise and Resubmit*). A review of behavioral economic approaches to quantifying reinforcement value and demand for substances in humans.
- Kassel, J.D., Wardle, M.C., Veilleux, J.C., Greenstein, J.E., **Heinz**, A.J., Evatt, D.P., Roesch, L.R., Braun, A., Segawa, E., Hedeker, D., Berbaum, M.L., Mermelstein, R., & Blumenthal, T.D (*Submitted*). The acute effects of cigarette smoking on emotional response in adolescent smokers: A multidimensional analysis.
- Heinz**, A.J., Olerjarska, N., Kassel, J.D., Braun, A.R., Conrad, M., & Veilleux, J. (*Manuscript in preparation*). An examination of harm perception in young adults reporting waterpipe use: Profile comparisons between cigarette smokers versus non-cigarette smokers.
- Braun, A.R., Kassel, J.D., Veilleux, J.C., **Heinz**, A.J., Wardle, M., Greenstein, J., Evatt, D. & Conrad, M. (*Manuscript in preparation*). Differences in emotional response among male and female adolescents.
- Heinz**, A.J., Lilje, T.*, Kassel, J.D., & de Wit, H. (*Manuscript in preparation*). The effects of alcohol, caffeine and expectancies on subjective experience, performance and personal agency.
- Heinz**, A.J., Lilje, T.*, Kassel, J.D., & de Wit, H. (*Manuscript in preparation*). Individual differences in the combined effects of alcohol, caffeine and expectancies on subjective experience, judgment of impairment and risk-taking behavior.

PROFESSIONAL PRESENTATIONS

* student mentee

Heinz, A.J., Babson, K.A., Bucossi, M.M., Trafton, J.A., & Bonn-Miller, M.O. (November, 2012). The impact of problematic alcohol use on memory functioning among an HIV positive sample. Poster submitted for presentation at the 46th annual meeting of the Association for Behavioral and Cognitive Therapies, National Harbor, MD.

Heinz, A.J., Waldrop, A., & Thomas, S.E. (November, 2012). Delay discounting in non-treatment seeking individuals with alcohol dependence: Relationships with negative emotionality, drinking motives and disinhibition. Poster submitted for presentation at the 46th annual meeting of the Association for Behavioral and Cognitive Therapies, National Harbor, MD.

Heinz, A.J., Waldrop, A., Lasher, B.A., Herbst, E., Metzler, T., Prathikanti, S., Neylan, T., Tarasovsky, G., & Batki, S.L. (November, 2012). PTSD symptoms predict alcohol cravings and obsessions across a trial of topiramate for alcohol dependence in veterans with PTSD. Poster submitted for presentation at the International Society for Traumatic Stress Studies, Los Angeles, CA.

Batki, S.L., Lasher, B.A., **Heinz, A.J., Waldrop, A., Herbst, E., Prathikanti, S., Metzler, T., Neylan, T., & Tarasovsky, G.**, (June, 2012). Impulsivity, memory and executive functioning as outcome predictors in a trial of Topiramate for alcohol dependence in veterans with PTSD. Poster accepted for presentation at the Research Society on Alcoholism.

Heinz, A.J., Waldrop, A., Lasher, B.A., Herbst, E., Prathikanti, S., Metzler, T., Neylan, T., Tarasovsky, G., & Batki, S.L. (June, 2012). Cognitive functioning, impulsivity and risk-taking: Relationships with measures of clinical symptomology in veterans with PTSD and Alcohol Dependence. Poster accepted for presentation at the Research Society on Alcoholism.

Batki, S.L., Lasher, B.A., Herbst, E., Prathikanti, S., Metzler, T., Neylan, T., Waldrop, A., **Heinz, A.J., & Tarasovsky, G.** (June, 2012). Smoking and non-alcohol substance use in veterans with PTSD and alcohol dependence. Accepted for oral presentation at the College for Problems on Drug Dependence, Palm Springs, CA.

Braun, A.R., Kassel, J., **Heinz, A.J., Conrad, M., Weber, S.** (November, 2011). Negative life events and depression impact adolescent substance use. Poster presented at the Caribbean Regional Conference of Psychology, Nassau, Bahamas.

