Alcohol Expectancies versus Subjective Response

as Mediators of Disposition in the Acquired Preparedness Model

by

Caitlin Scott

A Thesis Presented in Partial Fulfillment
of the Requirements for the Degree
Master of Arts

Approved November 2012 by the
Graduate Supervisory Committee:

William Corbin, Chair
Michelle Shiota
Laurie Chassin

ARIZONA STATE UNIVERSITY

December 2012

ABSTRACT

Levels of heavy episodic drinking peak during emerging adulthood and contribute to the experience of negative consequences. Previous research has identified a number of trait-like personality characteristics that are associated with drinking. Studies of the Acquired Preparedness Model have supported positive expectancies, and to a lesser extent negative expectancies, as mediators of the relation between trait-like characteristics and alcohol outcomes. However, expectancies measured via self-report may reflect differences in learned expectancies in spite of similar alcohol-related responses, or they may reflect true individual differences in subjective responses to alcohol. The current study addressed this gap in the literature by assessing the relative roles of expectancies and subjective response as mediators within the APM in a sample of 236 emerging adults (74.7% male) participating in a placebo-controlled alcohol challenge study. The study tested four mediation models collapsed across beverage condition as well as eight separate mediation models with four models (2 beverage by 2 expectancy/subjective response) for each outcome (alcohol use and alcohol-related problems). Consistent with previous studies, SS was positively associated with alcohol outcomes in models collapsed across beverage condition. SS was also associated with positive subjective response in collapsed models and in the alcohol models. The hypothesized negative relation between SS and sedation was not significant. In contrast to previous studies, neither stimulation nor sedation predicted either weekly drinking or alcohol-related problems. While stimulation and alcohol use appeared to have a positive and

significant association, this relation did not hold when controlling for SS, suggesting that SS and stimulation account for shared variability in drinking behavior. Failure to find this association in the placebo group suggests that, while explicit positive expectancies are related to alcohol use after controlling for levels of sensation seeking, implicit expectancies (at least as assessed by a placebo manipulation) are not. That the relation between SS and stimulation held only in the alcohol condition in analyses separate by beverage condition indicates that sensation seeking is a significant predictor of positive subjective response to alcohol (stimulation), potentially above and beyond expectancies.

ACKNOWLEDGMENTS

I would like to thank my mentor and committee chair, William Corbin, for his expert guidance, constructive feedback, and unfaltering encouragement throughout this project. I am grateful for his mentorship. I would also like to thank the members of my committee, Laurie Chassin and Michelle Shiota, for their invaluable expertise, support, and assistance in shaping the project. Without these committee members this would not have been possible and I am very grateful for their advice and guidance.

TABLE OF CONTENTS

APPENDIX Page

LIST OF TABLES

Table Page

LIST OF FIGURES

Figure Page

Chapter 1

INTRODUCTION

Levels of heavy episodic or "binge drinking" peak during the critical developmental period of emerging adulthood (age 18-25). Further, heavy drinking contributes to the experience of a host of negative consequences, including driving while intoxicated, risk taking behaviors, and alcohol-related injuries (Hingson, Heeren, Winter, & Wechsler, 2005). Incidence of alcohol use disorders (AUDs) also peaks during this age period (Grant et al., 2004). Studies have identified a range of risk factors for heavy drinking, including personality characteristics, expectancies, genetic and intergenerational risk, subjective response to alcohol, and gender (Ham and Hope, 2003; Simons, Carey, and Gaher, 2004; Leeman, Corbin, and Fromme, 2009; Knopik et al., 2004; Liu et al., 2004; Schuckit, 1994; Schuckit, 1998; Schuckit & Smith, 2000; Wechsler et al., 2002). Of primary interest to the current study, previous research has identified a number of trait-like personality characteristics that are associated with heavy drinking and problems. Although recent research demonstrates developmental changes in personality, individuals tend to retain their rank order (Caspi et al., 2005; Roberts & DelVecchio, 2000), and personality tends to be difficult to change through intervention efforts, as evidenced by poor treatment outcomes among individuals with personality pathology (Reich & Vasile, 1998). Thus, a focus on the mechanisms through which trait characteristics contribute to negative drinking outcomes is paramount for both prevention and intervention efforts as mediators of trait risk factors (e.g. alcohol-related cognitions) may be more amenable to change. The aim of the current study is to investigate the relative importance of differential learning (alcohol outcome expectancies) and differences in subjective response to alcohol as mediators of the relationship between trait characteristics and drinking outcomes.

There are a number of well-established trait-like personality characteristics shown to be related to alcohol use. For instance, using the five domains of the five factor model of personality (Costa & McCrae, 1992) conscientiousness and extraversion have received consistent support as predictors of alcohol use (Raynor & Levine, 2009), with low conscientiousness and high extraversion most strongly related to alcohol use and misuse (Raynor & Levine, 2009; Vollrath & Torgerson, 2002). The association between these traits and enhancement motives for drinking (Theakston, Stewart, Dawson, Knowlden-Loewen, & Lehman, 2004) suggests a possible mechanism through which low conscientiousness/high extraversion contribute to heavy alcohol consumption. Another of the five domains in the five factor model, neuroticism or negative emotionality, has been inconsistently associated with alcohol use (Raynor & Levine, 2009). Some studies show higher levels of neuroticism to be associated with alcohol use (Martin & Sher, 1994; Ruiz, Pincus, & Dickinson, 2003; Ham & Hope, 2003) while others have failed to find this association (Kashdan, Vetter, & Collins, 2005; Allsopp, 1986; Raynor & Levine, 2009). Similarly, while some studies suggest that subcomponents of agreeableness are inversely associated with alcohol use, relations between agreeableness, openness to experience, and alcohol outcomes are inconsistent (Raynor and Levine, 2009). In summary, the literature most consistently identifies low levels of conscientiousness and high levels of extraversion as significant correlates of drinking outcomes.

The higher order construct of behavioral undercontrol captures aspects of both low conscientiousness and high extraversion and has been shown to be consistently associated with risk for alcohol use and dependence (Slutske et al., 2002; Sher, 1991; Elkins, King, McGue, & Iacono, 2006). One aspect of behavioral undercontrol that has also been linked to high extraversion and low conscientiousness is sensation seeking. Sensation seeking is characterized by a preference for physiologically arousing and novel experiences, and willingness to take social, physical, and financial risks to obtain this arousal (Bardo et al., 2007; Borsari, Murphy, & Barnett, 2007). Factor analyses reveal that the "Excitement Seeking" facet of the Extraversion scale on the NEO-PIR loads on the sensation seeking factor, along with other measures designed to capture tendency to seek excitement and physiologically arousing experiences (Whiteside and Lynam, 2001; DeYoung, 2010). Others studies suggest that, while sensation seeking loads positively on extraversion, impulsive sensation seeking loads negatively on conscientiousness (Aluja, Garcia, and Garcia, 2002; Zuckerman, Kuhlman, Joireman, Teta, and Kraft, 1993). However, impulsive sensation seeking combines sensation seeking with the related but distinct construct of impulsivity, so it is not clear which aspect of impulsive sensation seeking drives its relation with conscientiousness. This is particularly true given that other studies have demonstrated a consistent inverse association between impulsivity and conscientiousness (Whiteside and Lynam, 2001; DeYoung, 2010).

Regardless, sensation seeking is consistently associated with alcohol use and problems (Stacy, Newcomb, & Bentler, 1993; Borsari et al., 2007), and studies have shown that sensation seeking specifically may explain the relation between overall disinhibition and alcohol use (Earleywine & Finn, 1991). A focus on sensation seeking rather than the broader construct of disinhibition is consistent with literature arguing that lower-order traits provide better prediction of behavioral outcomes than higher-order traits (Caspi, Roberts, & Shiner, 2005). Further, sensation seeking is one of the best established prospective predictors of alcohol use and there is strong evidence for sensation seeking's heritable biological basis (Bardo et al., 2007; Slutske et al., 2002). Studies show that between 48-63% of the variance in sensation seeking scores is attributable to genetic factors (Fulker, Eysenck, & Zuckerman, 1980; Koopmans, Boomsma, Heath, & van Doornen, 1995; Stoel, De Geus, & Boomsma, 2006). Recent studies have implicated the mesocorticolimbic dopamine reward pathway as contributing to sensation seeking (Bardo, Donohew, & Harrington, 1996).

