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Can we talk?: Synergistic Effects of Cognitive and Behavioral Frameworks to Address Substance Use and Abuse

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Can we talk?: Synergistic Effects of Cognitive and Behavioral Frameworks to Address Substance Use and Abuse

by

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ABSTRACT

Behavioral economic accounts of substance use have provided a novel framework to examine constraints that affect behaviorally driven outcomes. Several behavioral studies support the application of such frameworks to examine impulsive decision-making processes as well as how subjective reward influences substance use. Based on stimulus-response models, behavioral economic research often applies mathematical formulas to draw conclusions about behavioral outcomes. These mathematical formulas, while useful, largely ignore decades of cognitive psychology research that have examined state-based influences (e.g., mood, environment, motivational processes, etc.) on behavioral sequelae. To address this issue, the present study merged a cognitive framework into two behavioral economic measures: a delay discounting measure and an alcohol purchase task. Specifically, cognitive priming techniques were used to examine how contextual influences differentially affect outcomes on these behavioral economic measures using a wide range of drinkers. Our results suggest that both negative and positive alcohol-related cognitions affected outcomes on the alcohol purchase task, but not the delay discounting task. Specifically, participants in the negative and positive alcohol-related priming conditions spent significantly more money on alcohol overall, were willing to pay higher prices for standard drinks, and were willing to continue drinking at escalating prices relative to participants in priming conditions unrelated to alcohol use. Although alcohol expectancies were not related to either behavioral measure, our overall findings further emphasize the

complementary interplay of cognition and behavior that account for alcohol use and related behaviors.

CHAPTER ONE:

INTRODUCTION

Behavioral economic theories have provided novel approaches to the measurement of individuals' attribution of value to rewards and, in turn, to the prediction of future rewarding behaviors, including substance use. An extensive line of research has supported the utility of these approaches for examining the reinforcing efficacy of substance use in laboratory-based settings (Bickel et al., 1990; Bickel, DeGrandpre, & Higgins, 1993; Hursh, 1993). Similar to classical economic theories of consumer decisions, behavioral economics studies decision-making given various levels of constraint on commodities.

The field of behavioral economics emerged as a hybrid of operant psychology and microeconomics and relies heavily upon economic principles of reward and demand. Behavioral economic theories have provided a novel approach to understand and predict how organisms distribute valuable resources (e.g., money and time) to obtain various reinforcers such as food, drugs, and alcohol (Soto, Grandy, Hursh, & Katz, 2011; Bickel, DeGrandpre, Higgins, Hughes, & Badger, 1995; Petry & Bickel, 1998; MacKillop & Murphy, 2007). Recent research has sought to account for the fundamental behavioral aspects of addiction, including impulsive decision-making and a loss of control over substance use by using behavioral economic paradigms (Bickel, Madden, & Petry, 1998; Kirby & Maraković, 1996; Bickel, Johnson, Koffarnus, MacKillop, & Murphy, 2014). Typical behavioral economic studies of substance use apply

mathematically driven trait-based measures to examine and predict the reinforcing efficacy of drug and alcohol use. These paradigms have provided compelling support for the use of these trait-based measures to examine phenotypes of substance use.

Given that behavioral economic researchers developed stimulus-response measures to account for substance use, their interpretation of outcomes is arguably limited to an operant perspective. That is, behavioral economic measures are structured such that they only capture observable variables and thus cannot account for unobservable decision-making processes of substance use. Extensive research has demonstrated that several important cognitive processes (e.g., context, affective states, cognitive sets, etc.) influence the decision to use drugs and alcohol (Stein, Goldman, and Del Boca, 2000; Swendsen et al., 2000; Wall, Thrussell, and Lalonde, 2003). It may be possible, therefore, to extend the behavioral literature by linking cognitive accounts of substance use with behavioral economics measures. Specifically, the present study merged contextual priming procedures with behavioral measures to test whether the explicit activation of alcohol-related cognitions would influence response patterns on two behavioral economic measures. The widely used Monetary Choice Questionnaire (MCQ; Kirby & Marakovic, 1996), which is a behavioral measure thought to capture impulsive decision-making processes, was used in the current study to account for behavioral characteristics associated with alcohol use and alcohol-related outcomes. The Alcohol Purchase Task (APT; Murphy & MacKillop, 2006) is the other behavioral measure that was used to directly examine the contextual effects of alcohol-related cognitions on behavioral outcomes. Moreover, we chose the MCQ and the APT measures in order to examine how the activation of alcohol-related cognition would differentially influence behavioral outcomes in an alcohol-specific measure and a measure

of an alcohol-related behavior (i.e., impulsive decision-making). The goal of the current study was to extend the current behavioral literature by merging specific cognitive phenomena into an operant framework to influence alcohol-related behavioral outcomes. To that end, five conditions were used to examine potential alcohol expectancy activation: a non-primed condition, a positive priming condition, a negative alcohol-related condition, a positive alcohol-related condition, and negative priming condition. In the four primed conditions, participants described a recent positive or negative experience in which they consumed alcohol, while the non-primed condition did not include any contextual primes.

In subsequent sections, behavioral economic perspectives are discussed in the context of impulsive decision-making and substance use. A review of recent literature is also outlined along with the primary hypotheses of the current study. Finally, information regarding the experimental methodology, data analyses, and a summary of findings are discussed.

Behavioral Economics & Substance Use

Behavioral economics emerged as a hybrid area of study based on principles of operant psychology and microeconomics. Operant psychology refers to the aspects of learning that are influenced by both the rewarding and punishing outcomes of behavior, and these contextually driven stimulus-response interactions are the foundation of behavioral economics. The field of economics refers to the effects of fiscal constraint on the consumption of a good as demand. The law of demand states that an inverse relationship exists between price and the consumption of commodities: as the price for a commodity increases, the consumption of that commodity decreases. Additionally, behavioral economic frameworks predict higher rates of consumption when a given price is relatively inexpensive or free. Individually plotting the consumption of a

good as a function of price generates what are known as demand curves. Behavioral economics examines various conditions that influence the consumption of a commodity, such as alcohol. Previous research has supported the utility of behavioral economic measures that generate demand curves to reliably account for the reinforcing efficacy of drug and alcohol use in both animal and human models (Nader & Woolverton, 1991; Hursh, 1993; Bickel, DeGrandpre, & Higgins, 1993; Murphy & MacKillop, 2006). Demand curves have also successfully supported the behavioral predictions of substance use by illustrating that higher levels of reinforcement from drugs and alcohol results in a tendency to pay higher prices to obtain these substances.

For example, Petry and Bickel (1998) tested whether behavioral economic indices of demand could account for different aspects of substance use by using fiscal constraints on the availability of drugs or alternative reinforcers. Their sample consisted of detoxified opioid addicts in an outpatient treatment program. Experimenters provided the participants with a scenario involving hypothetical money to buy various drugs at different prices. The results showed that the participants were more willing to pay higher prices for their drug of choice (heroin) than other available drugs at lower prices, such as marijuana or alcohol. The resulting demand curves illustrated that increasing prices for heroin were associated with an increase in participants' purchases for less expensive drug alternatives and a decrease in heroin purchases. Their research has supported the value of applying behavioral economics to substance by providing new independent variables, methods of analysis, and dependent measures (Bickel, DeGrandpre, & Higgins, 1993); which, in turn, permit better understanding of the clinical phenomena of drug use. Additionally, this line of research has provided evidence for applying principles of behavioral economics to the study of naturalistic drug use in order to understand

varying conditions that reduce the consumption of a drug. Measures of demand are comprised of several parameters associated with reinforcement that can be individually plotted to produce demand curves. These parameters include: the first price at which consumption of alcohol is zero (breakpoint), the maximum amount of money spent on alcoholic beverages (O_{max}), the mean price per drink at a specific expenditure level (P_{max}), total alcohol consumption when drinks are offered when free (Intensity), and the rate of decline in consumption as a function of price (elasticity). Larger elasticity values reflect a greater sensitivity to increasing drink prices. The Hursh and Silberberg (2008) equation of estimated elasticity can be fit according to the guidelines using the calculator provided on the Institute for Behavioral Resources website (http://ibrinc.org/resources/).

Demand curves illustrate the demand-reward relationship of drug and alcohol use and are generated when these demand indices are plotted as a function of price. In addition, demand curves have provided a reliable approach to analyzing various contextual effects of drug self-administration procedures (Vuchinich & Simpson, 1998). Behavioral economic researchers have developed time- and cost-effective self-report measures designed to address the logistical issues of modeling experimental paradigms of drug self-administration, though these tasks also present with similar psychometric issues related to self-report questionnaires (Jacobs & Bickel, 1999; Murphy & MacKillop, 2006). More recently, the Alcohol Purchase Task (APT) was developed to study the relationship of reinforcing efficacy of drinking that is associated with alcohol use and alcohol-related outcomes (2006). Specifically, the APT measures demand for alcohol by examining how the function of economic constraint (price) affects the decision-making process underlying an individual's choice to drink as amount of alcohol to consume. Participants are

initially provided a specific drinking scenario, generally an outing with friends at a local bar, and are then asked how many standard drinks they would purchase at an increasing range of prices. The consumption values provided by the participants are used to generate total expenditure values for a given price level. Previous studies using this hypothetical purchase task have shown that this measure successfully captures clinical phenomena related to heavy, sustained alcohol use and is able to predict rates of future alcohol consumption (MacKillop & Murphy, 2007; Murphy et al., 2009).

Murphy and MacKillop (2006) specifically examined alcohol-related reward and demand using the APT. A sample of a wide-range of light and heavy drinking college undergraduates were presented with a hypothetical scenario involving alcohol purchases in the context of a typical alcohol-related setting. The hypothetical scenario involved a night in which participants were to imagine going to a bar with friends to see a band. Following the scenario and standard size beverage options (e.g., beer, wine, mixed drinks, or shots), participants responded to the question "How many drinks would you consume if they were _____ each?" at 14 incremental prices ranging from zero (free) up to $9.00. Responses on the APT generated demand indices that were plotted as demand curves. Their results found that heavier drinkers (defined as respondents meeting binge criteria on at least one occasion per week) were comparatively less sensitive to increasing prices and were willing to consume significantly larger amounts of alcohol than the lighter drinkers (defined as those respondents not meeting binge criteria on a weekly basis). In the same sample, heavier drinkers had significantly higher demand for alcohol (specifically breakpoint, intensity, and O_{max} values) compared to the same demand indices of lighter drinkers. Previous research has found inherent correlations among the demand indices

generated from the APT. Despite the inherent correlations among these demand indices, studies have supported the notion that these indices reveal various aspects of reinforcement, including the subjective valuation and craving for alcohol (MacKillop et al., 2009; MacKillop et al., 2010). Several replication studies have supported the APT as a reliable measure of the reinforcing efficacy in determining future patterns of alcohol consumption in samples of heavy drinkers (MacKillop & Murphy, 2007; MacKillop et al., 2009; Hitsman et al., 2008; Herschl et al., 2012). These studies have supported the utility of the APT as a reliable measure to examine individual differences in the demand for alcohol as well as its utility to predict future alcohol consumption.

Delay discounting (DD) is another behavioral economic index that examines conditions (i.e., the ability to delay gratification) that influence impulsive decision-making (Ainslie, 1975). Specifically, DD observes how the value of a delayed reinforcer (e.g., money) is discounted, or reduced in value, compared to the value of an immediate reinforcer (Bickel & Marsch, 2001; Kirby and Maraković, 1996). DD tasks typically ask participants, to varying degrees, to choose between a smaller, immediate reward and a larger, delayed reward (e.g., opting for $10 now or $20 in a week). Previous research has not found significant differences between hypothetical vs. actual monetary rewards for the MCQ or the APT (Lagorio & Madden, 2005; Bickel & Marsch, 2001; Amlung et al., 2011; Amlung and MacKillop, 2015; Madden et al., 2003; Dixon, Lik, Green, & Myerson, 2013).