Heinz, A.J., Lilje, T.C.*, Monroe, S.*, de Wit, H. & Kassel, J.D. (November, 2011). Caffeine, alcohol and risky behavior: The separate and combined influence of caffeine and alcohol on subjective experience. Poster accepted for presentation at the Association for Behavioral and Cognitive Therapy 45th annual convention, Toronto, Canada.

Newcomb, M.E., **Heinz, A.J., & Mustanski, B.** (November, 2011). Alcohol use trajectories in a longitudinal sample of LGBT youth: An analysis of risk and protective factors. Paper submitted for presentation at the annual mtg. of the Society for the Scientific Study of Sexuality, Houston, TX.

Heinz, A.J., Beidas, R., Suarez, L., Martinez, W., Simpson, D., Woods, B. & Braun, A. (November, 2011). Therapist attitudes about integrated care for traumatic stress and substance

abuse: Instrument development and implications for practice. In R. Beidas, Chair, Measurement in dissemination and implementation science. Paper accepted for presentation at the Association for Behavioral and Cognitive Therapy 45th annual convention, Toronto, Canada.

- Mustanski, B. Newcomb, M., **Heinz**, A.J., Birkett, M. & Ashback, A. (August, 2011). Sex differences in developmental trajectories of sexual attractions among LGBT youth. Poster presented at the International Academy of Sex Researchers annual meeting, Los Angeles, CA. Awarded best poster for a senior investigator.
- Olejarska, N.A.* *, **Heinz**, A.J., Kassel, J.D. (April, 2011). An examination of harm perception in young adults reporting waterpipe use: Profile comparisons between waterpipe users that smoke cigarettes and those who do not. Poster presented at the Midwestern Psychological Association annual meeting, Chicago, IL.
- Lilje, T.C.* *, **Heinz**, A.J., Kassel, J.D. (May, 2011). A process-oriented analysis of the Balloon Analogue Risk Task's sensitivity to acute alcohol consumption. Poster presented at the Midwestern Psychological Association annual meeting, Chicago, IL.
- Heinz**, A.J., Suarez, L.M., & Abdul-Adil, J. (November, 2010). Relationship between adolescent's traumatic stress symptoms and craving for drugs and alcohol over the course of residential treatment: A case study examination. Poster presented at the Association for Behavioral and Cognitive Therapy 44th annual convention, San Francisco, CA.
- Conrad, M., Kassel, J.D., Veilleux, J., **Heinz**, A.J., Braun, A.R. & Roesch, L. (November, 2010). Stability of emotional response in adolescent smokers and nonsmokers: A longitudinal analysis. Poster presented at the Association for Behavioral and Cognitive Therapy 44th annual convention, San Francisco, CA.
- Heinz**, A.J., Abdul-Adil, J., Suarez, L., Rechlicz, K., Hartle, N., Farmer, D., & Taylor-Crawford, K. (September, 2010). Risk and protective factors for substance use among youth in treatment for disruptive behavior disorders. Poster presented at the University of Illinois Chicago Annual Research Day, Chicago, IL.
- Monroe, S.J.* *, **Heinz**, A.J., Kassel, J.D. (May, 2010). Effects of alcohol and caffeine on sexual aggression and its moderators. Poster presented at the Midwestern Psychological Association annual meeting, Chicago, IL.
- Heinz**, A.J., Kassel, J.D., Veilleux, J.C., Braun, A., Conrad, M., Greenstein, J., Evatt, D., Wardle, M., Roesch, L., and Mermelstein, R. (February, 2010). The acute effects of cigarette smoking on negative affect moderates nicotine dependence over time in adolescents. Orally presented at the Society for Research on Nicotine & Tobacco 16th annual mtg., Baltimore, MD.
- Veilleux, J.C., Kassel, J.D., **Heinz**, A.J., Roesch, L., Braun, A., Conrad, M., Greenstein, J., Wardle, M.C., & Evatt, D.P. (February, 2010). Puffing behavior across a single cigarette for light adolescent smokers is influenced by nicotine dependence, depression and anxiety. Poster presented at the Society for Research on Nicotine & Tobacco 16th annual mtg., Baltimore, MD.
- Veilleux, J.C., Kassel, J.D., Wardle, M.C., **Heinz**, A.J., Greenstein, J., Evatt, D.P., Braun, A., Roesch, L., Segawa, E., & Berbaum, M.L. (2009). Cigarette smoking reduces negative affect in

adolescent smokers: concordance across self-report and psychophysiological measures. Poster presented at the annual mtg. of the Society for Psychophysiological Research, Berlin, Germany.