Although sensation seeking and other personality traits with a strong biological basis have long been thought of as relatively stable throughout the life course (McCrae et al., 2000), recent research has challenged and clarified this conceptualization. Studies using a life span developmental perspective have demonstrated that mean levels of personality change throughout the lifespan, especially during certain developmental periods (Caspi et al., 2005; Roberts, Walton, & Viechtbauer; 2006; Littlefield, Sher, & Wood, 2009). Mean level change refers to changes in the average trait level of a given population (Caspi et al., 2005). Personality traits change more in mean level during adolescence and young adulthood than any other period (Roberts et al., 2006), with greater stability in later adulthood. For example, A meta-analysis of 80 longitudinal studies spanning age 10 to 101 found that levels of social dominance, a facet of extraversion, increase in young adulthood and middle age, and that social vitality (another facet of extraversion) increases in adolescence and then decreases with age (Roberts et al., 2006). This same pattern has been demonstrated for the specific trait of sensation seeking. Mean levels of sensation seeking peak during late adolescence, between the ages of 10 and 15 (Steinberg et al., 2008; Steinberg, 2010), and then steadily decline in emerging adulthood (Bardo et al., 2007; Zuckerman, 1979; Zuckerman, 1994). Although there is now clear evidence for mean level changes over the life course, rank-order stability of personality traits is remarkably high across the lifespan (Caspi et al., 2005; Roberts & DelVecchio, 2000). In other words, although an entire population may show increases or decreases in levels of a given personality trait, depending upon the period of development, individuals within a cohort tend to retain their rank order (e.g. higher or lower) relative to others within that population. Of specific relevance to the current study, individual differences in rank-order remain fairly consistent during young adulthood (Caspi et al., 2005). Thus, when looking at sensation seeking as a trait risk factor for alcohol use and problems in emerging adulthood, it is important to consider that mean levels of the trait are declining but that rank order stability is relatively stable. In summary, among the traits of relevance to drinking behavior, sensation seeking appears to be a strong candidate given its association with alcohol use, it strong biological basis, and its rank order stability.

Although evidence for an association between sensation seeking and drinking outcomes has been well established for decades, efforts to understand mechanisms of risk are relatively more recent. One theoretical model linking behavioral undercontrol (including impulsivity, sensation seeking, and urgency) with alcohol use and problems is the Acquired Preparedness Model (APM). In this model, disposition and psychosocial learning are integrated to help account for alcohol-related risk processes and drinking behavior (Smith and Anderson, 2001). The model postulates that the presence of certain trait-like characteristics prepares individuals to acquire particular learning experiences (Settles, Cyders, and Smith, 2010). In other words, personality characteristics predispose individuals to differentially attend to outcomes of alcohol related behavior, thus enabling differential learning about alcohol outcomes. (Corbin, Iwamoto, Fromme, 2011). The idea that differences in personality contribute to different reactions and learning experiences surrounding the same environmental event is referred to as reactive person-environment transaction (Caspi, 1993). Presumably, this differential alcohol-related learning accounts, at least in part, for the influence of trait risk factors on drinking behavior (Settles, Cyders, and Smith, 2010).

According to the APM, differences in learning related to personality traits typically take the form of expectations about the outcomes of a particular behavior (i.e. outcome expectancies). In support of this hypothesis, Smith and Anderson (2001) conducted a study aimed at directly testing the role of personality in differentially learned expectancies. Business students were taught about stock market investing and then engaged in five practice investment sessions. Although each individual received the same return on their investments, the students developed different expectancies about stock investments. In other words, individuals received identical learning processes and outcomes, but formed different expectancies as a result of the experience. These learned expectancies were predicted by the individual's personality characteristics (Smith, Williams, Cyders, and Kelley, 2006).

Presumably, the same type of differential learning that was demonstrated for stock market investments should apply to other behaviors, including alcohol consumption. In fact, studies of the APM have demonstrated differential learning of both positive and negative alcohol expectancies associated with certain personality traits. The majority of the AP model literature focuses on alcohol expectancies as a mediator of relations between trait risk factors and alcohol use, as opposed to consequence of use (Anderson, Smith, and Fischer, 2003; Barnow et al., 2004; Corbin, Iwamoto, Fromme, 2011; Fu, Ko, Wu, Cherng, and Cheng, 2007; McCarthy, Kroll, & Smith 2001a; Settles, Cyders, and Smith, 2010). For example, Anderson, Smith, and Fischer (2003) demonstrated that higher positive and lower negative expectancies about alcohol mediated the association between a latent variable "disinhibition" (with sensation seeking, impulsivity, and novelty seeking as indicators) and drinking. More recently, in the first longitudinal test of the AP model, Settles, Cyders, and Smith (2010) found that positive and negative urgency predicted alcohol use through different mediators. Specifically, the relation between positive urgency and drinking quantity (at the end of first year of college) was mediated by positive expectancies, whereas the relation between negative urgency and use was mediated by the motive to drink alcohol to cope with subjective distress.

Moving beyond alcohol consumption as the outcome, several recent studies have examined the utility of the model in predicting alcohol-related problems, with promising results. For example, McCarthy, Miller, Smith, and Smith (2001b) found that positive expectancies mediated the relation between the disinhibition factor of the Sensation Seeking Scale (SSS; Zuckerman, 1979) and alcohol-related problems. A recent study by Corbin, Iwamoto, and Fromme (2011) expanded upon this study by examining both positive and negative expectancies as potential mediators. This study found that positive but not negative expectancies mediated the longitudinal relation between sensation seeking and impulsivity and alcohol-related problems in both men and women. Another study using a sample of Chinese college students also found that positive but not negative expectancies mediated the influence of impulsivity, though this study found that positive expectancies served as a mediator only for women (Fu et al., 2007). Thus, although an emerging literature provides support for the APM with respect to alcohol-related problems, more research is needed in this area.

In evaluating expectancies as a potential mediator of personality influences it is important to understand that expectancies may be reflective of multiple influences. In addition to differential learning, alcohol expectancies as examined in studies of the APM may also reflect, at least in part, individual differences in subjective responses to alcohol. Unfortunately, the use of self-report measures of expectancies has served as the norm in studies testing the AP model, leaving questions about the relative influence of subjective response and expectancies unanswered. Expectancies measured via self-report may reflect differences in learned expectancies despite similar alcohol-related responses, or they may reflect true individual differences in subjective responses to alcohol. Subjective effects of alcohol are relatively diverse, comprising both stimulant and sedative effects as well as both positive and negative effects. It is possible that individuals with certain personality traits focus their attention on particular aspects of their subjective response. In other words, personality traits may influence which aspects of subjective response (positive or negative and stimulant or sedative) individuals attended to, leading to different experiences of alcohol effects. This raises the possibility that differential alcohol-related learning based on true individual differences in subjective response to alcohol may serve as mediators of relations between trait risk factors and alcohol use and problems, in the same way that expectancies mediate these relations.

Although differential attention to certain aspects of subjective alcohol effects is a plausible mediator in the APM, it is also possible that a more purely biological process is involved given the well documented biological basis for both sensation seeking (Bardo et al., 2007; Slutske et al., 2002; Fulker et al., 1980; Koopmans et al., 1995; Stoel et al., 2006) and subjective response to alcohol (Schuckit, 1998; Schuckit, 1999). Levels of subjective response have been linked to family history of alcoholism (Schuckit, 1980; Schuckit, 1984; Newlin & Thomson, 1990), and behavioral genetic analyses indicate that sensation seeking also has a heritable biological basis (Bardo et al., 2007). Further, differences in brain dopamine function have been implicated in both risk for alcohol use and problems (Schuckit, 1999) as well as in higher levels of sensation seeking (Bardo et al., 2007). Because the current study did not employ biological or genetic measures, we are not in a position to directly investigate this alternate hypothesis. Nonetheless, it is important to recognize that common biological mechanisms could explain differences in both personality and subjective response (rather than the differential learning process we are proposing). Thus, evidence for mediation by subjective response to alcohol would provide only tentative support for differential learning of subjective alcohol effects, pending studies designed to rule out a more purely biological explanation.