Recent delay discounting studies have experimentally manipulated intrinsic processes that have been shown to influence discounting outcomes. For example, a recent study by Lin and Epstein (2014) demonstrated that episodic future thinking (EFT), or the vivid autobiographical, emotional, and/or circumstantial simulation of future events, influenced

discounting outcomes to examine more general impulsive decision-making processes. In their study, participants verbally described and mentally simulated realistic neutral events (e.g. activities they neither want to avoid nor look forward to) or realistic positive events (e.g. activities they would enjoy or look forward to) that could happen in the present (within the next 24 hours) or in the future (within the next six months). During the episodic thinking manipulation, participants imagined three events within specific timeframes with as many autobiographical, contextual, emotional, and procedural details. Participants rated the scenarios on positive valence, contextual detail, and vividness of imagery. Following the EFT manipulation, participants completed a DD task. Their results found that both positive and neutral episodic thinking reduced participants' overall discount rates (i.e., delaying gratification), particularly when instructed to imagine a positive or neutral event in the distant future. Overall, these findings suggest that behavioral outcomes are malleable, particularly when these paradigms incorporate expectancy generation and other cognitive priming approaches.

Although DD measures are typically used to examine general impulsivity, DD tasks have been extensively examined in the context of substance use (Vuchinich & Heather, 2003; Ainslie, 2001; Krishnan-Sarin et al., 2007; MacKillop and Kahler, 2009; Kirby, Petry, and Bickel, 1999; Bickel, Madden, and Petry, 1998). Given the relationship between alcohol use and impulsivity, for example, previous research has consistently demonstrated that alcohol misuse is associated with higher discounting of delayed rewards (Amlung & MacKillop, 2011; Mitchell et al., 2005; MacKillop et al., 2011; Vuchinich & Simpson, 1998). A study by MacKillop and colleagues (2010) examined individual differences in alcohol demand, DD, and craving among heavy drinkers using behavioral economic measures (i.e., the APT and MCQ). Of particular relevance

to the current study, they found significant associations among the alcohol demand indices of the APT and the discounting rates of the MCQ, meaning these two behavioral economic measures are likely tapping into similar alcohol-related constructs. Interestingly, their results showed a stronger relationship between the MCQ and heavy alcohol use compared to the demand indices of the APT, which provides support for using the MCQ in a sample of heavy drinkers. These findings lend preliminary support for the relationship between behavioral economic measures and heavy alcohol use. Behavioral economic accounts of substance use are generally framed as trait-based accounts of behavior, although recent studies have demonstrated the importance of more localized cognitive processes on behavioral outcomes (Lin & Epstein, 2014; Reynolds and Schiffbauer, 2004; Odum & Baumann, 2010).

Additional studies have elucidated important implications for the psychometric validity of observing broad constructs, such as impulsivity. A meta-analysis and review conducted by Cyders and Coskunpinar (2011; 2012) examined relationships among unidimensional self-report (e.g., UPPS-P Impulsive Behavior Scale; Lynam, Smith, Cyders, Fischer, & Whiteside, 2007), and behavioral tasks of impulsivity (e.g., delay discounting). First, their findings underscored the importance of construct validity and how researchers may inadvertently use measures that capture unique characteristics of impulsivity rather than the multidimensional conceptualization of impulsivity. Further, their results indicated very little overlap in self-report and behavioral lab task constructs. More importantly, and of particular interest to the current study, these findings reflect a larger construct measurement and validity issue for cognitive and behavioral researchers in that the measures we use may be tapping into related but distinct characteristics of constructs

and that we may not always account for the notion that our results may be differentially capturing state- and/or trait-based influences.

Although behavioral economic substance use frameworks have begun to broadly revisit some of the established cognitive research perspectives, they often do not account for important intrinsic processes that underlie behavioral outcomes. Several behavioral economic perspectives of substance use have proposed that alcohol-related traits (e.g., weekly consumption, craving) are better accounted for by "highly specific" trait-based purchase tasks than measures of state-level motivation (Amlung & MacKillop, 2012; Amlung & MacKillop, 2015; Murphy & MacKillop, 2013), which largely excludes the important cognitive features of alcohol use. This trend shares some overlap with the 'cognitive revolution' of psychology that occurred in the 1960's and 1970's. Several behavioral perspectives have persisted, such as behavioral economics' perspectives of substance use, although these measures could be improved with the integration of state-based cognitive paradigms. The present study revisited previous and current perspectives in operant psychology as well as discuss the historical shift to cognitive psychology. Moreover, we wanted to develop a cohesive framework that accounts for both cognitive (state-based, expectancies) and behavioral perspectives of substance use with the overarching goal to enhance extant behavioral measures and disseminate knowledge regarding the frameworks of these paradigms.

Contextual Priming and Alcohol Use

Early observational research has provided novel approaches for understanding the cognitive determinants of substance use above and beyond behavioral framework. For example, early cognitive perspectives began to address contextual and environmental influences, such as

cues, on drinking behavior and alcohol-related outcomes. These contextual influences included social, motivational, temporal, and affective states. Earlier state-based accounts found that drinking contexts (e.g., drinking with a group vs. alone, drinking in a bar setting, day of the week) can influence the amount of alcohol participants consume irrespective of typical drinking habits (Collins and Marlatt, 1981; Caudill and Marlatt, 1975; Graham, Marks, & Hansen, 1991; Harford and Grant, 1987; Kraft, 1979). Moreover, heavy alcohol consumption is more likely among people who drink to relieve negative affect as well as those whose peers also drink heavily (Abbey, Smith, and Scott, 1993; Senchak, Leonard, and Greene, 1998).

Although the situational factors described above have consistently demonstrated the importance of context (including cognitive contexts) in drinking behavior, they are among a variety of cognitive influences that can affect alcohol use and alcohol-related outcomes. According to social learning theory, alcohol-related behaviors can be influenced by both environmental-level contextual variables and cognitions regarding alcohol use (Maisto et al., 1999; O'Hare, 1997). The situational-specificity hypothesis (Wall et al., 2000) has also been examined as a conceptual framework to better understand why alcohol-related behavior might differ across settings. According to this hypothesis, drinking behavior varies across contexts because of the association between certain cognitions regarding the effects of alcohol and cues presented by the environment. Similar lines of research have examined the influence of cognitive priming on drinking behavior and outcomes. Implicit priming is said to occur when responses on a measure are facilitated by previous experiences/stimuli without conscious recollection (Schacter, 1987). Priming is concerned with perceptual identification of words and images and has been recognized as separate from other forms of memory or memory systems (Tulving and

Schacter, 1990). For example, priming positive or negative moods can influence affective states without conscious awareness (Isen et al., 1978; Storbeck and Clore, 2008), and in turn, influence alcohol consumption (Rholes, Riskind, and Lane, 1987; Riskind, 1989; Berry et al., 2012). Previous research suggests that context-specific cues are hypothesized to activate non-conscious memories of previous alcohol experiences that subsequently influence alcohol consumption (Abrams & Niaura, 1987; Wall, McKee, & Hinson, 2000). Several cognitive models of alcohol-related processes exist, including cognitive processing models and motivational models (Tiffany, 1990; Cox & Klinger, 1988). Importantly, most cognitive models of alcohol use account for both non-automatic and automatic processes that influence alcohol use and related behaviors. For example, Marlatt (1979) provided a foundation for a cognitive-behavioral conceptualization of alcohol use and misuse. He contended that much of the experimental support for understanding alcohol use was mediated by cognitive factors above and beyond its pharmacological effects (e.g., tension reduction). One of the mediational factors described by Marlatt, known as expectancies, provided a coherent and comprehensive framework that incorporated both cognitive and behavioral components of alcohol use (Marlatt & Rohsenow, 1980). Given its integration of cognition and behavioral outcomes, the present study used priming techniques to activate alcohol-related cognitions, such as alcohol expectancies, within two behavioral economic measures. Alcohol expectancy theory posits that alcohol-related expectations are stored as memories that can influence future behavior, consumption, and drinking outcomes in situations involving alcohol use (Christiansen, Smith, Roehling, & Goldman, 1989; Brown, Goldman, & Christiansen, 1985). In turn, these memories reinforce the subjective expectations regarding the effects of alcohol consumption. Previous research has shown that individuals who

believe they have consumed alcohol will behave in accordance with their expectations of the effects of alcohol use, even in placebo paradigms (Donovan & Marlatt, 1980; Nagoshi, Noll, & Wood, 1992). Alcohol expectancies refer to the memories that are formed based on an individual's previous experiences regarding the cognitive and behavioral changes that are associated with alcohol consumption (Brown, Goldman, & Christiansen, 1985). Cognitive-behavioral principles have provided much of the foundation for the theoretical accounts of alcohol expectancies (e.g., information-processing and behavioral control). Alcohol expectancy research has demonstrated that expectancies are associated with the initial onset of drinking, non-pathological consumption, and sustained, heavy alcohol use (Sher, Wood, Wood, & Raskin, 1996; Smith, Goldman, Greenbaum, & Christiansen, 1995). Importantly, alcohol expectancies have demonstrated a mediational role in alcohol-related behaviors and outcomes (Brown, Goldman, Inn, & Anderson, 1980; Rather & Goldman, 1994). Self-report measures, such as the Alcohol Expectancy Questionnaire (AEQ; Brown et al., 1987), have successfully demonstrated the mediational role of alcohol expectancies that reliably predict future alcohol-related behavior and outcomes (Cooper et al., 1992, Reich & Goldman, 2005). These measures typically assess the strength and intensity of currently held alcohol expectancies as well as anticipatory information processing related to alcohol use (see Reich and Goldman, 2015).

Specific domains of alcohol expectancies can be activated using cognitive priming techniques. The Encoding Specificity principle (Tulving & Thomson, 1973) states that in order for priming to be effective, a contextual cue must be encoded in reference to a related cue. In other words, contextually based alcohol cues, such as a bar setting, may become associated with alcohol expectancies memory networks (Krank and Wall, 2006; Wardell and Read, 2013).

Consequently, exposure to relevant cues through cognitive priming techniques can unconsciously activate alcohol expectancies (Wall, Hinson, McKee, and Goldstein, 2001; Wardell and Read, 2014). Roehrich & Goldman (1995), for example, used two types of implicit primes to influence alcohol expectancy activation and thereby increase future alcohol consumption. Participants were randomly assigned to watch one of two videotaped alcohol-related primes depicting bar settings (Cheers or Newhart). Following the Cheers or Newhart condition, the second priming technique presented participants with a modified Stroop task containing specific words: alcohol expectancy words or neutral words. Finally, participants were taken to a room designed to appear as an actual bar setting to take part in a taste-rating task for non-alcoholic beer (the participants were unaware that the beer contained no alcohol). The highest level of beer consumption resulted from the Cheers-alcohol expectancy word condition, followed by the Cheers-neutral, Newhart-expectancy, and Newhart-neutral conditions; these results suggested, therefore, that priming effects were operating for both the videotaped and expectancy word primes.

A recent study by Ham and colleagues (2013) examined contextual influences on alcohol outcome expectancies and consumption in three drinking scenarios: convivial (e.g., at a party or bar), negative coping (e.g., to reduce negative affect), and personal-intimate (e.g., on a date). As expected, their results indicated that alcohol expectancies differed across these contexts. In their study, the participants generally perceived the effects of alcohol (both positive and negative effects) as being less likely to occur and less desirable in the negative coping context than in convivial and personal-intimate contexts. Moreover, certain context-specific beliefs about the effects of alcohol (e.g., being friendly toward others) were differentially associated with reported

frequency of alcohol use in each context, with use in social contexts being higher. Specifically, participants in the negative coping condition were not only drinking while experiencing negative affect, they tended to drink alone in this context. Similarly to the results of Lin and Epstein (2014), the findings from Ham et al. (2013) further underscore the importance of alcohol-related cognitions on subsequent drinking behavior and alcohol-related phenomena. Moreover, both studies provide evidence that context is essential when examining alcohol-related behavior, cognitions, and outcomes.

It is important to understand the implications of alcohol expectancies because previous research suggests that these expectancies are associated with the initial onset of drinking, non-abusive consumption, and sustained, heavy alcohol use (Sher, Wood, Wood, & Raskin, 1996; Smith, Goldman, Greenbaum, & Christiansen, 1995). Alcohol expectancies have also been found to predict current and future drinking behavior and serve as mediators in the decision-making process underlying alcohol consumption (Brown, Christiansen, & Goldman, 1987; Goldman, Darkes, Reich, & Brandon, 2006). In some studies, alcohol expectancies have explained as much as 45-50% of the variance in drinking behavior (1989; Leigh & Stacey, 1993) and one study reported the percentage as high as 68% (Rather, Darkes, Greenbaum, & Goldman, 1992).