Heinz, A.J., Kassel, J.D., Veilleux, J.C., Braun, A., Wardle, M.C., Greenstein, J., Roesch, L., Evatt, D., Yates, M., & Drobles, D.J. (June, 2009). The separate and combined effects of alcohol and nicotine interact with drug-related negative affect reduction expectancies to predict startle reflex in response to a stressor. Poster presented at the 32nd annual meeting of the Research Society on Alcoholism, San Diego, CA.

Braun, A.R., Kassel, J.D., Wardle, M.C., Veilleux, J.C., **Heinz, A.J.**, Evatt, D., Greenstein, J. & Yates, M. (2009). The synergistic effects of alcohol and nicotine on self-reported anxiety. Poster presented at the 32nd annual mtg of the Research Society on Alcoholism, San Diego, California.

Heinz, A.J., Kassel, J.D., & Mermelstein, R. (May, 2009). Adolescent's expectancies for smoking to regulate affect predict smoking outcomes over time. Poster presented at the 21st annual convention of the Association for Psychological Science, San Francisco, CA.

Roesch, L.L., Kassel, J.D., Greenstein, J.E., Wardle, M.C., Evatt, D.P., Veilleux, J.C., & **Heinz, A.J.** (October, 2008). Emotional responsiveness to affective stimuli: Aggression in adolescence. Poster presented at the annual mtg. of the Society for Psychophysiological Research, Austin, TX.

Heinz, A.J., Kassel, J., Evatt, D., Wardle, M., Veilleux, J., Greenstein, J., Yates, M., & Roesch, L. (August, 2008). Smoking's effect on emotion in adolescent smokers: Reactivity to affective cues. Orally presented at the 7th annual Charite Conference on Psychiatric Research: Emotional Neuroscience, Berlin, Germany.

Kassel, J., Evatt, D., Wardle, M., Veilleux, J., Greenstein, J., **Heinz, A.J.**, Yates, M., & Roesch, L. (March, 2008). Does smoking a cigarette exert acute effects on emotional response in adolescent smokers? Presented at the biennial mtg. of the Society for Research on Adolescence, Chicago, IL.

Heinz, A.J., Kassel, J.D., & Mermelstein, R. (February, 2008). Coping motives and negative affect relief expectancies for smoking predict increase in nicotine dependence among adolescent smokers. Poster presented at the Society for Research on Nicotine & Tobacco 14th annual mtg., Portland, OR.

Greenstein, J.E., Kassel, J.D., Wardle, M.C., Veilleux, J.C., Evatt, D.P., **Heinz, A.J.**, Roesch, L., & Yates, M.C. (February, 2008). The acute effects of nicotine on working memory performance in non-abstinent smokers. Poster presented at the 14th annual mtg. of the Society for Research on Nicotine and Tobacco, Portland, OR.

Kassel, J.D., Greenstein, J.E., Wardle, M.C., **Heinz, A.J.**, Veilleux, J.C., Evatt, D.P., Roesch, L., & Yates, M. (February, 2008). The acute effects of cigarette smoking on self-report and psychophysiological measures of affect in adolescent smokers. In R. Mermelstein, Chair, Integrating laboratory, field, and observational methods to examine the social-emotional

contexts of adolescent smoking. Paper presented at the 14th Annual Meeting of the Society for Research on Nicotine and Tobacco, Portland, Oregon.

Veilleux, J.C., Kassel, J.D., Roesch, L., **Heinz**, A.J., & Wardle, M.C. (May, 2007). Using cognitive appraisals to better understand laboratory emotion induction. Poster presented at the annual meeting of the Association for Psychological Science, Washington D.C.

Heinz, A.J., Mermelstein, R., & Kassel, J.D. (February, 2007). Pubertal timing, self image, and smoking escalation among adolescent females. Poster presented at the Society for Research on Nicotine & Tobacco 13th annual mtg., Austin, TX.