In examining subjective response to alcohol as a potential mediator of the influence of trait behavioral undercontrol on drinking outcomes, a straightforward comparison can be drawn to the expectancy literature. For both expectancies and subjective response to alcohol, positive and negative pathways have been examined. The broader literature on expectancies supports the predictive utility of both types of expectancies, though effects of personality traits operating through positive expectancies have been more consistently identified than those operating through negative expectancies (see Jones, Corbin, and Fromme, 2001 for review). Much like the factor structure of expectancies, examination of the factor structure of subjective response has identified both positive and negative aspects of individual responses to alcohol.

The Differentiator Model (DM), as outlined by Newlin and Thomson (1990) describes the nature of the relations among stimulant and sedative alcohol effects and risk for increased use and alcohol-related problems. The DM posits that high risk individuals experience increased sensitivity to positive, stimulating effects of alcohol (typically on the ascending limb of the blood alcohol curve) and decreased sensitivity to negative, sedating effects of alcohol (typically on the descending limb). Although this pattern of biphasic effects appears to be universal (Morean & Corbin, 2010) individual differences in the degree to which stimulation and sedation are experienced can help explain risk for negative alcohol-related outcomes (King et al., 2011).

Consistent with the DM, the experience of increased stimulation predicts increased within-session consumption (Corbin, Gearhardt, & Fromme, 2008), and groups with known risk factors for alcohol-related problems report stronger stimulant effects. Both heavy drinkers and alcoholics show increased stimulation, particularly on the ascending limb, as compared to social drinkers (King, de Wit, McNamara, & Cao, 2011; King, Houle, de Wit, Holdstock, & Schuster, 2002; Thomas, Drobes, Voronin, & Anton, 2004; Quinn & Fromme, 2011). Importantly, stronger stimulant effects predict higher levels of future binge drinking among heavy drinkers (King et al., 2011). These findings support the idea that stimulant effects correspond to positive expectancies, leading to increased consumption.

Although both the expectancy and subjective response literatures provide strong support for the argument that positive effects (positive expectancies and positive subjective response) play a critical role in conferring risk for alcohol use and alcohol-related problems, there is an important difference in the types of positive effects examined across studies. Studies of positive expectancies often combine both positively reinforcing (e.g. increased sociability) and negatively reinforcing (e.g. tension reduction) effects. In contrast, studies of subjective alcohol effects have tended to focus exclusively on the positively reinforcing effects (e.g. stimulation). One exception to this is a relatively separate literature on Stress-response Dampening (SRD) effects of alcohol. Studies on SRD have typically focused on response to alcohol under very specific conditions (e.g. following a social stressor), using measure of mood that were not specifically designed to capture subjective alcohol effects. Further, results of these studies have been mixed. Early studies of SRD showed that individuals who were high on behavioral undercontrol experienced increased SRD effects (Sher & Levenson, 1982), but the robustness of this relation was questioned in later replications (Sher & Walitzer, 1986; Sayette, 1999). More recent research focused on the association of other personality traits and SRD demonstrated that extraversion was associated with increased SRD effects under certain conditions (Armeli et al., 2003). Given that there is some evidence for individual differences in negatively reinforcing effects of alcohol, it is important that studies address this aspect of subjective response. Unfortunately, the most widely used measures of subjective response, including the one used in the current study, do not capture potentially negatively reinforcing alcohol effects (BAES; Martin, Earleywine, Musty, & Perrine, 1993), a problem highlighted in a recent review of research on subjective response (Morean & Corbin, 2010). Thus hypotheses regarding positive subjective response in the current study were limited to the positively reinforcing (e.g. stimulation) effects of alcohol.

Although the range of measures differs across studies of expectancies and subjective response, the results are consistent in identifying a positive relation between positive effects (expectancies/subjective response) and drinking behavior. The evidence for the role of negative expectancies/subjective response is more mixed. Whereas tests of the AP model have consistently supported the idea that positive expectancies mediate risk associated with trait risk factors

(Corbin, Iwamoto, and Fromme, 2011; Fu, Ko, Wu, Cherng, and Cheng, 2007; McCarthy, Miller, Smith, and Smith, 2001b), studies have inconsistently shown that negative expectancies serve as mediators (Anderson, Smith, and Fischer, 2003), and the broader literature on expectancies shows inconsistent associations between negative expectancies and drinking outcomes (See Jones, Corbin, & Fromme, 2001 for a review). In contrast, negative or sedative subjective responses have been consistently identified as predictors of drinking behavior (King et al., 2011; Schuckit, 1994; Schuckit et al., 2007). For example, studies by Schuckit and colleagues (Schuckit, 1994; Schuckit et al., 2007) have demonstrated that a low level of response to sedating and impairing effects of alcohol is longitudinally predictive of alcohol related outcomes up to 25 years later. Given the strength of this literature, and the absence of prior studies evaluating subjective response as a mediator in the APM model, it will be important to evaluate both positive (stimulant) and negative (sedative) subjective alcohol effects as possible mediators of the relation between trait risk and alcohol-related outcomes.

To date, we were able to identify only one study that examined the relation between trait risk factors and subjective response to alcohol. Shannon, Staniforth, McNamara, Bernosky-Smith, and Liguori (2011) found no significant relation between self-reported trait impulsivity and subjective alcohol response measures. They did, however find significant relations between a response inhibition impulsivity task and subjective response to alcohol, with behavioral disinhibition on a go-stop task associated with higher levels of sedation and lower levels of stimulation following alcohol consumption. Unfortunately, a number of methodological issues made these unexpected findings difficult to interpret. Most importantly, the study was not placebo controlled, so the relation between disposition and subjective response could have been due to either expectancy or true differences in subjective response to alcohol. Further, the administration of alcohol in a sterile laboratory context may have affected subjective response ratings, resulting in higher levels of sedation and lower levels of stimulation. While this study provides preliminary evidence that disposition may influence subjective response to alcohol, additional studies are needed, particularly studies with placebo controls.

To determine the relative importance of differential learning and differences in subjective response as mediators of trait influence, it is necessary to first investigate the extent to which trait-like characteristics are associated with individual differences in response to alcohol (relative to placebo). Thus, the first goal of the current study was to determine if personality uniquely influences the experience of alcohol effects relative to expectancies regarding those effects. Based on prior results of studies testing the APM, higher levels of sensation seeking (SS) were expected to be associated with *greater* stimulant response and *lesser* sedative response. Further, we hypothesized that the relation between SS and subjective effects would differ by beverage condition (placebo vs. alcohol). Although higher levels of SS were expected to be associated with stronger stimulant and weaker sedative response to both placebo and alcohol, the magnitude of these effects was expected to be larger among individuals in the alcohol condition.

The strategy for testing the full mediation models was contingent on the results of the prior set of analyses. We planned to conduct separate analyses in the alcohol and placebo groups, regardless of the outcomes of the prior analyses. In contrast, we planned to test models in the combined sample (alcohol and placebo) only in the absence of significant interactions between beverage condition and sensation seeking in the prediction of expectancies/subjective response. The former approach effectively provides separate tests of the APM for expectancy (placebo response) and subjective response (alcohol response), whereas the latter approach would replicate and extend the existing literature by evaluating an implicit measure of expectancies as a mediator of the relation between sensation seeking and drinking outcomes.

In the separate models by beverage condition, we anticipated that subjective response under placebo (both stimulant and sedative) would mediate the relation between SS and both alcohol use and alcohol-related problems. In support of this hypothesis, there is consistent evidence in the literature that subjective response under placebo implicitly captures expectancies (Marlatt and Rohsenow, 1980; Rohsenow and Marlatt, 1981; Testa et al, 2005). Of central importance to the current study, we anticipated that subjective response to alcohol would mediate the association between SS and alcohol-related outcomes (both alcohol use and related problems). Although the pattern of hypothesized results is the same as described for the placebo condition, we expected the indirect effects of SS operating through subjective effects to be stronger than the corresponding indirect effects within the placebo condition. The difference in magnitude of indirect effects across beverage condition was expected to be largest for sedative effects for which subjective response has much more consistently predicted alcohol problems than have expectancies. Hypotheses for the model collapsed by beverage condition were the same as for the placebo group described previously.