Given the importance of cognitive influences on alcohol use, particularly alcohol expectancies, a few cross-sectional purchase task studies have examined contextual influences on consumption (MacKillop et al., 2010) or behavioral motivations to consume alcohol (Yurasek et al., 2011; Herschl et al., 2012). For example, Yurasek and colleagues (2011) used the APT to examine the mediational role of drinking motives (e.g., behavioral enhancement, relief of negative affect, etc.) in a sample of heavy drinking college students. The resulting demand

curves generated from the APT were compared to participants' responses on a questionnaire that assessed drinking motives as well as a questionnaire examining alcohol-related consequences (e.g., driving a car while inebriated). Their results suggested that behavioral economic principles are useful for observing the influence of self-reported motivation on drug-related behaviors and outcomes. As with many behavioral economic accounts of alcohol demand, their sample primarily consisted of heavy drinkers who likely experience negative alcohol-related outcomes. In addition, they did not account for gender differences or address motivational processes that influence lighter drinkers' alcohol use. Further, their study was designed to examine very specific motivational antecedents (behavioral enhancement and coping motives) that are more strongly associated with heavy alcohol rather than a broader sample of drinkers. In other words, this study largely ignored other processes that influence alcohol use in both heavier and lighter drinkers, such as gender differences and socially driven expectancies (Park & Grant, 2005; Sher, Wood, Wood, & Raskin, 1996; Scheier & Botvin, 1997).

Present Study

Although behavioral economic tasks are useful for examining and predicting the operant components of substance use and impulsive decision-making processes, these accounts are often structured such that they minimize the importance of cognitive processes underlying drug and alcohol use. Current behavioral accounts of substance use are primarily trait-based and constrain variables such that the outcomes are limited to their framework, though we argue that their interpretations are limited to their exact methodology. Although behavioral economic studies have recently begun to incorporate principles from cognitive psychology to enhance their methodologies, these "hybrid" approaches are psychometrically limited in their interpretations.

These recent studies provide a foundation in which to reintegrate cognitive paradigms of substance use. Merging theories that can account for both the cognitive and behavioral components of substance use, such as alcohol expectancy theory, with these operant paradigms is one approach that may offer a comprehensive method to enhance behavioral methodology, offer a unique but theoretically robust interpretation of outcomes, and elucidate a richer conceptual understanding of alcohol-related demand and reward.

Recently, we examined the influence of expectancy priming on purchase task outcomes by merging alcohol expectancy literature with the operant framework of behavioral economics. Our participants consisted of college student drinkers who reported consuming at least one standard drink within the previous month. We modified expectancy content and contextual primes that are often imbedded within the instructions of the APT. Specifically, three versions of the APT instruction set (Adams, 2014) were used: a non-primed APT with all contextual/expectancy content removed, the original APT designed by Murphy and MacKillop (2006) with inherently positive-social expectancies embedded within the instruction set, and an enhanced priming APT that used the original instruction set and incorporated a free associates task. We hypothesized that the participants in the enhanced priming condition would report the highest consumption values and have a higher demand overall for alcohol, followed by the original and non-primed conditions. Contrary to our hypothesis, the results demonstrated that the original priming condition had the strongest effect on consumption and demand followed by the enhanced priming condition. That is, participants in the conditions that retained expectancy primes reported higher demand for alcohol and spent more money in a hypothetical purchase task than participants who were not primed with expectancies or context. Although we

successfully demonstrated the influence of alcohol expectancy priming on purchase task outcomes, we hypothesized that the enhanced priming condition would have the strongest effect in that it likely activated a deeper level of processing regarding alcohol use. We speculate that this deeper level of processing may have adversely affected the lighter drinkers' perception of their alcohol use and, in turn, reduced the positive-social priming effect in a modified Alcohol Purchase Task. In the present study, we wanted to broaden and extend these findings by using similar approaches to examine both general and specific alcohol-related influences. To that end, we incorporated cognitive priming techniques into two hypothetical behavioral economic measures to compare and contrast how the activation of alcohol-related cues would uniquely influence and predict outcomes in these measures. The overarching theme of the current study is to revisit important cognitive frameworks and theories in order to disseminate awareness of these important processes in the context of substance use research.

Given the close relationship between impulsive decision-making and alcohol use, we chose a behavioral economic measure of generalized impulsivity, the Monetary Choice Questionnaire (MCQ; Kirby & Maraković, 1996). The MCQ is a widely used behavioral economic discounting measure that captures individual information regarding impulsive decision-making outside the context of substance use. One goal of the current study was to demonstrate that alcohol-related contextual influences would affect impulsive decision-making outcomes on a measure of delay discounting. We also chose the Alcohol Purchase Task (APT; Murphy and MacKillop, 2006) to extend our previous findings and to determine whether specific expectancy domains moderate outcomes on a behavioral measure of alcohol use.

Primary Hypothesis 1

For the current study, we hypothesized that the four primed conditions would differentially influence the outcomes on the APT demand indices and the MCQ discounting parameter (*k*). Consistent with previous research examining mood inductions and alcohol cues on the APT demand indices (e.g., Amlung & MacKillop, 2013; Rousseau et al. 2011), we expected the general Negative Condition (i.e., no alcohol-related cues), followed by the Negative Alcohol Condition, to significantly influence participants' responses on the APT demand indices, particularly Intensity of demand, O_{max}, and Breakpoint more than participants in the Positive Alcohol Condition, general Positive Condition, and Non-Primed Condition. That is, the negative mood induction in the Negative Condition and the manipulation of negative alcohol-related outcomes in the Negative Alcohol Condition were predicted to influence participants to significantly drink more when drinks were free (Intensity), hypothetically spend more money on drinks overall (O_{max}), and be more willing to purchase drinks at higher prices (Breakpoint) than participants in the Positive Alcohol Condition, the generally Positive Condition, and the Non-Primed Condition. Similarly, we expected participants in the negative conditions to report higher *k* values (temporal delay discounting) on the MCQ than participants in the other three conditions, including the Non-Primed (control) Condition. As for the conditions with the positive mood inductions, we expected the alcohol-related cues in the Positive Alcohol Condition to also significantly influence participants' responses on Intensity and Breakpoint, whereas we predicted participants' in the generally Positive Condition would report significantly higher Intensity and Breakpoint values than the control condition.

Primary Hypothesis #2

Based on previous research that has examined the role of mood priming and alcohol expectancies (e.g., Wardell et al., 2012; Roehrich and Goldman, 1995; Friedman et al., 2009), we hypothesized that specific alcohol expectancy domains [as measured by the Alcohol Expectancy Questionnaire (AEQ; Brown, Christiansen, & Goldman, 1987)] would differentially moderate the relationships among the four priming conditions and the outcomes on the two behavioral measures. The 68-item AEQ produces six expectancy factors: positive global changes in experience, sexual enhancement, social and physical pleasure, assertiveness, relaxation/tension reduction, and aggression/arousal. For the current study, we included four primed conditions (detailed on pages 25-26) in which participants provided an open-ended description of a recent positive or negative drinking experience or a recent positive or negative general life experience. The four primed conditions consist of a general Negative condition, a Negative Alcohol condition, a general Positive condition, and a Positive Alcohol condition. A fifth Non-Primed condition was included as a control for experimental and statistical comparisons.

MCQ k Parameter. Previous research has shown that some individuals may engage in risky drinking to enhance positive mood states (Cooper, Agocha, and Sheldon, 2000; Cyders et al., 2007). Thus, we expected positive global expectancies to moderate the relationship between the alcohol-related positive mood induction (i.e., Positive Alcohol Condition) and the outcomes on the MCQ *k* parameter. That is, we predicted that the participants who reported higher global positive expectancies who undergo the alcohol-related positive mood induction will be more sensitive to temporal delays than participants in all other conditions.

APT Intensity. Based on previous research comparing the APT to drinking motives (e.g., Herschl et al., 2012), including tension reduction motives, we hypothesized tension reduction expectancies to moderate the relationships between the alcohol-related cues embedded within a negative mood induction (i.e., Negative Alcohol Condition) and Intensity, or how many standard drinks participants would consume when the cost is free. Moreover, we predicted higher global-positive alcohol expectancies and/or sexual enhancement expectancies would moderate the relationships between the alcohol-related positive mood priming (i.e., Positive Alcohol Condition) on Intensity values as well. For example, participants' who endorsed more positive global expectancies OR higher sexual enhancement expectancies would putatively consume more alcohol overall, particularly when the cost of each standard drink is free (Intensity).

APT Omax. We hypothesized that participants who report higher global positive and/or sexual enhancement expectancies, in conjunction with a positive alcohol-related mood induction, to spend more money overall on alcohol. For example, participants who reported higher positive global expectancies or sexual enhancement expectancies would also hypothetically spend more on standard drinks in a hypothetical drinking scenario following a positive alcohol-related mood induction.

APT Breakpoint. We expected positive global expectancies to moderate the relationship between the alcohol-related positive mood induction (Positive Alcohol Condition), the general positive mood induction (Positive Condition), and Breakpoint outcomes(i.e., the price point at which consumption stops). That is, participants with higher global positive expectancies would be willing to purchase standard drinks at higher prices and thus would be less sensitive to escalating costs, regardless of alcohol-related cues.

APT Pmax. Finally, we predicted global positive expectancies to moderate the relationship between the alcohol-related positive mood induction (Positive Alcohol Condition) and P_{max} values, or the mean price per drink at a specific expenditure level. That is, participants with higher global positive expectancies would be willing to consume more standard drinks on average at higher price points following a positive alcohol-related mood induction.

CHAPTER TWO:

METHOD

Experimental Design

The current study employed a five-group design and all participants were randomly assigned to one of five groups: Negative Priming, Positive Priming, Negative Alcohol Priming, Positive Alcohol Priming, and a Non-Primed control group. Following the priming manipulation, participants were then randomly assigned to complete one of the following: the APT followed by the MCQ, or the MCQ followed by the APT. Participants in the four primed conditions also completed two manipulation check items to determine the extent of the effects of the embedded mood inductions on the outcomes of the behavioral measures. Assignment restrictions were implemented in order to maintain balanced groups among study conditions.

Table 1
Demographics for Overall Sample

Ethnicity/Race	
African-American (of Hispanic origin)	1.8%
African-American (not of Hispanic origin)	14.2%
Asian/Pacific Islander	6.6%
Caucasian/White (of Hispanic origin)	9.4%
Caucasian/White (not of Hispanic origin)	45.8%
Hispanic/Latino	17.2%
Other (not specified)	5.0%
Age M(SD)	20.77(3.22)
Sex (% Female)	73.5%
AUDIT Total M(SD)	5.42(1.94)

Note. N = 441. AUDIT Total scores reflect raw data values that were transformed prior to further analysis.

Participants

A total of 689 undergraduates from a large university in Florida completed the study. Demographic information regarding age, sex, ethnicity, drinking data, and other relevant variables were collected. Data for 162 participants were excluded from the final analyses due to eligibility restrictions: a total of 142 participants were ineligible because they reported that they did not consume at least one standard drink per month, and an additional 20 participants indicated that they consumed at least one standard drink per month on a measure of drinking habits but later reported that they did not consume alcohol on related measures, such as the Alcohol Purchase Task and/or free associates task). Further, an additional 41 participants were discarded because their responses indicated that they were inputting invalid data [(i.e., responses indicated 0's across entire scale(s)]. Finally, 45 participants were excluded from the analyses because they did not complete at least 50% of the study. Thus, the final overall sample size included 441 participants.

Table 2
Demographics by Condition

	Negative Alcohol	Positive Alcohol	Negative	Positive	Non-Primed
Sample (*n*)	95	88	80	86	92
Age M(SD)	20.72(2.47)	20.70(3.56)	21.10(3.46)	20.81(3.09)	20.58(3.52)
Sex (% Female)	72.6%	75.0%	71.3%	73.3%	75.0%
AUDIT Total M(SD)	5.32(4.60)	5.18(3.57)	5.27(4.66)	5.21(4.14)	6.08(5.52)

Note. AUDIT Total scores reflect raw data values that were transformed prior to further analysis.