Veilleux, J.D., Kassel, J.D., Roesch, L., & **Heinz**, A.J. (January, 2007). Is all positive affect the same? Differentiating between two positive emotion induction procedures. Poster presented at the Emotion Pre-conference at the annual meeting of the Society for Personality and Social Psychology, Memphis, TN.

Heinz, A.J., Belendiuk, K., Epstein, D.H., & Preston, K.L. (June, 2006). Beck Depression Inventory scores and drug use in methadone-maintained outpatients. Poster presented at the College on Problems of Drug Dependence, 68th annual mtg., Scottsdale, AZ.

Heinz, A.J., Waters, A., Taylor, R., Myers, C., Singleton, E., & Heishman, S. (February, 2006). Effect of tobacco deprivation on the attentional blink in rapid serial visual presentation. Poster presented at the Society for Research on Nicotine & Tobacco, 12th annual mtg, Orlando, FL.

Heinz, A.J., Epstein, D.H., & Preston, K.L. (May, 2005; June, 2005). Spiritual/Religious experiences and in-treatment outcome in an inner-city program for heroin and cocaine dependence. Poster Presented at The NIH annual research symposium, Bethesda, MD, and The 67th Annual Meeting, College on Problems of Drug Dependency, Orlando, FL.

Heinz, A.J., Schroeder, J., Epstein, D.H., Singleton, E., Heishman, S., Preston, K.P., (October, 2005). Craving and cocaine and heroin use during treatment: Measurement validation and potential relationships. Poster presented at The Association for Medical Evaluation and Research in Substance Abuse, 29th annual conference, Washington, D.C., and orally presented at the Pre-IRTA Seminar Series, Bethesda, MD.

Heinz, A.J. & Bartholow, B., (November, 2003; April, 2004). Alcohol and aggression without consumption: Alcohol cues, aggressive thoughts, and hostile perception bias. Poster presented at the Triangle Undergraduate Research Symposium, Duke University, and The Office of Undergraduate Research Annual Symposium, UNC-Chapel Hill.

RESEARCH EXPERIENCE

Predoctoral Research Trainee

July 2011 - Present

San Francisco Veteran Affairs Medical Center, Addiction Psychiatry Research Program

Mentors: Steven Batki, M.D., Angela Waldrop, Ph.D.

- Assist with data analysis and data management for a study examining the effects of Topiramate for the treatment of comorbid post-traumatic stress disorder and alcohol dependence.
- Contribute to preparation of manuscripts and presentations

- Receive individual mentorship and didactic training on conducting research with clinical populations with multiple risks

Graduate Research Assistant

August 2009 – May 2011

University of Illinois Chicago, Urban Youth Trauma Center

Mentors: Liza Suarez, Ph.D., Jaleel Abdul-Adil, Ph.D.

- Participated in a variety of research activities on a SAMSHA funded grant to help 1) forge national and local collaborations for the dissemination of trauma informed treatment approaches, 2) develop needed products, resources and therapeutic materials for service providers, and 3) mobilize community responses to youth and families affected by community violence
- Assisted in coordinating activities and research directives for the *National Child Traumatic Stress Network* – Trauma and Substance Use Committee
- Coordinated clinic-wide research program and developed effective patient tracking systems

Graduate Research Assistant

August 2006 – June 2011

University of Illinois Chicago, Substance Use Research Lab; Institute for Health Research Policy

Mentors: Jon Kassel, Ph.D., Robin Mermelstein, Ph.D.

- Conducted experimental sessions and assisted in data management, analysis, and interpretation for two National Cancer Institute funded R01 laboratory-based project assessing the effects of smoking on emotional and psychophysiological response in adolescents
- Conducted and supervised experimental sessions for ongoing studies involving nicotine, alcohol, caffeine, mood induction, and assessment of cognitive performance and risky behaviors

Intramural Research Training Awardee

June 2004 – August 2006

National Institutes of Health, National Institute on Drug Abuse, Intramural Research

Program, Clinical Pharmacology and Treatment Branch. Mentors: Kenzie Preston Ph.D.,