Chapter 2

METHOD

Participants

The proposed analyses included data from 236 participants who completed an alcohol administration session in a simulated bar lab and follow-up surveys one to two weeks following the lab session. The study took place over a two year period across two sites. Participants were recruited from college campuses in New Haven county and from the greater New Haven community and from the Arizona State University campus and surrounding community. The sample was predominately male (74.7%) and Caucasian (76.5%) with a mean age of 22.75 (SD = 2.32). Recruitment efforts included flyers, postings on Craig's list, and print advertisements indicating that individuals between the ages of 21 and 30 who drank and gambled were potentially eligible for an alcohol research study that paid $12 an hour with a $50 minimum total payment.

Measures

For complete copies of all measures see Appendix B.

Demographics

Age, gender, and ethnicity were included as covariates in all analyses. Gender and ethnicity were both entered as dichotomous variables, with gender coded as men = 0, women = 1, and ethnicity coded as non-Caucasian = 0 and Caucasian = 1.

Sensation Seeking

Sensation Seeking was assessed using the 11-item sensation seeking subscale of the Zuckerman-Kuhlman Personality Questionnaire (ZKPQ; Zuckerman, Kuhlman, Joireman, Teta, Kraft, 1993). This scale uses true-false questions to capture the desire to seek out experiences that are physiologically arousing. Sample items include “I like to have new and exciting experiences and sensations”, “I’ll try anything once”, and “I like wild “uninhibited” parties.” In the present study, the items of the SS scale of the ZKPQ demonstrated adequate internal consistency (Cronbach’s alpha= .722).

Subjective Response

Subjective response to alcohol and placebo was assessed using the Biphasic Alcohol Effects Scale (BAES; Martin, Earleywine, Musty, & Perrine, 1993), a 14 item unipolar adjective rating scale. The BAES is a self-report measure designed to capture stimulant and sedative subjective effects of alcohol. Seven items pertain to stimulant alcohol effects (e.g. energized and talkative) and seven items capture sedative alcohol effects (e.g. inactive and down). Participants were asked to use a scale where 0 = not at all, 5 = moderately, and 10 = extremely to rate their current subjective experience. Given clear evidence for alcohol's biphasic effects, we used the BAES stimulation score assessed as blood alcohol levels were rising, and the BAES sedation score assessed as blood alcohol levels were falling. Internal consistency reliability was adequate for stimulation (Cronbach’s alpha= 0.79), and good for sedation (Cronbach’s alpha= 0.82).

Alcohol Use

To retrospectively assess alcohol use, we used the Timeline Follow-Back Interview (TLFB; Sobell & Sobell, 1992). This study focused on weekly consumption as the outcome of interest from the TLFB. With the assistance of an interviewer, participants completed a 30-day calendar starting from the day of the initial lab session and working backwards. Participant provided daily drinking estimates for each day during that period of time. The TLFB provides a comprehensive measure of drinking frequency, and quantity, and the version used in the current study also asked about the time span over which each drinking episode occurred. Weekly consumption was calculated as the average number of drinks per week over the prior 30 days.

Alcohol-Related Problems

The experience of alcohol-related problems was assessed using the Rutgers Alcohol Problem Index (RAPI; White & Labouvie, 1989). This 23 item scale asked respondents to report how many times they experienced each negative consequence while drinking or because of their alcohol use in the last 3 months. Response categories included never, 1-2 times, 3-5 times, 6-10 times, and more than 10 times. Sample items included “neglected your responsibilities,” “kept drinking when you promised yourself not to,” and “passed out or fainted suddenly.” Examination of the RAPI data indicated that few participants had scores greater than 1 (1-2 times) for any item. Thus, to improve the overall distribution of the summary score, each consequence was rescored dichotomously (0 = not at all, 1 = 1 or more times), and these items were summed, creating a variable with values ranging from 0 to 23. Using this approach, the RAPI items demonstrated good internal consistency reliability (Cronbach's alpha= .85).

Procedures

Participant eligibility was determined using a phone screener which included the Daily Drinking Questionnaire (DDQ; Collins, Parks, & Marlatt, 1985) to assess the average number of drinks on each day of a typical week during the past three months. To be eligible, participants had to consume at least three drinks on one occasion at least once a week in the past three months. Also, the larger study from which this sample was drawn focused on gambling, so participants were also selected according to gambling-related inclusion criteria. Participants were asked if they had played poker in the last year, and if yes, their three favorite forms of gambling. Participants had to report having played poker in the last year and rank poker in their top three favorite forms to be considered for the study.

Exclusion criteria included adverse reactions to alcohol (for example, extreme flushing immediately after consuming even a small dose of alcohol), past or current enrollment in abstinence-oriented treatment programs for alcohol or gambling problems, and pregnancy (for women). Screener responses indicative of gambling or alcohol psychopathology did not serve to exclude an individual from participation as long as the individual expressed no desire to stop the behavior and was not enrolled in an abstinence-oriented treatment program currently or in the past. Participants reporting significant alcohol or gambling problems were provided with additional debriefing information about their risk for alcohol or gambling-related problems. Participants were also given information about resources in the community for treatment should they desire assistance in changing their alcohol or gambling behaviors.

Once a participant was selected as eligible for participation, they were scheduled in groups of 2 to 4 to attend the first of two sessions in the BARCA Lab, a naturalistic bar setting. This first session involved beverage administration (either alcohol or placebo) and assessment of subjective response. Participants were instructed to abstain from alcohol and drugs 24 hours prior to the study, to refrain from using nicotine products during the study, and to refrain from eating in the 4 hours preceding the study in order to control participant's baseline state and allow them to achieve the target blood alcohol level. Upon arrival, participants completed a consent form and were given a breathalyzer test to ensure that they had not consumed any alcohol. Females were given a pregnancy test. All participants then completed computerized cognitive tasks and beverage administration.

For beverage administration, all participants on a given night were randomly assigned as a block to either the active placebo or alcohol condition. The beverage condition was predetermined by a coin toss. In the alcohol condition, the volume of alcohol in each drink was adjusted based on the participants' gender and weight to better ensure the target breath alcohol concentration (BrAC) of 0.08 g%. In the alcohol condition, the beverage content was a ratio of one part 80 proof vodka to three parts mixer. In the placebo condition participants received beverages that contained one part vodka to four parts flat tonic, combined at a ratio of one part alcohol/tonic to three parts mixer, with a target BrAC of 0.01 g%. Use of an active placebo increases the credibility of the placebo condition and, while it includes a small dose of alcohol, the amount is considered insufficient to result in significant changes in subjective experience.

To ensure that research assistants who served the drinks remained blind to the beverage condition, one of the senior staff members (the PI, graduate students, or a Master's level project manager) prepared the beverages in the BARCA Lab before research assistants and participants entered the lab. The protocol supervisor was responsible for taking BAC readings at specific time intervals following beverage consumption to monitor participants' position on the blood alcohol curve as they completed the tasks.

After completing baseline tasks, participants were escorted into the BARCA Lab and administered one drink every ten minutes for a total of three drinks over thirty minutes. This was followed by a fifteen minute absorption period, after which participants' BrAC was verified by the protocol supervisor using a breathalyzer. Participants were then asked to complete a rating of their subjective response to alcohol. A series of computer tasks were then administered every 15-20 minutes with subjective response measures and BrACs assessed between tasks. This resulted in a total of 5 post-alcohol subjective response and BrAC assessments.

After the final BrAC reading, participants were debriefed about their beverage assignment. The protocol supervisor informed participants that, while some individuals received a high dose of alcohol, others received a low dose of alcohol. The minimal debriefing was necessary as placebo participants were allowed to leave at the end of the protocol. In accordance with the National Institute on Alcohol Abuse and Alcoholism Guidelines for Ethyl Alcohol Administration in Human Experimentation, participants in the alcohol condition were asked to remain in the laboratory until their BrAC dropped to 0.02 g % (measured by breathalyzer tests) and their behavior returned to normal. All participants, regardless of beverage condition, were scheduled for their second session and provided with transportation to their place of residence.