All data were collected online using a survey management system and participants were awarded extra credit points. In order to minimize any alcohol-related influence on experimental

outcomes, several measures were completed as a requirement prior to study enrollment. These measures included demographic information, the Alcohol Use Disorder Identification Test (AUDIT), the AEQ, and a free associates task in which participants provided five unique words or phrases to complete the statement "*Alcohol makes me _____*." A primary goal of the current study sought to account for how the activation of alcohol-related descriptions may differentially affect the general measure of impulsive decision-making (MCQ) and the alcohol-related behavioral measure (APT).

Priming Manipulation Descriptions

For the four primed conditions, participants provided an open-ended description of a recent positive or negative drinking experience or a recent positive or negative general life experience. Refer to the Appendix on pages 69-72 to review excerpts of descriptions selected from each of the four priming conditions.

Positive Alcohol Description:

> *Please take a moment to think about a recent time you had a **positive** experience in which you consumed alcohol. Please take a moment to write THREE (3) sentences or more to describe a recent positive drinking experience. Please provide an honest response regarding your most recent positive drinking experience. Remember, all answers will be kept confidential. In order to maintain confidentiality, DO NOT include any personal or identifying information (e.g., actual names) in your description.*

Negative Alcohol Description:

Please take a moment to think about a recent time you had a ***negative*** *experience in which you consumed alcohol. Please take a moment to write THREE (3) sentences or more to describe a recent negative drinking experience. Please provide an honest response regarding your most recent negative drinking experience. Remember, all answers will be kept confidential. In order to maintain confidentiality, DO NOT include any personal or identifying information (e.g., actual names) in your description.*

General Positive Description:

Please take a moment to think about a recent time you had ***positive*** *experience in your life. Please take a moment to write THREE (3) sentences or more to describe a recent positive experience. Please provide an honest response regarding your most recent positive experience. Remember, all answers will be kept confidential. In order to maintain confidentiality, DO NOT include any personal or identifying information (e.g., actual names)in your description.*

General Negative Description:

Please take a moment to think about a recent time you had a ***negative*** *experience in your life. Please take a moment to write THREE (3) sentences or more to describe a recent negative life experience. Please provide an honest response regarding your most recent negative experience. Remember, all answers will be kept confidential. In order to maintain confidentiality, DO*

NOT include any personal or identifying information (e.g., actual names)in your description.

A fifth Non-Primed condition did not require participants to describe a recent drinking experience. We included a Non-Primed condition for two purposes: 1) to examine differential outcomes on the behavioral economic measures without any contextual influence, and 2) to examine potential sequencing effects on the outcomes of these two measures.

Participants initially completed all informed consent procedures and pre-study measures prior to enrollment. Eligible participants were randomly assigned to one of the five conditions in Qualtrics. Following the open-ended description for the primed conditions, participants were then randomly assigned to complete either the Monetary Choice Questionnaire (MCQ; Kirby & Marakovic, 1996), a hypothetical discounting measure of general impulsive decision-making, or the Alcohol Purchase Task (APT; Murphy & MacKillop, 2006), which is a hypothetical self-report measure of alcohol-related reward and outcomes. Participants across all conditions were randomly assigned to complete either the MCQ or APT to minimize potential sequencing effects. Following the two behavioral measures, participants provided a word or phrase to complete the sentence "*Alcohol makes me_____"* in a free associates task. Finally, a two-item manipulation check was included for participants in the four primed conditions to determine the extent to which the activation of alcohol expectancy-related primes affected responses on the MCQ and the APT demand indices. In addition, we expected broad and variable open-ended responses among the alcohol-related descriptions at the beginning of the study. Participants were asked to rate the positive or negative valence of their descriptions using two five-point Likert items,

Manipulation Check Item 1 (MC1) and Manipulation Check Item 2 (MC2); please see Figure 1 below:

MC1. *Please think about the previous description you provided regarding a positive experience that you provided at the beginning of this survey. Overall, how would you rate this positive experience?*

Not at all positive	Less positive	Positive	More positive	Very positive
1	**2**	**3**	**4**	**5**

MC2. *How much did you think about this positive experience while completing the rest of the survey?*

Not at all/ Not very much	A little bit	Not too much, not too little/ Somewhere in the middle	A lot	Almost the entire duration of the study
1	**2**	**3**	**4**	**5**

Figure 1. *Manipulation check items.*

Measures

Pre-Study Measures

Alcohol Use Disorders Identification Test (AUDIT; Saunders et al., 1993). The AUDIT is a seven-item survey used to capture baseline drinking data. The AUDIT is designed to collect information regarding quantity and frequency of alcohol use as well as alcohol misuse (e.g., binge drinking episodes). Each question has a specific set of responses and each response has a score ranging from zero to four. Individual item scores are summed to provide a total score (ranging from 0-24); total scores of eight or more are typically indicative of harmful alcohol use and negative drinking-related consequences.

The Alcohol Expectancy Questionnaire (AEQ; Brown, Christiansen, & Goldman, 1987) is a 68-item self-report measure of an individual's experiences regarding the effects of alcohol and was included as a pre-study measure. The AEQ assesses the degree to which individuals expect alcohol use to produce a variety of possible effects including global positive changes, changes in social behavior, sexual enhancement, increased aggression and/or arousal, and relaxation and tension reduction. The AEQ has moderate internal consistency (mean coefficient $\alpha = .84$) and has been shown to have moderate test-retest reliability over a one and two month period in adults (one month coefficient $\alpha = .66$; two months coefficient $\alpha = .64$).

The Free Associates Task (Nelson, McEvoy, & Dennis, 2000; Reich & Goldman, 2005) allows participants to freely respond to the sentence, "Alcohol makes me ____."
The instruction set, as well as all scoring procedures, were based on Reich and Goldman (2005):

In the blank space provided below, please write down a word or short phrase you would use to complete the sentence 'Alcohol makes me _____.' Please write whatever first comes to mind. Do not think too long and respond as quickly as you can.

Experimental Study Measures

The Monetary Choice Questionnaire (MCQ; Kirby & Marakovic, 1996) is a widely used 27-item self-administered questionnaire of impulsive decision-making and is considered a general index of reward. Given the extensive use of the MCQ in delay discounting research, we chose the MCQ in order to determine how the activation of alcohol-related cognition would differentially influence outcomes on a behavioral measure of general reward. For each item on the MCQ, participants are asked to choose between a smaller, immediate monetary reward and a

larger, delayed monetary reward (e.g., *Would you prefer $55 today, or $75 in 61 days?*). Each item was individually presented to participants. The MCQ is scored by calculating reference discounting curves, where placement amid steeper curves indicates higher levels of impulsivity. In the current study, the present study used the following hyperbolic equation to derive individual discounting rates:

$$V=A/(1+k\mathrm{D})$$

Where V is the subjective value of a reward of amount A that is available after a delay of D time units; the k parameter reflects an individual discount rate.

The Alcohol Purchase Task (APT; Murphy & MacKillop, 2006) is a behavioral economic self-report measure of the subjective reward of alcohol use. The present study used the APT to directly compare and contrast alcohol-specific behavioral outcomes within an alcohol-specific context. The APT is comprised of four demand indices: Breakpoint, or the first price at which alcohol consumption is zero; O_{max}, or the maximum expenditure on alcoholic beverages; P_{max}, the mean price per drink at the highest expenditure level, and Intensity, or the total alcohol consumption when drinks are free. The instructions appeared as follows:

The following questions ask how many drinks you would purchase at various prices. The available drinks are standard size domestic beers (12 oz.), wine (5 oz.), shots of hard liquor (1.5 oz.), or mixed drinks containing one shot of liquor. Please respond to these questions honestly.

After reading the instructions, participants responded to the question: "How many drinks would you consume if they were ____ each?" at 17 prices: zero (free), $0.25, $0.50, $1, $1.50,

$2, $2.50, $3, $4, $5, $6, $7, $8, $9, $10, $12, and $14. We increased the expenditure range from 14 prices in the original APT (highest price: $9) to 17 prices (highest price: $14) to more accurately reflect alcohol-related spending habits in west central Florida.

CHAPTER THREE:

RESULTS

Analytic Plan

In the current study, IBM SPSS Version 22 (IBM Corp., 2013) and GraphPad Prism 7.0a (GraphPad Software, La Jolla CA) were used for the primary analyses. All variables were initially screened for outliers, missing data, and distributional abnormalities. Missing data for 73 cases were multiply imputed and the resulting data were pooled according to conventional procedures outlined by Rubin (1996). Consistent with previous alcohol research, several alcohol-related variables, including the AUDIT, were positively skewed and kurtotic and were transformed using square root mean transformations and logarithmic transformations.

Previous behavioral economic studies of substance use have primarily addressed outliers within the APT demand variables according to the methods prescribed by Tabachnick and Fidell (2001). This approach changes any values ≥ 3.29 SDs above the mean to be one unit greater than the highest non-outlier value. In addition to addressing outliers using the Tabachnick and Fidell method (2001), studies have generally used logarithmic transformations to normalize any demand variables that remain skewed and/or kurtotic. For the current study, APT index outliers were transformed according to the Tabachnick and Fidell method (2001). As with previous studies (e.g., MacKillop et al., 2010; Jacobs and Bickel, 1999), we replaced all zero values with arbitrarily low but non-zero values (e.g., 0.001) in order to calculate the demand indices.

In the current study, the overall *k* parameter derived from the MCQ as well as the four demand indices on the APT were positively skewed and kurtotic, so square root transformations were applied to P_{max}, Breakpoint, and O_{max}, while Intensity and *k* were logarithmically transformed. As a result of these transformations, the variables of interest were no longer significantly skewed or kurtotic.

In order to examine the overall goodness of fit, the APT data was examined using the exponential model template provided by Hursh and Silberberg (2008) using the following equation:

$$\ln Q = \ln Q_0 + k\,(e^{-\alpha P} - 1)$$

In this equation, Q = consumption at a given price; Q_0=consumption when price is zero; α is the derived demand parameter (elasticity) reflecting the decreased consumption; k = α constant across individuals that denotes the range of consumption values in logarithmic powers of ten, and P = price. Based on previous APT studies as well as for the purposes of the logarithmic transformations, all zero values were replaced with a low non-zero value of 0.001 to ensure proper curve fit. In addition, R^2 values were computed in each condition to ensure adequate fit for the data and to determine whether the demand indices were equally represented across each condition. GraphPad Prism for Macintosh 7.0c (GraphPad Inc., San Diego, CA) was used to examine the APT demand indices to determine the overall goodness of fit and compute R^2 values to asses model fit. The overall demand equation indicated excellent fit for the overall data, R^2 = .96. Although previous studies have argued that lighter drinking participants may negatively impact demand curve fit (e.g., Skidmore & Murphy, 2011), the present study determined that the mean R^2 values for the individual conditions were adequate: Negative Alcohol Prime mean R^2 =

.95, Negative Prime mean R^2 = .95, Positive Prime mean R^2=.96, Positive Alcohol Prime mean R^2 = .99, and Non-Primed mean R^2 = .98. A conventional significance level of $p < 0.05$ was used for all analyses and effect sizes (e.g., η_p^2) were also generated.

Hypothesis 1 Planned Analyses. A two-way factorial multivariate analysis of variance (MANOVA) was conducted to determine whether the five conditions and order of the behavioral tasks influenced the outcomes on the APT demand indices and the MCQ discounting parameter (*k*). The dataset was initially screened prior to multivariate analysis to ensure that the data satisfactorily met the assumptions of a multivariate analysis of variance (MANOVA), including whether any multivariate outliers were present in the data (i.e., Mahalanobis distance). Outliers were corrected using procedures outlined on pages 30-31. Box's M test was used to determine whether covariance matrices were equal, which was significant, $p < .000$. Thus, we also used Levene's test to determine whether our data met the assumption of homogeneity of variances. Levene's test was not significant for any of the five dependent variables (*p*s ranged from 0.099-.451). As such, we interpreted the results of the MANOVA using Pillai's trace as it is widely considered to be a powerful and robust test regarding unequal sample sizes that may violate the assumption of homogenous variance-covariance matrices. A significant Pillai's trace will be followed by ANOVAs and pairwise comparisons using Tukey corrections.