David Epstein Ph.D., Stephen Heishman Ph.D., Wallace Pickworth Ph.D., David Gorelick M.D.,

- Logged hundreds of hours interaction with and exposure to treatment-seeking substance-abusing individuals and gained awareness of pressing issues endemic to the population
- Accrued valuable hands-on experience in the design and operation of clinical studies; took an active role in clinical aspects of ongoing research by attending weekly treatment-team meetings and conducting various psychological assessments
- Acquired a general knowledge of substances of abuse, addiction and addictive behaviors, mechanisms of craving and relapse, psychological and pharmacological interventions, and an appreciation for the neurobiology of addiction through lectures, and conferences
- Gained academic autonomy through conducting independent research projects in addition to collaborating with individuals of diverse professional backgrounds

Research and Clinical Assistant

September 2005 – August 2006

Center for Addiction and Pregnancy, Johns Hopkins Bayview Medical Center

Supervisor: Vickie Walters, LCSW-C

- Co-facilitated group counseling and education sessions, attended clinical rounds, and participated in treatment team meetings

- Assisted in the development of a behavioral incentive system
- Performed data analyses to determine which factors predict 1) returning to the program with a new pregnancy and, 2) retention time in treatment

Research Assistant

February - June 2004

UNC-CH School of Public Health, Department of Health Behavior and Health Education.

Supervisors: Susan Ennett, Ph.D., Andrea Hussong, Ph.D.

- Conducted extensive phone interviews with parents of adolescents screened for a wide range of factors that put youth at risk for substance use and other health-risk behaviors

Student Research Extern

January – May 2004

UNC-CH School of Public Health, Pacific Institute for Research & Evaluation

Supervisors: Sandra Martin, Ph.D., Kathryn Moracco, Ph.D.

CDC-funded Evaluation of an Emergency Department (ED)-based Intimate Partner Violence (IPV) Intervention.

- Recruited participants and conducted IPV screening interviews with Hospital ED patients and abstracted data from electronic medical records with particular attention to IPV-related variables
- Assisted in the development and implementation of an intervention designed for an ED based IPV screening and referral program

Research Assistant

April 2003 - May 2004

UNC-CH Social Cognition and Schizophrenia Lab; Supervisor: David Penn, Ph.D.

- Conducted sessions to determine whether exposure to auditory hallucinations simulating the experience of a schizophrenic episode, reduced stigma towards persons with schizophrenia using virtual reality technology
- Learned to identify and rate deficits in social-cognitive functioning specific to schizophrenia

Research Assistant

August 2002 - May 2004

UNC-CH Social Cognitive Neuroscience Laboratory; Supervisor: Bruce Bartholow, Ph.D.

- Measured reaction time and recorded cortical activity using EEG to assess the effects of alcohol intoxication on the cognitive processing of stereotyping
- Collected data for thesis examining the relationships between alcohol and aggression in memory

CLINICAL EXPERIENCE***Graduate Clinical Provider***

January 2010 – May 2011

University of Illinois at Chicago, Chicago, IL. Institute for Juvenile Research, Pediatric Stress and Anxiety Disorders Clinic Supervisors: Liza Suarez, Ph.D., Sucheta Connolly, M.D., David Simpson, Ph.D., LCSW

- Assisted in the development and delivery of an integrated treatment program that incorporated empirically supported strategies for adolescents clients struggling with chronic stress and substance use

- Received individual supervision and participated in weekly multidisciplinary treatment meetings

Clinical Extern

July 2009 – July 2010

University of Illinois at Chicago, Chicago, IL. Institute for Juvenile Research, Disruptive Behaviors Clinic, School-Age Program.

Supervisors: Jaleel Abdul-Adil, Ph.D., Karen Taylor-Crawford, M.D.

- Provided supervised evidence-based clinical psychology services for a weekly case-load of 6 youth and their families using an extensive manualized treatment protocol.
- Facilitated psycho-educational multiple family group sessions
- Participated in scholarly projects including conference presentations and co-authoring manuscripts for peer-reviewed journals.

Therapy Practicum

January 2008 – June 2011

University of Illinois at Chicago, Chicago, IL. Office of Applied Psychological Services (OAPS). Supervisors: Gloria Balague, Ph.D., Stewart Shankman, Ph.D., Evelyn Behar, Ph.D., Elise Massie, Ph.D.