Participants returned to the lab one to two weeks after the beverage administration session for the follow-up session. Participants were administered the Time Line Follow Back (Sobell & Sobell, 1992) interview to assess drinking over the month prior to the lab session, and completed additional self-report measures assessing personality, positive and negative affect, social desirability, alcohol expectancies, drinking motives, and alcohol-related problems. Once participants completed the measures they were debriefed and paid $12 per hour, along with a $20 bonus for computerized tasks in which they were given the opportunity to win additional money.

Analytic Plan

Prior to conducting the primary analyses, distributions of all variables were examined for outliers and assumptions of normality. In the event that a variable was non-normally distributed, log transformations were used. After addressing variable distributions, partial correlations were examined to see if the associations among the variables were consistent with study hypotheses after controlling for covariates. Indices of multicollinearity to ensure that correlations among the predictor variables would not create problems in the analyses. Lastly, t-tests of differences between the two data collection sites (Yale and ASU) were conducted to determine if the samples differed on variables of interest. If differences by site were identified, site was entered as a covariate in subsequent analyses.

The primary data analyses were conducted in two phases. The first phase involved two separate simultaneous entry multiple regression analyses. These models test the hypothesis that the relation between SS and expectancies/subjective response would be moderated by beverage condition (alcohol or placebo). Separate models were tested for BAES stimulation (positive expectancies/subjective response) and BAES sedation (negative expectancies/subjective response). The measure of BAES stimulation was taken from the ascending limb assessment and the measure of BAES sedation was taken from the descending limb assessment, consistent with the theory of biphasic alcohol effects (Newlin &Thomson, 1990; Morean & Corbin, 2010). Baseline levels of subjective effects were used as covariates in the analyses to control for any baseline differences in levels of stimulation or sedation.

We anticipated that the relation between SS and subjective effects would differ by beverage condition for both stimulation and sedation. In the model testing BAES sedation, we hypothesized that the effect of SS (higher SS predicting *less* sedation) would be stronger for those in the alcohol condition as compared to placebo. In the model testing BAES stimulation, we anticipated that the effect of SS (higher SS predicting *greater* stimulation) would be stronger for those in the alcohol condition as compared to placebo.

In phase two, eight separate mediation models with four models (2 beverage by 2 expectancy/subjective response) for each outcome (alcohol use and alcohol-related problems) were tested. Because the models for alcohol use and alcohol-related problems were identical other than the outcome measure and the inclusion of baseline alcohol use in the models for problems, only the four models with alcohol use as the outcome are described below. Separate models were tested for each mediator (stimulation and sedation) within each beverage condition (alcohol and placebo). Tests of the mediation models used the steps put forth by Baron and Kenny (1986). Each path was estimated using Ordinary Least Squares (OLS) regression. In the first step, the test of the *c* path, we tested the hypothesis that the independent variable (SS) would be significantly associated with the outcome (i.e. alcohol use). The second step involved the test of the *a path*, in which the mediator (simulation or sedation) was used as the criterion variable and the independent variable (SS) served as the predictor. Step three tested the *b path* to show that the mediator was associated with the outcome variable by simultaneously entering the mediator (stimulation or sedation) and independent variable (SS) as predictors in a regression equation with alcohol use as the criterion.

If the pre-requisites for testing mediation were met, the significance of indirect effects was assessed using PRODCLIN2, which utilizes the product of coefficients method (Fritz & MacKinnon, 2007). This method is preferable to the Sobel test because it is more powerful and takes into account the asymmetric nature of the confidence intervals (MacKinnon, Warsi, & Dwyer, 1995). PRODCLIN2 computes critical values using the regression coefficients and standard errors of the *a* and *b* paths, the correlation between the a and b paths, and type one error rate. Confidence intervals are computed for each critical value. If the confidence interval does not contain the value of zero, the indirect effect is significant.

In the event that the relative magnitude of the mediated effects differed in the alcohol and placebo conditions (as hypothesized), the SPSS Macro provided by Preacher and Hayes (2008) was used to formally test the hypothesis that the indirect effects differed significantly by beverage condition.

Chapter 3

RESULTS

Examination of the distributions of all variables for outliers and assumptions of normality revealed that age, sedation (baseline, ascending, and descending limb), and weekly drinking were skewed. These variables were log transformed for all subsequent analyses with the exception of age. Age remained skewed even after log transformation; therefore, the original age variable was used in the analyses. All predictor variables were centered for the regression analyses. T-tests were used to examine potential differences between the two data collection sites on key variables. There was a significant effect for baseline sedation, and because Levene's test showed that the homogeneity of variance assumption was violated, $F = 7.496$, $p = .007$, we used the corrected t-test, $t(190.217) = 3.73$, $p < .001$. There was also a significant effect for descending limb sedation, $t(229) = 2.894$, $p = .004$. These significant effects indicated that Yale participants reported higher levels of sedation than ASU participants. There was also a significant effect for baseline stimulation, $t(230) = -1.63$, $p = .017$, with ASU participants reporting higher levels of baseline stimulation than Yale participants. Lastly, there was a significant effect for sensation seeking, $t(229) = -2.41$, $p = .017$, with ASU participants reporting higher levels of sensation seeking than Yale participants. Given the significant differences in key study variables across the two sites, we controlled for site in all subsequent analyses.

Partial Correlation Analyses

Partial correlations among the variables of interest, controlling for the covariates of sex, age, ethnicity, and site, were generally in line with study hypotheses though not all hypothesized relations were statistically significant (see Table 2). There were only 2 correlations that were in the opposite direction of hypotheses. The correlation between sensation seeking and sedation was positive, though not significant (r = .093, p = .185). Surprisingly, the association between sedation and alcohol problems was positive and significant (r = .165, p = .018). We also examined partial correlations among the variables of interest separately by beverage condition (see Table 3 and Table 4).

Multiple Regression Analyses

Simultaneous entry multiple regression analyses were then conducted to test study hypotheses regarding sensation seeking by beverage interactions in the prediction of expectancies/subjective response. Separate models were tested for BAES stimulation (positive expectancies/subjective response) and BAES sedation (negative expectancies/subjective response). No variables in the analyses exhibited problems with multicollinearity, with all tolerance values > .2 and VIF values < 4. We report the standardized coefficients in the text, with unstandardized regression coefficients and standard errors in Tables 4-7.

Sensation Seeking by Beverage Condition Interactions

The first model tested the hypothesis that the relation between SS and BAES stimulation (ascending limb) would be moderated by beverage condition (alcohol or placebo), with baseline level of stimulation and site used as covariates in the analysis. As hypothesized, higher levels of SS were associated with the experience of greater stimulation, B = 9.946, SE = 3.094, β = .160, p = .001. Although the overall model (including the interaction term) was significant, F (5, 221) = 38.972, p <.001, the interaction term did not account for significant variability in stimulation above and beyond SS and beverage condition, B = 0.975, SE = 6.131, β = .011, p = .874. Thus, the relation between SS and stimulation did not differ by beverage condition.

The second interaction model tested the hypothesis that the relation between SS and BAES sedation (descending limb) would be moderated by beverage condition, with baseline level of sedation and site used as covariates. Although higher levels of SS were associated with less sedation, B = -.018, SE = .127, β = -.008, this association was not statistically significant, p = .887. Further, although the overall model (including the interaction term) was significant, F (5, 213) = 15.625, p <.001, the interaction term did not account for significant variability in sedation above and beyond SS and beverage condition, B = -.248, SE = .253, β = -.081, p = .328. Thus, the relation between SS and BAES sedation did not differ by beverage condition.

Given that the hypothesized interactions did not emerge for either of the proposed mediating variables (stimulation or sedation), we conducted separate mediation models by beverage condition as well as models that were collapsed across beverage condition. The results of the analyses conducted separately by beverage condition were very similar to the results in the combined sample. Thus, to simplify the presentation of the results, results of the four models (2 mediators and 2 outcomes) for the combined sample are presented in the text, with the 8 separate models (4 within each beverage condition) presented in Appendix C.