Hypothesis 2 Planned Analyses. Moderated regression was used to determine whether alcohol expectancy domains moderated the outcomes on the behavioral measures (APT demand indices and MCQ). First, the five priming conditions were converted into four dummy coded variables for the regression: Negative Condition, Negative Alcohol Condition, Positive Alcohol Condition, and Positive Condition. Next, each of the six expectancy factors dervived from the

AEQ were mean centered. Interaction terms were created by multiplying each of the six centered AEQ factors with the four dummy coded priming conditions. Thus, a total of 30 linear regressions were conducted for each of the five dependent variables: the four APT demand indices and the MCQ *k* parameter. Five predictors (main effects) were entered into the first block of the regression model: the four dummy coded conditions followed by one of the centered AEQ factors. The four interaction terms for a given AEQ factor of interest were entered in the second block. Multicollinearity diagnostics were assessed to ensure acceptable levels of variance inflation factor for all of the regression models. Any statistically significant interactions were probed using the procedures (i.e., pick-a-point simple slopes) outlined by Cohen et al. (2003) and Aiken and West (1991). In order to compare simple slopes, three arbitrary values will be chosen: the value of the outcome variable at the mean of the moderator (i.e., a given AEQ expectancy factor) as well as the values of the outcome variable at one standard deviation above and below the mean of the moderator.

Primary Analyses

Correlations. Pearson's *r* correlations were conducted to explore the relationships among the key demographic variables, the alcohol-related variables (AEQ, AUDIT), and the impulsivity measure (UPPS-P). Correlational data for these relationships are presented in Table 3 on page 37.

Next, we conducted bivariate correlations to determine whether specific alcohol-related variables (e.g., AEQ factors and AUDIT scores) would elucidate any meaningful relationships among the APT demand indices and the MCQ parameter *k*. None of the six AEQ factors were related to the outcomes on the APT demand indices. Only one AEQ factor, Global Positive, was

significantly negatively correlated with the MCQ discounting parameter *k* (see Table 4 on page 39 for details). Of note, none of the APT demand indices were related to the MCQ *k* parameter. The total AUDIT score was significantly correlated with three of the four APT demand indices for the overall sample. The positive relationships among O_{max}, Intensity, Breakpoint, and the AUDIT scores are consistent with previous findings.

Manipulation Checks. Prior to interpreting the results of the primary hypotheses, it was necessary to determine if the manipulations produced the effects intended; that is, if the priming of positive and negative affect indeed resulted in affective responses consistent with the primes. As previously described on page 27, participants in the four primed conditions answered two items intended to serve as manipulation checks at the end of the study. In order to determine the effect of the experimental manipulation on positive mood priming, we conducted separate independent sample t-tests to compare the means between the two manipulation check items for the general Positive Priming and Positive Alcohol Priming conditions. Although there were no significant differences between groups on MC1, $t(172) = -1.94$, $p = .054$, participants in the Positive Alcohol Priming reported significantly higher mean values on MC2 compared to participants in the general Positive Prime condition, $t(172) = 2.55$, $p = .012$. Thus, the Positive Alcohol Priming participants reported that they thought about their positive alcohol-related descriptions (i.e., "*How much did you think about this positive experience while completing the rest of the survey?"*) more than participants in the Positive Priming condition as they completed the study. Overall, the Positive Alcohol Priming participants were less sensitive to the positive mood manipulation than participants in the general Positive Priming condition.

Table 3
Correlations among AUDIT, AEQ, and UPPS for Overall Sample

	1	2	3	4	5	6	7	8	9	10	11	12
1. AUDIT	1											
2. Glo-Pos	.123**	1										
3. Sex	.061	.687**	1									
4. Soc-Phy	.050	.648**	.490**	1								
5. Soc-A	.129**	.751**	.561**	.678**	1							
6. Ten-Rdx	.085	.773**	.585**	.729**	.735**	1						
7. Agg-Ar	.112*	.717**	.552**	.491**	.646**	.628**	1					
8. UPPS-P NU	.299**	.092	.045	.013	.100*	.090*	.115*	1				
9. UPPS-P Pre	.254**	-.020	-.032	-.018	-.009	-.005	-.022	.341**	1			
10. UPPS-P SS	.145**	.053	-.034	.032	.013	-.018	-.012	.095*	.188**	1		
11. UPPS-PU	.334**	.139**	.046	.031	.093	.077	.103*	.691**	.293**	.205**	1	
12. UPPS-P LP	.242**	.018	.032	-.042	.042	.065	.059	.480**	.450**	-.087	.375**	1

Note. * Correlation is significant at .05. **Correlation is significant at .001. "Glo-Pos" = AEQ Global-Positive factor, "Sex = AEQ Sexual Enhancement factor, "Soc-Phys" = AEQ Social & Physical Pleasure factor, "Soc-A" = AEQ Social Assertion factor, "Ten-Rdx" = AEQ Tension Reduction factor, "Agg-Ar" = AEQ Aggression/Arousal factor; UPPS-P NU= Negative Urgency factor, "Pre" = Premeditation factor, "SS" = Sensation Seeking factor, "PU" = Positive Urgency factor, "LP" = Lack of Planning factor.

We also conducted separate independent sample t-tests for the two negative conditions (i.e., general Negative and Negative Alcohol). For MC1, participants in the Negative Priming condition rated their descriptions significantly more negative than the participants in the Negative Alcohol Priming condition, $t(173)= 2.21$, $p = 0.028$, although there were no significant group differences on MC2 $t(173)= -0.245$, $p = 0.807$. Given that the descriptions of the Negative Alcohol Priming group were subjectively rated less negatively (in terms of valence), their descriptions were ostensibly consistent with a more positive alcohol-related outcome. That is, the Negative Alcohol Priming manipulation did not appear to reflect an inherently negative effect as intended, which partially explains these counterintuitive findings. It is important to highlight the implication of these results when interpreting the overall findings of our study, as the Negative Alcohol Priming condition descriptions were not consistent with our *a priori* hypotheses. Given this notable limitation, the results of the current study are discussed within the context of this caveat. The Appendix on pages 69-72 provides examples of raw descriptions obtained from each of the priming conditions.

Hypothesis #1. A two-way factorial multivariate analysis of variance (MANOVA) was conducted to determine whether the five conditions and order of the behavioral tasks influenced the outcomes on the APT demand indices and the MCQ discounting parameter (k). There was a significant main effect of condition on the behavioral measures, $F(20,1720) = 1.861$, $p = 0.012$, Pillai's trace = 0.085, $\eta_p^2 = 0.021$. There was a nonsignificant main effect for order of behavioral measure presentation, $F(5,427) = 0.639$, $p = 0.670$, Pillai's trace = 0.007, $\eta_p^2 = 0.007$, which suggests that participants' were not influenced by a sequencing effect of behavioral measures. Means and standard deviations for the demand indices by condition are presented in Table 5.

Table 4
Correlations among AEQ Factors, AUDIT, APT Indices, and k

	1	2	3	4	5	6	7	8	9	10	11	12
1. AUDIT	1											
2. AEQ Glo-Pos	.123*	1										
3. AEQ Sex	.061	.687**	1									
4. AEQ Soc-Phy	.050	.648**	.490**	1								
5. AEQ Soc-A	.129*	.751**	.561**	.678**	1							
6. AEQ Ten-Rdx	.085	.773**	.585**	.729**	.735**	1						
7. AEQ Agg-Ar	.112*	.717**	.552**	.491**	.646**	.628**	1					
8. Overall k	.072	-.097*	-.076	-.052	-.060	-.054	-.043	1				
9. O_{max}	.281**	-.020	-.080	-.005	.009	-.025	.006	-.037	1			
10. Intensity	.384**	.065	-.007	.089	.084	.071	.006	-.044	.587**	1		
11. Breakpoint	.163**	-.007	-.072	.051	.048	-.011	.005	-.032	.793**	.470**	1	
12. P_{max}	.035	-.040	-.066	-.030	-.016	-.035	-.014	-.025	.644**	.141**	.746**	1

Note. * Correlation is significant at .05. **Correlation is significant at .001. "Glo-Pos" = AEQ Global-Positive factor, "Sex = AEQ Sexual Enhancement factor, "Soc-Phys" = AEQ Social & Physical Pleasure factor, "Soc-A" = AEQ Social Assertion factor, "Ten-Rdx" = AEQ Tension Reduction factor, "Agg-Ar" = AEQ Aggression/Arousal factor.

Table 5
Means and Standard Deviations for APT Demand Indices by Condition

	Negative Alcohol	Positive Alcohol	Negative	Positive	Non-Primed
Intensity	5.53(3.48)	5.86(4.10)	5.24(3.80)	5.37(4.54)	6.07(3.77)
O_{max}	16.23(11.25)	14.45(10.76)	11.28(11.15)	14.30(13.36)	14.39(11.65)
Breakpoint	10.82(4.81)	9.34(4.42)	7.35(4.45)	9.10(4.69)	9.92(4.09)
P_{max}	6.39(4.10)	5.42(3.81)	3.93(3.34)	4.87(3.36)	5.33(3.14)

Note. Reported raw data values were transformed prior to further analysis.

Given the nonsignificant sequencing effect in the current study, and in order to achieve the most parsimonious model, follow-up univariate analyses only accounted for the main effect of Condition. Follow-up ANOVAs were conducted to determine which of the priming conditions influenced outcomes on specific APT demand indices, which are presented in Table 6 on page 42. Three APT demand indices were significantly influenced by the cognitive priming: O_{max}, $F(4, 431) = 3.176$, $p = .014$, $\eta_p^2 = 0.03$, Breakpoint, $F(4, 431) = 5.814$, $p < .000$, $\eta_p^2 = 0.05$, and P_{max}, $F(4, 431) = 5.746$, $p < .000$, $\eta_p^2 = 0.05$. Contrary to our hypothesis that the participants in the negative conditions would report higher Intensity and *k* values, these two indices were not significantly affected by any of the conditional priming manipulations.

Regarding O_{max}, the highest overall amount of money that is spent on alcohol, *post hoc* comparisons using Tukey corrections revealed significant differences among groups. Specifically, participants in the general Negative condition reported significantly lower O_{max} values than the Negative Alcohol condition ($p = 0.006$). That is, participants who underwent the general negative mood manipulation spent significantly less money on alcohol than participants who underwent a negative alcohol-related mood manipulation. Although this finding is contrary to our original hypothesis that the general negative mood induction would significantly influence

outcomes on O_{max}, the result of the manipulation checks suggest that the negative mood induction adversely affected participants' desire to drink.

Similarly, we found group differences for Breakpoint values (i.e., the first price point at which consumption stops). Specifically, participants in the general Negative Prime condition reported significantly lower Breakpoint values than participants in all other conditions (*p*s ranged from .000-.014), with the exception of the general Positive condition, $p = .07$. In other words, the negative mood induction may have influenced participants in the general Negative Priming Condition to be more sensitive to higher standard drink prices (and thus stop consumption sooner) than participants in the positive and alcohol-related conditions. Again, this finding is contrary to our hypothesis that the general negative mood induction would significantly affect participants' Breakpoint index. Also contrary to our hypotheses for the positive priming conditions and the control (Non-Primed) condition, there were no significant group differences on Breakpoint. As such, it appears that the positive mood inductions did not affect participants' APT demand indices as we predicted.

Post-hoc pairwise comparisons also revealed several significant group differences among participants on P_{max} values (i.e., highest price point at which a participant was willing to pay for a standard drink). With the exception of the Positive Priming Condition, participants in the Negative Priming condition reported significantly lower P_{max} values than the other three conditions (*p*s ranged from .000-.013). That is, participants who underwent a negative mood manipulation were less willing to purchase standard drinks at higher prices than participants who underwent a general positive mood induction. Although this finding initially appears counterintuitive, it is consistent with the outcomes of the manipulation checks that suggested the

participants in the Negative Alcohol Condition rated their descriptions more positively than expected.