- Provided individual psychotherapy in a community based clinic, treating clients with varying psychiatric disorders including nicotine dependence, eating disorders, depression, and anxiety, under the supervision of licensed clinical psychologists

Assessment Practicum

August 2007 – July 2008

University of Illinois at Chicago, Chicago, IL. Office of Applied Psychological Services (OAPS). Supervisors: Audrey Ruderman, Ph.D., Nancy Dasso, Ph.D., Gloria Balague, Ph.D.

- Selected, administered, scored, and interpreted psychological test batteries and integrated data to produce 8 comprehensive psychological evaluations under the supervision of licensed clinical psychologists
- Provided feedback of test results and recommendations to clients
- Population served included ethnically diverse children, adolescents, and adults

Community Connections Partner

September 2002 - June 2004

ARC of Orange County; Director: Charlene Harris (former), Kim Costello (current)

- Actively involved in non-profit designed to promote friendship and community access for adults with developmental disabilities through community partnerships.
- Acquired extensive knowledge of mental retardation and autism, learned people-first language techniques, familiarized with attitudinal barriers, helped foster self-efficacy using various methods.

Activities Therapist, Private Employer

January - June 2004

- Designed workout agendas, formulated weight-loss and fitness goals, administered medication, frequently managed mild to severe seizures, and further developed skills to effectively interact with individuals demonstrating special needs.

TEACHING EXPERIENCE

Undergraduate Research Mentor

May 2009 – June 2011

- Independently supervised the research of 3 undergraduate Honors Thesis Projects
- Oversaw the training of 14 undergraduate research assistants, confirmed fidelity to the research protocol, held monthly professional development seminars (e.g., SPSS training, Reference Management; Literature Searches; Scientific Writing Skills), advised students on post-baccalaureate opportunities and graduate school

Teaching Practicum

August 2008 – May 2009

- Year-long practicum on instruction of psychology and mentoring of undergraduate students.

Instructor

Spring 2009

Research Methods and Design

University of Illinois at Chicago, Chicago, IL

- Taught 25 students and handled all responsibilities as an instructor including lecture and discussion planning, test construction, development of writing assignments and grading.

Graduate Teaching Assistant

August 2006 – May 2011

Psychological Testing

Fall, 2010, Spring 2011

- Guided students on selection of psychometric tools and foster their appreciation for careful attention to evidence supporting their reliability and validity in the assessment of special populations.

Applied Fieldwork in Psychology

Fall 2009 – Spring 2010

- Helped students develop empirical studies at internship sites to facilitate an appreciation for scientific rigor and academic writing in applied settings.
- Independently conducted a series of lecture-based seminars on scientific writing

Introductory Psychology

Fall 2006, Spring and Fall 2007, Spring 2008, Fall 2009

- Independently led multiple introductory psychology discussion sessions on a weekly basis

Abnormal Psychology

Fall 2008, Spring 2009, Spring 2011

- Assisted students with scientific writing skills and managed course grades

Psychology of Interviewing

Fall, 2008

- Supervised over 50 one hour interviews conducted by students with mock clients
- Role played tough interviewing situations in class

Guest Lectures

- Eating disorders NOS: Assessment difficulties, treatment approaches and medical provider collaboration. UIC Clinical Psychology Department Brownbag, March 2011.

- Alcohol, an overview: History, prevalence of use and abuse, mechanisms of action and treatment. Loyola University, January 2011.
- Make it rain: Tips on how to obtain an F31 NRSA. UIC Department colloquium, March 2010.
- Literature reviews: How to prepare, integrate and write an effective introduction. Applied Clinical Psychology, UIC, February 2010.
- Results and scientific writing: tips on presenting your data and providing clear interpretations of statistical analyses. Applied Clinical Psychology, UIC, March 2010.
- Threats to validity in experimental laboratory research. Honors Research Methods, UIC, October, 2009.