Mediation Models for Weekly Drinking

The first mediation model for weekly drinking tested the hypothesis that the relation between SS and weekly consumption would be mediated by BAES stimulation. In the first linear regression model for weekly consumption, SS, age, sex, site, and ethnicity were entered as simultaneous predictors, accounting for significant variability (12.3%) in weekly consumption, F (5, 216) = 6.033, $p <$ .001. Sensation Seeking, β = .201, p = .003 and sex, β = -.207, p =.002 were both significant predictors of consumption with men and those reporting higher levels of sensation seeking reporting greater consumption. Age, β = -.031, p = .634, site, β = -1.07, p = .100, and ethnicity, β = .114, p = .077 were not significant predictors.

The same variables were then examined as predictors of BAES stimulation, with the addition of BAES baseline stimulation included to control for baseline differences. These variables accounted for significant variability in stimulation (44.70%), F (6, 210=1) = 28.393, p < .001. Sensation Seeking, β = .175, p = .001, and baseline BAES stimulation, β = .620, p < .001 were both significant predictors of BAES stimulation with higher levels of SS and baseline stimulation associated with more BAES stimulation. Age, β = .069, p = .185, sex,

β = -.048, p =.381, site, β = .000, p =.994, and ethnicity, β = .053, p = .304 were not significant predictors.

Lastly, the full mediation model was tested, accounting for 13.1% of the variance in weekly drinking, F (7, 210) = 4.515, p < .001. Sensation Seeking, β = .193, p = .006 and sex, β = -.191, p =.006 remained significant predictors, with men and those reporting higher levels of sensation seeking reporting greater consumption. Baseline BAES stimulation, β = .047, p =.580, age, β = -.039, p =.555, site, β = -.123, p =.065, and ethnicity, β = .118, p =.072 were not significant predictors. Importantly, ascending limb BAES stimulation did not emerge as a significant predictor of weekly drinking when controlling for SS and the covariates, β = .061, p = .479. Therefore, the relation between SS and weekly consumption was not mediated by BAES stimulation.

The second mediation model tested the hypothesis that the relation between SS and weekly drinking would be mediated by BAES sedation. The first linear regression model testing SS, age, sex, site, and ethnicity as simultaneous predictors of weekly drinking was already tested in the first mediation model, confirming a significant direct relation between SS and weekly consumption, F (5, 216) = 6.003, p < .001. The same variables were then examined as predictors of BAES sedation, with the addition of BAES baseline sedation included to control for baseline differences. These variables accounted for significant variability in sedation (31.6%), F (6, 203) = 17.096, p < .001. Baseline BAES sedation, β = .414, p < .001, age, β = -.138, p = .019, sex, β = .213, p =.001, site, β

= -.159, *p* =.008, and ethnicity, *β* = .169, *p* = .004 were each significant predictors of BAES sedation with women, Caucasians, those with higher levels of baseline sedation, participants from Yale, and younger participants reporting more BAES sedation. Sensation Seeking, *β* = .069, *p* = .254 was not a significant predictor of sedation. Therefore, the test of the "a path" was not significant.

In the full mediation model, the predictor variables accounted for 13.1% of the variance in weekly drinking, F (7, 202) = 4.346, $p < .001$. Sensation Seeking, *β* = .194, *p* = .006 and sex, *β* = -.211, *p* =.003 remained significant predictors with men and those higher in sensation seeking reporting higher levels of weekly drinking. Baseline BAES sedation *β* = .047, *p* =.536, age, *β* = -.057, *p* =.401, site, *β* = -.102, *p* =.145, and ethnicity, *β* = .131, *p* =.056 were not significant predictors. Importantly, descending limb BAES sedation did not emerge as a significant predictor of weekly drinking when controlling for SS and the covariates, *β* = -.065, *p* = .421. Therefore, the relation between SS and weekly consumption was not mediated by BAES sedation.

Mediation Models for Alcohol-Related Problems

The first mediation model for alcohol-related problems tested the hypothesis that the relation between SS and problems would be mediated by BAES stimulation. In the first linear regression model, SS, weekly drinking, age, sex, and ethnicity were entered as simultaneous predictors, accounting for significant variability (24.7%) in alcohol problems, F (6, 215) = 11.744, $p < .001$. Sensation Seeking, *β* = .263, *p* = .001, weekly drinking, *β* = .362, $p < .001$, age, *β*

= -.137, *p* = .024, sex, *β* = .159, *p* =.014, and site, *β* = -.121, *p* = .047, were each significant predictors of the experience of alcohol related problems, with women, younger participants, participants from Yale, and those reporting higher levels of sensation seeking and weekly drinking reporting more problems. Ethnicity, *β* = -.088, *p* = .142 was not a significant predictor.

The same variables were then examined as predictors of BAES stimulation, with the addition of BAES baseline stimulation included to control for baseline differences. These variables accounted for significant variability in stimulation (44.8%), *F* (7, 210) = 24.351, *p* < .001. Sensation Seeking, *β* = .167, *p* = .003, and baseline BAES stimulation, *β* = .617, *p* < .001 were both significant predictors of BAES stimulation with higher levels of SS and baseline stimulation associated with more BAES stimulation. Weekly drinking, *β* = .039, *p* = .709, Age, *β* = .071, *p* = .178, sex, *β* = -.040, *p* =.469, site, *β* = .005, *p* =.922, and ethnicity, *β* = .049, *p* = .353 were not significant predictors.

When the full mediation model was tested, the predictor variables accounted for 25.1% of the variance in the experience of alcohol problems, *F* (8, 209) = 8.765, *p* < .001. Sensation Seeking, *β* = .258, *p* = .001, weekly drinking, *β* = .366, *p* < .001, age, *β* = -.132, *p* =.033, and sex, *β* = .151, *p* =.022, remained significant predictors. Baseline BAES stimulation, *β*= -.078, *p* =.328, site, *β* = -.110, *p* =.080, and ethnicity, *β* = -.099, *p* =.108 were not significant predictors. Importantly, ascending limb BAES stimulation did not emerge as a significant predictor of alcohol problems when controlling for SS and the covariates, *β* =

.003, $p = .972$. Therefore, the relation between SS and alcohol related problems was not mediated by BAES stimulation.

The second mediation model tested the hypothesis that the relation between SS and the experience of alcohol problems would be mediated by BAES sedation. The first linear regression model examining SS, weekly drinking, age, sex, and ethnicity as simultaneous predictors of alcohol problems was already tested in the previous model, confirming a significant direct relation between SS and alcohol problems, F (6, 215) = 11.744, $p < .001$. The same variables were then examined as predictors of BAES sedation with the addition of BAES baseline sedation included to control for baseline differences. These variables accounted for significant variability in sedation (33.8%), F (7, 202) = 14.721, $p < .001$. Baseline BAES sedation, $\beta = .415$, $p < .001$, age, $\beta = -.140$, $p = .017$, sex, $\beta = .202$, $p = .001$, site, $\beta = -.163$, $p = .007$, and ethnicity, $\beta = .174$, $p = .003$ were each significant predictors of BAES sedation with women, Caucasians, those with higher levels of baseline sedation, and younger participants reporting more BAES sedation. Sensation Seeking, $\beta = .078$, $p = .204$, and weekly drinking, $\beta = -.049$, $p = .421$ were not significant predictors of sedation. Therefore, the test of the “a path” was not significant.

In the full mediation model, the predictor variables accounted for 32.1% of the variance in problems, F (8, 201) = 11.874, $p < .001$. Sensation Seeking, $\beta = .239$, $p < .001$, baseline sedation, $\beta = .196$, $p = .004$, weekly drinking, $\beta = .396$, $p < .001$, sex, $\beta = .164$, $p = .012$, and ethnicity, $\beta = -.151$, $p = .014$ were each significant predictors of problems. Age, β = -.106, p =.079 and site, β = -.070, p =.258 were not significant predictors. Importantly, descending limb BAES sedation did not emerge as a significant predictor of problems when controlling for SS and the covariates, β = .072, p = .312. Therefore, the relation between SS and the experience of alcohol problems was not mediated by BAES sedation.