Hypothesis #2. In order to test the hypotheses that alcohol expectancy domains would differentially moderate the relationships among priming conditions and the outcomes on the two behavioral measures, we conducted separate moderated regressions for each outcome variable. Multicollinearity diagnostics were assessed and fell within an acceptable range for all regression models (i.e., ≤ 1.50). Results for each of the outcome variables (four APT demand indices and the MCQ *k* parameter) are presented below.

Table 6

Follow-Up Analyses of Variance (ANOVAs) for Main Effects of Multivariate Analysis of Variance

Source	Type III SS	*df*	*F*	Partial η^2	*p*
Condition					
k	.159	4	.088	.001	.986
Intensity	.611	4	1.833	.017	.121
O_{max}	27.666	4	3.176	.029	.014
Breakpoint	19.935	4	5.814	.051	.000
P_{max}	14.848	4	5.746	.051	.000
Order					
k	.020	1	.044	.000	.833
Intensity	.087	1	1.048	.002	.306
O_{max}	.920	1	.422	.001	.516
Breakpoint	1.242	1	1.448	.003	.229
P_{max}	.896	1	1.387	.003	.240
Error					
k	195.395	431			
Intensity	35.908	431			
O_{max}	938.564	431			
Breakpoint	369.464	431			
P_{max}	278.418	431			
Total					
k	1959.249	441			
Intensity	228.028	441			
O_{max}	6269.000	441			
Breakpoint	4133.000	441			
P_{max}	2308.500	441			

Note. Computed using $\alpha = .05$. *k* = transformed MCQ delay discounting parameter. N = 441.

MCQ k parameter. Global-positive expectancies were hypothesized to moderate the relationships between the alcohol-related positive priming condition and the outcomes on the *k* parameter. Five variables for the main effects were included in the first step of the regression model: the four dummy coded variables for each condition and the centered Global-Positive AEQ factor. In the second step, the four two-way interaction terms (AEQ Global-Positive x Negative Condition dummy coded variable, AEQ Global-Positive x Negative Alcohol dummy coded condition, AEQ Global-Positive x Positive Alcohol dummy coded condition, AEQ Global-Positive x Positive dummy coded condition) were entered.

Table 7
Results from moderated regression analysis examining interaction effects of priming conditions and AEQ Global Positive expectancies in predicting *k*

	Unstandardized Coefficients		Standardized Coefficients				
Predictors	B	SE	β	*t*	*p**	R^2	ΔR^2
Model	--	--	--	--	--	.021	.012
(Constant)	-1.974	.070	--	-28.125	.000		
Negative Condition	-.008	.103	-.005	-.080	.936		
Negative Alcohol Condition	-.053	.098	-.033	-.541	.589		
Positive Alcohol Condition	-.048	.100	-.029	-.477	.634		
Positive Condition	-.023	.101	-.014	-.230	.818		
AEQ GloPos	-.007	.012	-.064	-.610	.542		
AEQ GloPos x NC	-.016	.018	-.059	-.931	.352		
AEQ GloPos x NAC	-.020	.016	-.083	-1.227	.220		
AEQ GloPos x PAC	-.007	.016	.030	.450	.653		
AEQ GloPos x PC	.008	.016	.036	.528	.597		

Note. Reported *p* value for overall model represents significance of change in *F*. Computed using $\alpha = .05$. *k* = transformed MCQ delay discounting parameter. NC = Negative Condition, NAC = Negative Alcohol Condition, PAC = Positive Alcohol Condition, PC = Positive Condition. AEQ GloPos = AEQ Global Positive Expectancy factor. Reported values derived from variables entered into final step (Step 2) of regression model.

Contrary to our hypothesis, global positive alcohol expectancies did not moderate the relationships between any of the priming conditions and the outcomes on the MCQ and did not account for a significant portion of the variance, $R^2 = .021$, $\Delta R^2 = 0.012$, $F(4, 431) = 1.276$, $p =$

.278 (see Table 7). Further, the remaining expectancy factor interactions (i.e., Condition x AEQ Sexual Enhancement, Condition x AEQ Social and Physical Pleasure, Condition x AEQ Social Arousal, Condition x AEQ Tension Reduction, Condition x AEQ Aggression/Arousal) were not significant and did not account for a significant portion of the variance in the respective models.

APT Intensity. Tension reduction, global positive, and sexual enhancement expectancies were predicted to moderate the relationships between the priming conditions and the amount of alcohol participants hypothetically consumed when drinks were free (Intensity). Main effects were included in the first step of the regression model for separate expectancy factors: the four dummy coded variables for each condition and the centered AEQ factor variables. In the second step, the four two-way interaction terms (AEQ Factor x Negative Condition dummy coded variable, AEQ factor x Negative Alcohol dummy coded condition, AEQ factor x Positive Alcohol dummy coded condition, AEQ factor x Positive dummy coded condition) were entered.

Results of the moderated regression analysis revealed no significant Condition x AEQ Tension Reduction interactions for Intensity outcomes (*p*s ranged from .282–.973), nor did any of these interaction terms account for a significant portion of variance in the overall models. Specifically, and contrary to our hypotheses, tension reduction expectancies did not moderate the relationships between a negative mood induction and the amount of "free" standard drinks participants would hypothetically consume if the price was free. In addition, there were no significant Condition x AEQ Global Positive (*p*s ranged from .226–.750) or Sexual Enhancement (*p*s ranged from .183–.568) interactions for Intensity outcomes. Table 8 on page 46 provides details for hypothesized moderated regression outcomes for Intensity. Similarly, the other three Condition x AEQ factor interactions did not moderate the outcomes on Intensity values.

APT *Omax*. As previously noted, we expected specific expectancy factors to moderate the relationship between the alcohol-related cues embedded within a positive mood induction (Positive Alcohol Condition) on O_{max} outcomes, or the overall amount of hypothetical money participants spent on alcohol. Specifically, global positive and sexual enhancement expectancies were hypothesized to moderate the relationships between priming and the total amount of money participants hypothetically spent on alcohol (see Table 9 on page 48 for details). For the moderated regression with global positive expectancies, five variables for the main effects were included in the first step of the regression model: the four dummy coded variables for each condition and the centered Global-Positive AEQ factor. In the second step, the four two-way interaction terms (AEQ Global-Positive x Negative Condition dummy coded variable, AEQ Global-Positive x Negative Alcohol dummy coded condition, AEQ Global-Positive x Positive Alcohol dummy coded condition, AEQ Global-Positive x Positive dummy coded condition) were entered. For sexual enhancement expectancies, five variables for the main effects were included in the first step of the regression model: the four dummy coded variables for each condition and the centered Sexual Enhancement AEQ factor. In the second step, the four two-way interaction terms (AEQ Sexual Enhancement x Negative Condition dummy coded variable, AEQ Sexual Enhancement x Negative Alcohol dummy coded condition, AEQ Sexual Enhancement x Positive Alcohol dummy coded condition, AEQ Sexual Enhancement x Positive dummy coded condition) were entered. Results from moderated regression analyses noted no significant enhancing interactions among the six AEQ expectancy factors for the outcomes on either behavioral measure, which are contrary to our hypotheses. Further, none of the additional four AEQ factors moderated the relationships between the positive alcohol-related mood induction on Breakpoint

Table 8

Results from moderated regression analysis examining interaction effects of priming conditions and AEQ Global Positive expectancies in predicting APT Intensity

	Unstandardized Coefficients		Standardized Coefficients				
Predictors	B	SE	β	*t*	*p*	R^2	ΔR^2
Model	--	--	--	--	--	.022	.002
(Constant)	.709	.030	--	23.351	.000		
Negative Condition*	-.097	.044	-.129	-2.200	.028*		
Negative Alcohol Condition	-.047	.042	-.066	-1.103	.271		
Positive Alcohol Condition	-.033	.043	-.046	-0.763	.446		
Positive Condition	-.094	.044	-.128	-2.151	.032		
AEQ GloPos	.006	.005	.127	1.211	.226		
AEQ GloPos x NC	-.004	.008	-.031	-.495	.621		
AEQ GloPos x NAC	-.002	.007	-.022	-.319	.750		
AEQ GloPos x PAC	-.007	.007	-.062	-.927	.355		
AEQ GloPos x PC	-.004	.007	-.040	-.590	.555		
Model	--	--	--	--	--	.022	.005
(Constant)	.712	.030	--	23.522	.000		
Negative Condition *	-.093	.045	-.124	-2.069	.039*		
Negative Alcohol Condition	-.048	.043	-.068	-1.112	.267		
Positive Alcohol Condition	-.036	.043	-.049	-.830	.407		
Positive Condition*	-.096	.044	-.131	-2.198	.028*		
AEQ Sex. Enhance	.015	.014	.114	1.106	.269		
AEQ Sex. Enhance x NC	-.025	.020	-.085	-1.264	.207		
AEQ Sex. Enhance x NAC	-.014	.020	-.045	-.684	.494		
AEQ Sex. Enhance x PAC	-.026	.019	-.090	-1.334	.183		
AEQ Sex. Enhance x PC	-.012	.021	-.036	-.572	.568		
Model	--	--	--	--	--	.027	.006
(Constant)	.712	.030	--	23.619	.000		
Negative Condition*	-.98	.044	-.131	-2.222	.027*		
Negative Alcohol Condition	-.050	.042	-.071	-1.176	.240		
Positive Alcohol Condition	-.037	.043	-.051	-.855	.393		
Positive Condition*	-.096	.043	-.131	-2.203	.028*		
AEQ TR	.012	.010	.115	1.132	.258		
AEQ TR x NC	.008	.017	.027	.461	.645		
AEQ TR x NAC	-.016	.015	-.073	-1.077	.282		
AEQ TR x PAC	-.008	.014	-.041	-.588	.557		
AEQ TR x PC	-.001	.015	-.002	-.034	.973		

Note. *Computed using $\alpha = .05$. *p* values for overall models represent significance in *F* values. NC = Negative Condition, NAC = Negative Alcohol Condition, PAC = Positive Alcohol Condition, PC = Positive Condition. AEQ GloPos = AEQ Global Positive factor, AEQ Sex. Enhance = AEQ Sexual Enhancement Factor, AEQ TR=AEQ Tension Reduction factor. Reported values derived from variables entered into final step (Step 2) of regression models.

Interestingly, we found a significant antagonistic interaction effect for Positive Alcohol Condition x AEQ Sexual Enhancement, t =-2.473, p =.014. In the Positive Alcohol Condition, as participant's sexual enhancement expectancies increased, their reported O_{max} values decreased. That is, Positive Alcohol Condition participants who reported higher sexual enhancement expectancies spent significantly less money overall on hypothetical standard drinks. The significant Positive Alcohol Condition x AEQ Sexual Enhancement interaction was probed according to the procedures outlined by Aiken and West (1991). In order to compare simple slopes, three arbitrary values were chosen: the value of O_{max} at the mean of AEQ Sexual Enhancement expectancies as well as the values of O_{max} at one standard deviation above and below the mean of AEQ Sexual Enhancement expectancies. Thus, the priming influences of the Positive Alcohol Condition, in conjunction with higher AEQ Sexual Enhancement expectancies, were associated with lower O_{max} values (see Figure 2 on page 49 for details).

APT Breakpoint. We expected global positive and sexual enhancement expectancies to moderate the relationships between the alcohol-related positive mood induction (Positive Alcohol Condition) and the outcomes on Breakpoint, or participants' willingness to purchase standard drinks at higher prices before ceasing alcohol consumption.