PROFESSIONAL ASSOCIATION MEMBERSHIPS (past and current)

- Society for Research on Nicotine and Tobacco
- American Psychological Association, Student Affiliate
 APA Division 2: Society for the Teaching of Psychology
 APA Division 12: Society for a Science of Clinical Psychology
- Research Society on Alcoholism
- Association for Psychological Science
- College of Problems on Drug Dependence
- Association for Behavioral and Cognitive Therapy; Addictive Behaviors Special Interest Group

SPECIALIZED TRAINING AND OTHER PROFICIENCIES

- Biological specimens collection and universal precautions
- Psychophysiological research methodologies and data reduction and scoring
- Experience moderating focus groups
- Experience working closely with developmentally disabled individuals
- Extensive experience with statistical analysis software programs SPSS, SAS, HLM, Winsteps, ConquestAcer, M-Plus

AD-HOC REVIEWING EXPERIENCE

- *Psychological Bulletin*
- *NIH grant review*
- *Behavioural Pharmacology*
- *Experimental & Clinical Psychopharmacology*
- *Nicotine & Tobacco Research*
- *BMC Clinical Pharmacology*
- *Psychopharmacology*

PRIMARY REVIEWING EXPERIENCE

- *Journal of Studies on Alcohol and Drugs*
- *Addiction Research and Theory*

WORKSHOPS AND CERTIFICATE COURSES

- ***Acceptance and Commitment Therapy: 1 day advanced experiential and training workshop*** (2011). Presented by Robyn Walser at the San Francisco VA Medical Center.
- ***Advanced Applied Psychophysiological Research Methods Training Clinic*** (2010). Presented by Terry Blumenthal at the University of Illinois Chicago.
- ***Advanced Workshop in Cognitive Processing Therapy*** (2010). Presented by Patricia Resick at the Association for Behavioral and Cognitive Therapy.
- ***DBT and CBT for Emotion Dysregulation*** (2010). Presented by Ed Craighead and Lori Ritschel at the Association for Behavioral and Cognitive Therapy.
- ***Alcohol Dependence and PTSD*** (2010). Presented by Edna Foa at the Association for Behavioral and Cognitive Therapy.
- ***Hierarchical Linear Modeling Workshop*** (2010). Presented by Steve Raudenbush and Tony Bryk at the University of Chicago.
- ***Integrated Care for Adolescents with Trauma and Substance Abuse: Training for a manualized therapeutic approach*** (2010). Presented by Liza Suarez and sponsored by SAMHSA as part of the National Child Traumatic Stress Network.
- ***Introduction to Structural Equation Modeling Workshop*** (2010). Presented by Gregory Hancock at the Association for Psychology Science in Boston, MA.
- ***Growth Modeling with Latent Variables Using MPLUS: Introductory, Intermediate and Advanced Growth Models, Survival Analysis, and Missing Data*** (2009). Presented by Muthen and Muthen at the Johns Hopkins School of Public Health.
- ***Wechsler Memory Scale – Forth Edition Training (WAIS-IV)*** (2009).
- ***Tourette Syndrome Workshop*** (2009). Presented by Douglas Woods and sponsored by the Tourette Syndrome Association.
- ***Wechsler Adult Intelligence Scale – Forth Edition Training (WAIS-IV)*** (2008).
- ***Motivational Interviewing Workshop***; Howard Brown Health Center, (2008)
Learned to increase effectiveness in implementing the fundamental principles of MI
- ***SPSS Workshop***; Center for Information Technology, NIH, (Fall 04', Spring 05', Spring 06')
- ***Principles of Clinical Pharmacology***; National Institutes of Health, (09/04-04/05)
Developed basic understanding of pharmacokinetics, drug metabolism and transport, drug therapy in special populations, drug development and utilization, assessment of drug effect
- ***Basic Spanish***; Johns Hopkins Medical Campus, (09/04 – 12/04)
Learned to apply the Spanish language in health care and research settings

SERVICE WORK

- **Baltimore Animal Rescue and Care Shelter**, January – August 2006; adoption counselor
- **Meadowbrook Swim Club**, Baltimore, MD, April – August 2006; swim instructor for underprivileged children
- **UNC Dance Marathon**, September 2001-February 2004; Served on a publicity committee to raise money for families experiencing financial hardship due to long-term hospitalization of a child
- **Habitat for Humanity**, March 1998 - April 2003; Summers and Weekends.