In sum, none of the four collapsed mediation models supported the hypothesis that the relation between SS and weekly drinking (or problems) would be significantly mediated by BAES expectancies/subjective effects. The two outcome variables (weekly drinking and problems) regressed on expectancies/subjective effects (accounting for SS) were not significant in any of the models, and expectancies/subjective effects regressed on SS were significant only for BAES stimulation.

As indicated previously, when the models were run separately by beverage condition, the results were largely consistent with the models conducted in the full sample. None of the 8 models demonstrated support for mediation of the relation between SS and drinking outcomes by expectancies/subjective response (either stimulation or sedation). Consistent with the models in the combined sample, SS was not a significant predictor of sedation under alcohol or placebo, and neither sedation nor stimulation significantly predicted drinking outcomes for either group. There were only a few relations that differed by beverage condition. The relations between SS and use were only significant in the placebo group, while the relations between SS and problems were significant in both beverage conditions.

Further, the path between SS and BAES stimulation was only significant in the alcohol condition. To some extent, these differences may simply reflect a loss of power due to the decreased sample size. For example, the standardized regression coefficient for sensation seeking in the model predicting use in the alcohol condition was $\beta = .164$, a value that was not dramatically different from the one in the analyses collapsed across beverage condition, $\beta = .201$. The full results of the 8 separate models by beverage condition are presented in Appendix C.

Given that the pre-requisites for testing mediation were not met, we did not test the significance of indirect effects utilizing the product of coefficients method (PRODCLIN2; Fritz & MacKinnon, 2007). Further, because no indirect effects were significant in either beverage condition, we did not compare the relative magnitude of the mediated effects in the alcohol and placebo conditions using the SPSS Macro provided by Preacher and Hayes (2008).

Post-Hoc Analyses

The women in the sample were much less likely to meet the drinking and gambling criteria than were men. Because of these inclusion criteria, our sample of women was less representative of the broader population (relative to men), calling into question the extent to which the findings among women are generalizable. Therefore, we replicated all analyses reported above (moderation analyses and path analytic models collapsed and separate by beverage condition) among men only to determine if relations among study variables were more consistent with study hypotheses within this group. The four mediation models collapsed across beverage condition and in the placebo condition were comparable to the models in the full sample in that none of the models supported the hypothesis that the relation between SS and weekly drinking (or problems) would be significantly mediated by BAES subjective effects.

In the sample of men, there were three paths within the alcohol condition that differed from the analyses in the full sample. Sensation seeking was not a significant predictor of BAES stimulation in either the use or problems models. The standardized regression coefficients ranged from β = .139-.156 with *p* values ranging from *p* = .130-.175. Significance in the full sample and lack of significance in the sample of men in models separate by beverage condition likely reflects a decrease in power and not a substantive change. Additionally, sensation seeking was not a significant predictor of problems in the alcohol condition; the c path was only significant in the placebo condition in the sample of men. Despite these few differences, overall the findings suggest that the original pattern of results was not substantially impacted by the unique sample of women included in the study. Out of the 38 paths examined in the regression models in the sample of men, only 4 paths differed from the full sample.

We also conducted post-hoc analyses replicating all regression models (moderation analyses and path analytic models in the combined samples and separately by beverage condition) without controlling for baseline levels of subjective response as their inclusion represented a very stringent test, particularly given the sample size. Again, the results of the analyses were essentially unchanged. Moderation analyses did not find evidence for SS by beverage condition interactions for either BAES stimulation or sedation. In the path analytic models, very few paths significantly differed from the prior analyses. In the collapsed models, SS fell away as a significant predictor of BAES stimulation in the model for problems, though this path just barely missed the cutoff for significance, $\beta = .137$, $p = .051$. Further, BAES sedation emerged as a significant predictor of alcohol-related problems, $\beta = .165$, $p = .011$. This path was also significant in the placebo group, $\beta = .248$, $p = .008$, demonstrating that the effect observed in the combined sample was driven by the placebo group. Within the alcohol condition, the effect of sensation seeking on ascending limb BAES stimulation in the models for both use and problems were no longer significant when baseline BAES stimulation was not included in the model. However, the standardized regression coefficients for these paths were $\beta = .180$ in the model for use and $\beta = .158$ in the model for problems, values very close to that of the original values controlling for baseline BAES stimulation, $\beta = .217$ and $\beta = .200$. Overall, the findings from the post hoc analyses suggest that the results of the original analyses were not substantially impacted by the inclusion of baseline subjective response as a covariate. Of the 38 paths examined in the regression models only 5 differed between the analyses that controlled for baseline BAES scores and the models that did not control for baseline scores.

Chapter 4

DISCUSSION

Previous studies on the APM have supported positive expectancies, and to a lesser extent negative expectancies, as mediators of the relation between trait-like personality characteristics and alcohol outcomes. However, expectancies measured via self-report may reflect differences in learned expectancies in spite of similar alcohol-related responses, or they may reflect true individual differences in subjective responses to alcohol. To date, no study of the APM has examined subjective response following alcohol administration as a potential mediator of the relation between personality and drinking outcomes. The current study addressed this gap in the literature by assessing the relative roles of expectancies and subjective response as mediators within the APM. We hypothesized that both expectancies and subjective response would mediate effects of sensation seeking on alcohol use and problems but that subjective response would be a stronger mediator as it captures individual differences in both expectancies and the actual experience of alcohol effects. Regarding direction of effects, we expected results to parallel previous findings, with higher levels of sensation seeking (SS) associated with stronger positive expectancies/subjective response (e.g. stimulation), and weaker negative expectancies/subjective response (e.g. sedation). In turn, stronger stimulant and weaker sedative effects were expected to relate to heavier drinking and more alcohol-related problems.

Consistent with study hypotheses and previous literature, sensation seeking was significantly associated with heavier drinking and more problems in models collapsed across beverage condition. The relation between higher levels of sensation seeking and increased alcohol use and problems is consistent with the profile for this personality construct, which includes preference for physiologically arousing and novel experiences and willingness to take risks to obtain this arousal. Contrary to hypotheses, there was not a significant interaction between sensation seeking and beverage condition in the prediction of subjective response (stimulation and sedation respectively) when controlling for baseline subjective response and other relevant covariates. While the direction of effects were as hypothesized, with higher levels of sensation seeking related to more stimulation and less sedation, these relations did not differ by beverage condition, and the inverse association between SS and BAES sedation was not statistically significant under alcohol or placebo. The context of the data collection may have played a significant role in these findings. The simulated bar lab provides a cue-rich environment that is likely stimulating to participants regardless of beverage condition. As a result, participants may have reported higher levels of stimulation under both alcohol and placebo, thus making an interaction between sensation seeking and beverage condition difficult to detect. As support for this contention, the mean level of stimulation under alcohol was 35.095 while the mean level under placebo was 28.25. These mean levels demonstrate that placebo participants experienced a great deal of stimulation, nearly comparable to the alcohol group.

Further, the highly stimulating environment may have attenuated the experience of sedative effects regardless of beverage condition. The mean level of stimulation across both beverage conditions was 31.61 while the mean level of sedation was 16.01, suggesting the participants experienced much less sedation relative to stimulation overall in this drinking context.

Failure to detect significant SS by beverage condition interaction effects may also have been due to a lack of power associated with the modest sample size. Evidence for this possibility, particularly in the model for stimulation, lies in the analyses that were conducted separately by beverage condition. While sensation seeking did not significantly predict positive expectancies (BAES stimulation under placebo), sensation seeking did predict positive subjective response (BAES stimulation), suggesting a potentially unique role for alcohol effects. Future studies should investigate these possibilities by performing tests of interaction on data collected in a less stimulating environment and using larger samples.