Table 9

Results from moderated regression analysis examining interaction effects of priming conditions and AEQ Global Positive expectancies in predicting APT O_{max}

	Unstandardized Coefficients		Standardized Coefficients				
Predictors	B	SE	β	*t*	*p*	R^2	ΔR^2
Model	--	--	--	--	--	.036	.006
(Constant)	3.582	.155	--	23.120	.000		
Negative Condition*	-.608	.227	-.157	-2.683	.008*		
Negative Alcohol Condition	.161	.217	.044	.742	.459		
Positive Alcohol Condition	-.066	.221	-.018	-.300	.764		
Positive Condition	-.157	.222	-.042	-.707	.480		
AEQ GloPos	.013	.025	.053	.506	.613		
AEQ GloPos x NC	-.022	.039	-.036	-.571	.568		
AEQ GloPos x NAC	-.006	.036	-.011	-.161	.872		
AEQ GloPos x PAC	-.054	.036	-.100	-1.491	.137		
AEQ GloPos x PC	-.014	.035	-.027	-.390	.697		
Model	--	--	--	--	--	.045	.014
(Constant)	3.584	.154	--	23.344	.000		
Negative Condition*	-.593	.228	-.154	-2.601	.010*		
Negative Alcohol Condition	.146	.218	.040	.671	.502		
Positive Alcohol Condition	-.076	.220	-.020	-.348	.728		
Positive Condition	-.160	.221	-.043	-.726	.468		
AEQ Sex. Enhance	.073	.069	.108	1.064	.288		
AEQ Sex. Enhance x NC	-.103	.100	-.068	-1.027	.305		
AEQ Sex. Enhance x NAC	-.096	.102	-.062	-.948	.344		
AEQ Sex. Enhance x PAC*	-.241	.098	-.165	-2.473	.014*		
AEQ Sex. Enhance x PC	-.109	.104	-.066	-1.044	.297		

Note. Computed using $\alpha = .05$. *p* values for overall models represent significance in *F* values. NC = Negative Condition, NAC = Negative Alcohol Condition, PAC = Positive Alcohol Condition, PC = Positive Condition. AEQ GloPos = AEQ Global Positive factor, AEQ Sex. Enhance = AEQ Sexual Enhancement Factor. Reported values derived from variables entered into final step (Step 2) of regression models.

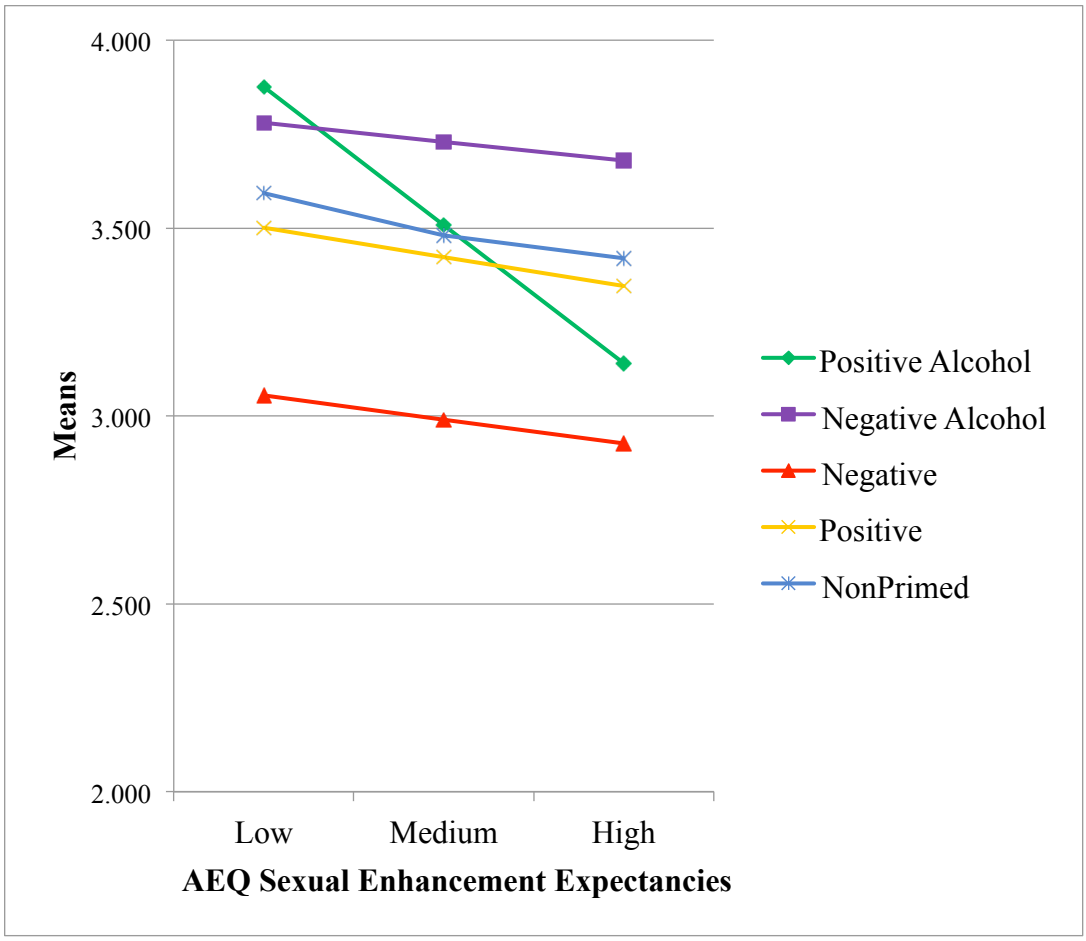

Figure 2. Pick-a-point simple slopes for moderated regression of O_{max} at low, medium, and high levels of sexual enhancement expectancies. Low, medium, and high values of AEQ Sexual Enhancement are defined as ±1SD above and below the mean (-2.20, 0, +2.20).

Specifically, global positive and sexual enhancement expectancies were predicted to moderate the positive priming effect on participants' willingness to purchase standard drinks at higher price points. Five variables for the main effects were included in the first step of the regression model: the four dummy coded variables for each condition and the centered Global-Positive AEQ factor. In the second step, the four two-way interaction terms (AEQ Global-Positive x Negative Condition dummy coded variable, AEQ Global-Positive x Negative Alcohol dummy

coded condition, AEQ Global-Positive x Positive Alcohol dummy coded condition, AEQ Global-Positive x Positive dummy coded condition) were entered. The moderated regression model for the AEQ Sexual Enhancement factor was built using the same steps used for the AEQ Global Positive factor.

We found that global positive expectancies and sexual enhancement expectancies did not moderate the relationships between the positive alcohol-related mood induction and the amount of standard drinks participants would hypothetically purchase at higher prices (see Table 10 on page 51). Further, none of the interactions accounted for a significant portion of the variance in their respective models and none of the additional four AEQ factors moderated the relationships between the positive alcohol-related mood induction on Breakpoint outcomes.

APT Pmax. We hypothesized global positive expectancies to moderate the relationship between the general positive mood induction and P_{max}. That is, we hypothesized that positive global expectancies would strengthen the relationships between positive mood priming and the outcomes on P_{max}. Five variables for the main effects were included in the first step of the regression model: the four dummy coded variables for each condition and the centered Global-Positive AEQ factor. In the second step, the four two-way interaction terms (AEQ Global-Positive x Negative Condition dummy coded variable, AEQ Global-Positive x Negative Alcohol dummy coded condition, AEQ Global-Positive x Positive Alcohol dummy coded condition, AEQ Global-Positive x Positive dummy coded condition) were entered. As such, and contrary to our hypothesis, global positive alcohol expectancies do not moderate the relationship between an alcohol-related positive mood induction and the outcomes on P_{max} (*p*s ranged from .621-.752; refer to Table 11 on page 52) and did not account for a significant portion of the variance.

Further, none of the additional five AEQ factors moderated the relationships between the positive alcohol-related mood induction on Breakpoint outcomes.

Table 10

Results from moderated regression analysis examining interaction effects of priming conditions and AEQ Global Positive expectancies in predicting APT Breakpoint

	Unstandardized Coefficients		Standardized Coefficients				
Predictors	B	SE	β	*t*	*p*	R^2	ΔR^2
Model	--	--	--	--	--	.057	.006
(Constant)	3.067	.097	--	31.560	.000		
Negative Condition**	-.564	.142	-.230	-3.969	.000		
Negative Alcohol Condition	.071	.136	.031	.525	.600		
Positive Alcohol Condition	-.157	.139	-.067	-1.134	.257		
Positive Condition	-.186	.139	-.078	-1.331	.184		
AEQ GloPos	.005	.016	.034	.335	.738		
AEQ GloPos x NC	-.024	.024	-.062	-.996	.320		
AEQ GloPos x NAC	.009	.023	.026	.390	.697		
AEQ GloPos x PAC	-.019	.023	-.057	-.862	.389		
AEQ GloPos x PC	-.007	.022	-.021	-.316	.752		
Model	--	--	--	--	--	.060	.008
(Constant)	2.205	.084	--	26.274	.000		
Negative Condition*	-.377	.125	-.177	-3.023	.003		
Negative Alcohol Condition	.175	.119	.088	1.470	.142		
Positive Alcohol Condition	-.036	.120	-.018	-.301	.763		
Positive Condition	-.147	.121	-.071	-1.214	.225		
AEQ Sex. Enhance	.011	.038	.030	.300	.765		
AEQ Sex. Enhance x NC	-.039	.055	-.048	-.722	.471		
AEQ Sex. Enhance x NAC	-.003	.056	-.004	-.054	.957		
AEQ Sex. Enhance x PAC	-.083	.053	-.103	-1.562	.119		
AEQ Sex. Enhance x PC	.005	.057	.005	.085	.932		

Note. *$p < .05$; **$p < .001$. Computed using $\alpha = .05$. *p* values for overall models represent significance in *F* values. NC = Negative Condition, NAC = Negative Alcohol Condition, PAC = Positive Alcohol Condition, PC = Positive Condition. AEQ GloPos = AEQ Global Positive factor, AEQ Sex. Enhance = AEQ Sexual Enhancement Factor. Reported values derived from variables entered into final step (Step 2) of regression models.

Taken together, our results suggest that specific alcohol expectancies (as measured by the AEQ) do not moderate the relationships on two behavioral economic self-report measures: a DD parameter based on temporal delays (i.e., MCQ *k*) and the APT demand indices following a

mood induction procedure. Only one Condition x Expectancy interaction was significant: Positive Alcohol Condition x AEQ Sexual Enhancement expectancies. As previously noted, unintentional priming effects may have ostensibly influenced the outcomes on the moderation analyses; thus, the nature of this significant interaction may be coincidental in the context of the mood inductions. Further, prior behavioral economic studies have typically used these measures in samples of heavy drinkers who ostensibly may behave more impulsively under the influence of alcohol. Moreover, these results suggest that alcohol expectancies may be differentially accounting for separate but related processes associated with delayed reward discounting and demand for alcohol.

Table 11

Results from moderated regression analysis examining interaction effects of priming conditions and AEQ Global Positive expectancies in predicting APT P_{max}

	Unstandardized Coefficients		Standardized Coefficients				
Predictors	B	SE	β	*t*	*p*	R^2	ΔR^2
Model	--	--	--	--	--	.055	.003
(Constant)	2.209	.084	--	26.150	.000		
Negative Condition* *	-.398	.124	-.187	-3.223	.001		
Negative Alcohol Condition	.167	.118	.084	1.411	.159		
Positive Alcohol Condition	-.037	.121	-.018	-.307	.759		
Positive Condition	-.152	.121	-.074	-1.255	.210		
AEQ GloPos	-.006	.014	-.044	-.427	.669		
AEQ GloPos x NC	-.010	.021	-.031	-.494	.621		
AEQ GloPos x NAC	.006	.020	.021	.317	.752		
AEQ GloPos x PAC	-.006	.020	-.022	-.328	.743		
AEQ GloPos x PC	.009	.019	.032	.470	.639		

Note. Computed using $\alpha = .05$. *p* values for overall models represent significance in *F* values. NC = Negative Condition, NAC = Negative Alcohol Condition, PAC = Positive Alcohol Condition, PC = Positive Condition. AEQ GloPos = AEQ Global Positive factor, AEQ Sex. Enhance = AEQ Sexual Enhancement Factor. Reported values derived from variables entered into final step (Step 2) of regression models.

CHAPTER FOUR:

DISCUSSION

Based on the results of recent behavioral accounts of substance use, which often do not capture important information regarding underlying cognitive processes associated with substance use, the overall goal of the present study was to merge cognitive and behavioral theories of substance use to extend existing measures of behavioral economic rewards value and impulsivity. The framework of the current study was built by merging alcohol expectancy theory with behavioral economic accounts of impulsivity and substance use. To that end, we incorporated an expectancy-based cognitive priming approach to assess whether hypothetical alcohol-related, state-based mood manipulations would yield differential outcomes on an alcohol purchase task and a DD task. Our experimental framework granted participants as much open-ended freedom to describe recent general or alcohol-related descriptions, which adversely and unexpectedly affected our predictions and the interpretation of our findings. These unintentional effects were largely evidenced by the results of the manipulation checks at the end of the experiment. Specifically, participants in the Negative Priming condition subjectively rated their open-ended descriptions significantly more negative than participants in the Negative Alcohol Condition. These results warranted further investigation to determine the exact nature of these differences, particularly related to our findings in the Negative Alcohol Priming condition. As with all of the primed conditions, the Negative Alcohol Prime condition was intentionally open-

ended such that participants were able to construct their own narrative of their recent experiences. As previously noted, participants in the Negative Alcohol Prime condition were asked to describe a recent negative experience in which they consumed alcohol. The nature of the open-ended response field was designed to capture this subjective information to reduce the influence of unintentional cognitive primes that would putatively confound the results. Further, we expected the descriptions of the negative alcohol-related experiences to elicit responses that were more consistent with the responses in the Negative Priming condition, although this was not evident in our findings. Rather, the responses in the Negative Alcohol Priming condition were more consistent with the findings in the Positive Alcohol Priming condition, as evidenced by the participants' subjective ratings of their experiences (e.g., manipulation checks). Indeed, many participants in the Negative Alcohol Condition reported generally humorous encounters related to recent drinking ventures, while participants in the Negative Condition reported much more conventionally negative recent life events (e.g., loss of loved ones/pets, poor grades, etc.). While these results were unexpected, our findings do elucidate important underlying issues related to ensuring that participants operationally conceptualize constructs of interest as intended. As such, perhaps having more stringent experimental control, rather than open-ended descriptions, in the priming conditions may ensure responses that are consistent with conventionally negative alcohol-related experiences. In light of these issues, it is vitally important to interpret our results with an understanding that the responses the Negative Alcohol Prime condition were contrary to our intentions. Moreover, these findings also underscore the importance of recognizing disparate views of what typically constitutes risky drinking behavior with negative outcomes among college students.

In light of this major limitation, the results of the Negative Prime condition yielded results that were consistent with our intentions and appeared to capture an ostensibly negative priming effect. Specifically, participants in the Negative Prime condition significantly differed on three APT demand indices: O_{max}, P_{max} , and Breakpoint. That is, participants who reported generally negative recent life experiences indicated that they were less willing to spend money on alcohol overall, were less willing to purchase standard drinks at higher prices, and were more likely to cease alcohol consumption sooner than participants in the other four conditions.

We also wanted to determine whether specific alcohol expectancy domains would moderate the relationships between the negative and positive priming manipulations and the outcomes on the behavioral measures (i.e., APT and MCQ), respectively. Only one Condition x Expectancy interaction was significant (i.e., Positive Alcohol Condition x AEQ Sexual Enhancement factor), which may be a chance finding relative to the rest of the rest of the nonsignificant interactions and the unintentional effects of the priming manipulations. As such, and contrary to our hypotheses, our results generally indicate that the six alcohol expectancy domains we tested did not moderate the outcomes on the APT or the MCQ, regardless of priming manipulations. Again, these results must be interpreted with caution given the aforementioned limitations associated with the priming manipulations. Taken together, the results of our moderation analyses suggest that alcohol expectancies (as measured by the AEQ) and the behavioral economic measures are likely tapping into separate domains related to alcohol use and misuse. Moreover, these findings suggest that, as previously noted, the MCQ and APT are most sensitive to at-risk and problem drinkers rather than social and low-risk drinkers. In addition, it may be that these specific behavioral measures are tapping into different domains of

alcohol use rather than specific cognitions related to alcohol. Indeed, findings from a recent meta-analysis suggest that the APT has good construct validity, but may have limited incremental utility in predicting alcohol-related problems and risk (Kiselica, Webber, & Bornovalova, 2015). Nevertheless, these results should be interpreted with caution given the unintentional outcome of the priming effects found in the Negative Alcohol Priming condition.

In addition to the unintentional priming effects, the current study has several additional limitations to consider. First, we used a sample of convenience, which may limit the generalizability of the findings. Unlike many of the recent behavioral economic accounts of substance use, our sample was intentionally comprised of a non-clinical sample in which to explore an alcohol-related framework, which may have also served as a strength. Second, our sample was comprised of nearly 75% females, which limits the generalizability of our findings across both genders. Third, the current study was conducted entirely online, which can negatively impact the level of experimental control. As a result, several participants' data were not analyzed due to missing data; as such, the statistical analyses were more conservative in nature. Further, the results of our study also necessitate greater experimental control over similar mood induction procedures to ensure greater ecological and construct validity.

It is important to note that the participants in the Negative Alcohol Priming condition did not respond to the mood induction as we intended. Rather, our findings from the manipulation check suggest that these participants subjectively rated their experiences significantly less negative than participants in the general Negative Priming condition. Further exploration of the descriptions provided by participants in the Negative Alcohol Priming condition indicated that their descriptions were ostensibly more positive than not, which partially explains the unintended

results found among participants in this condition. Although this limits the interpretation of our findings, it underscores the need to potentially revise the way alcohol researchers perceive and measure negative alcohol-related consequences, particularly among undergraduate samples. Further, it also necessitates greater experimental control over similar mood induction procedures to ensure greater psychometric and construct validity.

Although a number of considerations apply, future research should consider several avenues to further explore a similar cognitive-behavioral framework of the present study. First, this type of research should be extended beyond a sample of convenience and applied within a wide range of drinkers, including risky/heavy drinkers. Second, this paradigm could be implemented with greater experimental control in a laboratory-based setting using traditional self-report measures as well as computerized tasks. For example, newer computerized discounting measures, such as the Experiential Discounting Task (EDT; Reynolds & Schiffbauer, 2004) may be more sensitive to state-based changes, although there is some contention regarding the construct validity of this task (see Hamilton et al., 2015). The EDT is purported to be a state-based, real-time temporal discounting task, but research has argued that this task may be tapping into constructs related to impulsivity, such as boredom proneness, rather than delay discounting processes (Smits et al., 2013). In addition, the priming manipulation warrants more experimental control to reduce the unexpected *post hoc* effects we encountered in our study design. Moreover, although several studies suggest that using real versus hypothetical rewards yield similar outcomes (Hamilton et al., 2015; Lagorio & Madden, 2005; Madden et al., 2004; Amlung et al., 2011), the current study could be extended to determine whether real rewards would yield different results.

In summary, the current study sought to merge cognitive and behavioral theories of drinking to extend existing behavioral measures of alcohol use and impulsivity. To address this, we employed cognitive priming techniques to manipulate mood- and alcohol-related contexts to influence outcomes on an alcohol purchase task and a temporal DD task. Although the Negative Alcohol Priming manipulation yielded unintentionally positive alcohol-related outcomes, our overall results suggest that the outcomes on an alcohol purchase task are influenced by cognitive set, (i.e., context and mood), which are largely unaccounted for in the measurements that developed and used within a strictly operant framework. Future studies are warranted to further elucidate the nature of this hybrid framework of the current study to better understand the unique contributions of cognition and behavior to substance use.

CHAPTER FIVE:

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CHAPTER SIX:

APPENDIX A

All of the following excerpts have been directly lifted from actual participants' responses and include abbreviated instructions.

Positive Alcohol Description

Please take a moment to think about a recent time you had a **positive** experience in which you consumed alcohol. Please take a moment to write THREE (3) sentences or more to describe a recent positive drinking experience.

"My most recent positive drinking experience was last night. I recently moved in with my significant other and we adopted a dog, so for us it's kinda been like playing house. Anyways, we made dinner together and then sat down to eat and I had a glass of wine with dinner. It was a very pleasant experience."

"Recently I went out with some friends on a Friday night to relax and catch up. We went to a local restaurant and had some appetizers and drinks. It was a good night where we were able to chat and just get away from the stress of school and work for a few hours."

"The last time I drank alcohol was New Year's Eve. I was with family and I had a glass of wine to toast the New Year. I did not have much."

Negative Alcohol Description

Please take a moment to think about a recent time you had a **negative** experience in which you consumed alcohol. Please take a moment to write THREE (3) sentences or more to describe a recent negative drinking experience.

"*One night me and my boy Juice were 3 four lokos into the night. We got too turnt and had to be escorted from the club for yelling at strangers asking them "DO YOU WANNA PARTY"? We ended up going back to my room and stared at each other for 2 hours.*"

"During gasparilla, i went out with my boyfriend and his two female friends. He became so drunk that he passed out in the grass and his two friends left me with him. I tried fruitlessly to wake him up but it only angered him. Later that evening he continued to drink and began to ignore my grabs for his attention and directed all of his attention to one of his female friends, leaving me alone among strangers. I began drinking heavily as well, and became so intoxicated that I wet myself and broke my glasses."

"My Great Aunt had written a letter to my dad about the last family vacation we had together, where everyone was drinking. In the letter, she told him that I should be put into rehab for drinking and that i should be a strict diet because I looked like a 'beached whale.' After i saw the letter I consumed a lot of alcohol."

Positive Description

Please take a moment to think about a recent time you had **positive** experience in your life. Please take a moment to write THREE (3) sentences or more to describe a recent positive experience.

"I recently got a promotion at work. I am now able to hold more responsibility and have more of a say in functions that occur at work. The best thing about this experience is that I also got a pay raise."

"Today I found a penny on the ground. It was a really shiny penny. It was also heads up so it was good luck."

"My nineteenth birthday was two weeks ago, and the weekend before my boyfriend took me out. We went to the beach and walked, and we got lunch at my favorite restaurant. Then we went to see a movie, and got ice cream afterward. It was really nice, since we have both been very busy lately, and it was the first time in months that we spent an entire day together."

Negative Description

Please take a moment to think about a recent time you had a **negative** experience in your life. Please take a moment to write THREE (3) sentences or more to describe a recent negative life experience. Please provide an honest response regarding your most recent negative experience. Remember, all answers will be kept confidential. In order to maintain confidentiality, DO NOT include any personal or identifying information (e.g., actual names)in your description.

"I just went through a break-up with someone who meant the world to me. He helped me get out of a slump I was in from another previous relationship, helped me gain confidence again. But then he started to belittle me and make me feel bad. I thought he was different, and it hurt to be proven wrong."

"My dog got sick not too long ago. The vet we took her to said the disease wasn't life threatening, but she died a couple of days later. We've had her for eight years so it was definitely hard to see her go."

"The most recent negative experience in my life was my father having a massive heart attack and nearly died from it. It really affected his health and affected the family as a whole because he could no longer work. He also was unable to do things we used to do growing up."

CHAPTER SEVEN:

APPENDIX B

August 21, 2015

Lauren Adams
Department of Psychology
4202 E. Fowler Ave, 4118 G
Tampa, FL 33620

RE: Exempt Certification
IRB#: Pro00023312
Title: Financial Planning and College Student Spending Habits

Dear Ms. Adams:

On 8/21/2015, the Institutional Review Board (IRB) determined that your research meets criteria for exemption from the federal regulations as outlined by 45CFR46.101(b):

(2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless:
(i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

Approved Items:

IRBProtocolGuidelinesv2.docx
Informed Consent_Pro00023312.docx

As the principal investigator for this study, it is your responsibility to ensure that this research is conducted as outlined in your application and consistent with the ethical principles outlined in the Belmont Report and with USF HRPP policies and procedures.

Please note, as per USF HRPP Policy, once the Exempt determination is made, the application is closed in ARC. Any proposed or anticipated changes to the study design that was previously

declared exempt from IRB review must be submitted to the IRB as a new study prior to initiation of the change. However, administrative changes, including changes in research personnel, do not warrant an amendment or new application. Given the determination of exemption, this application is being closed in ARC. This does not limit your ability to conduct your research project.

We appreciate your dedication to the ethical conduct of human subject research at the University of South Florida and your continued commitment to human research protections. If you have any questions regarding this matter, please call 813-974-5638.

Sincerely,

Kristen Salomon, Ph.D., Vice Chairperson
USF Institutional Review Board