Sensation seeking was not significantly associated with BAES sedation under alcohol or placebo. Although contrary to study hypotheses, these results are not entirely inconsistent with prior literature on the Acquired Preparedness Model. Prior studies have shown inconsistent relations between trait-like personality characteristics and negative expectancies and negative expectancies have inconsistently mediated effects of personality characteristics on drinking behavior (Jones, Corbin, and Fromme, 2001; Corbin, Iwamoto, and Fromme, 2011; Fu, Ko, Wu, Cherng, and Cheng, 2007; McCarthy, Miller, Smith, and Smith, 2001b; Anderson, Smith, and Fischer, 2003). The present study extends the existing literature by replicating null findings regarding relations between SS and negative expectancies using an implicit measure of negative expectancies (subjective response to placebo). Further, the current findings extend the results to subjective response in an alcohol challenge suggesting that sensation seeking is not strongly associated with either expectations of or the experience of sedation.

Although results were partly consistent with study hypotheses with respect to relations between sensation seeking and expectancies/subjective response (i.e. significant associations between SS and BAES stimulation), neither BAES stimulation nor sedation predicted either weekly drinking or alcohol-related problems in the models collapsed across beverage condition. These results were surprising given that previous literature has consistently supported increased positive subjective response to alcohol (stimulation) and decreased negative subjective response (sedation) as predictors of heavier alcohol use (King et al., 2011; Corbin, Gearhardt, & Fromme, 2008; King, Houle, de Wit, Holdstock, & Schuster, 2002; Thomas, Drobes, Voronin, & Anton, 2004; Quinn & Fromme, 2011; Schuckit, 1994; Schuckit et al., 2007). There are several possible explanations for these unexpected findings. First, there was a restricted range of drinking behavior in the sample due to the inclusion and exclusion criteria. Participants were required to be above certain cutoffs in terms of their typical weekly drinking (at least three drinks on one occasion at least once a week in the past three months). Those endorsing behavior indicative of alcohol dependence and/or desire to abstain from alcohol (past or current enrollment in abstinence-oriented treatment programs for alcohol) were also excluded. Thus, the sample was limited to heavy but not dependent drinkers, restricting the range of possible drinking habits. However, previous longitudinal studies have shown that binge drinkers (who do not meet the criteria for alcohol dependence) show even stronger relations between stimulation and sedation and later binge drinking than do lighter drinkers (King et al., 2011). Longitudinal design and temporal precedence in the measured variables may be important in capturing these relations in heavy non-dependent drinkers. Nevertheless, while restriction of range may have played some small role in making effects difficult to detect, the lack of findings cannot be attributed solely to this attribute of study participants.

It is important to note that the zero order correlation between stimulation and alcohol use was positive and significant (r = .142, p <.05), suggesting a significant relation between stimulation and alcohol use. It was only when effects of SS on alcohol use were controlled for that stimulation was not significantly related to alcohol use. This suggests that SS and stimulation account for shared variability in drinking behavior. When sensation seeking and stimulation were included together in the regression model, the variability in alcohol use was largely explained by sensation seeking. Indeed, previous studies that have supported stimulant subjective response as a predictor of alcohol use have not typically accounted for sensation seeking. Thus, failure to find effects for the b paths in which alcohol outcomes were regressed on positive subjective effects may be due, at least in part, to the inclusion of sensation seeking in the models. There may be an underlying risk factor for increased alcohol use that is associated with both SS and stimulant alcohol response. For example, it is possible that a biological process is involved given the well documented biological basis for both sensation seeking (Bardo et al., 2007; Slutske et al., 2002; Fulker et al., 1980; Koopmans et al., 1995; Stoel et al., 2006) and subjective response to alcohol (Schuckit, 1998; Schuckit, 1999). Therefore, a common underlying biological or genetic mechanism may explain the shared variability of these risk factors with drinking behavior and related problems.

Although the failure of BAES stimulation to predict alcohol use and related problems in the alcohol condition may be partly attributed to the inclusion of sensation seeking, this does not explain the null findings in the placebo condition. Previous studies of the APM have found significant mediation, specifically showing that positive expectancies are predictive of drinking outcomes, accounting for SS and other trait-like characteristics. This suggests that, while explicit positive expectancies are related to alcohol use after controlling for levels of sensation seeking, implicit expectancies (at least as assessed by a placebo manipulation) are not. This finding parallels the broader literature on implicit and explicit expectancies. Previous studies suggest that the correlation between implicit and explicit expectancies is only modest, with meta-analytic studies finding an average correlation of approximately $r = .25$ (Reich, Below, and Goldman, 2010) with relatively small effect sizes. Further, the relation between implicit and explicit expectancies and drinking outcomes differs (Larsen, Engels, Wiers, Granic, and Spijkerman, 2012; Reich et al., 2010) and there is evidence that implicit expectancies account for variance in drinking behavior over and above explicit expectancies (Houben and Wiers, 2008; Wiers, Van Woerden, Smulders, and de Jong, 2002). Thus, it is not surprising that the current study's findings differed from previous literature in the APM given that the two types of expectancies capture different mechanisms. It is important to note that the implicit measure used in this study (subjective response under placebo) has not been widely used in the literature on the relation between implicit expectancies and alcohol-related outcomes, nor has it been used in studies comparing the correlation between implicit and explicit expectancies. Rather, implicit measures have typically been formal measures of attentional bias (e.g. the Stroop Task) and memory associations using reaction time measures (e.g. the Implicit Association Test). Therefore, future studies should employ both explicit measures and multiple types of implicit measures of expectancies (subjective response to placebo, Stroop, IAT) to examine the potentially different mediating pathways of implicit and explicit expectancies of the relation between personality and alcohol-related outcomes.

In addition to their implicit nature, the measure of expectancies in the current study differed from those used in past studies in terms of the specification of the parameters of the drinking episode. Whereas explicit measures do not specify the dose, context, or timing of the drinking episode, the current study assessed implicit expectancies regarding a specific anticipated dose (.08 g%) consumed over a specific time frame (30 minutes) in a specific context (bar setting). Future studies comparing implicit and explicit measures as mediators within the APM would benefit from use of an explicit measure of expectancies that specifies parameters of the imagined drinking episode. For example, the AEAS (Morean, Corbin, & Treat, in press) asks participants to imagine a specific dose and assesses expectancies of alcohol effects as BACs both rise and fall. As an added benefit, the AEAS has a subjective response complement (SEAS; Morean, Corbin, & Treat, under review) with parallel item content.

Given the study's unexpected findings, particularly with respect to relations between BAES stimulation and sedation and drinking outcomes, we explored possible sample and analytic explanations for the largely null findings. These post-hoc analyses revealed that the pattern of original findings was consistent when restricting the analyses to the sample of men only, and when removing baseline BAES scores as covariates in the models. This lends confidence to the validity of the findings, despite the fact that they were not consistent with study hypotheses. It is worth noting that the analyses that did not control for baseline BAES sedation scores identified a significant relation between BAES sedation and alcohol-related problems, both in the combined sample, and in the placebo sample. This suggests that baseline sedation was an important predictor of alcohol-related problems. It may be that those with internalizing disorders are more likely to endorse items from the sedation scale, such as feeling down, slow, inactive, and having difficulty concentrating. Participants with internalizing problems are also at increased risk for alcohol-related problems (Cranford, Nolen-Hoeksema, and Zucker, 2011; Grant, Hasin, Stinson, Dawson, Ruan, Goldstein, Smith, Saha, and Huang, 2005). Therefore, the association between levels of baseline sedation and alcohol problems may have been due, at least in part, to internalizing problems. Future studies should investigate this possibility by measuring and accounting for internalizing problems when looking at the relation between sedation and alcohol-related problems.

Although results of our analyses did not support the APM, they were not wholly inconsistent with one of the two proposed theoretical models for relations between SS and subjective response to alcohol. There was little support for a differential learning explanation, but the data were in some ways consistent with the possibility that a more purely biological process could be involved. As indicated previously, the zero order correlation between stimulation and alcohol use was positive and significant (r = .142, p <.05) before controlling for sensation seeking. As discussed above, this is consistent with the notion that there could be an underlying biological mechanism that may contribute to greater sensation seeking, greater stimulant response to alcohol, and heavier drinking/alcohol-related problems.

There were several limitations of the study, some of which may have contributed to the lack of significant findings. First, the data were cross-sectional. The mediation analyses may have provided a clearer picture of the relations among the study variables if the predictor variables satisfied temporal precedence. Further, for the significant findings that did emerge, the cross-sectional nature of the data makes it difficult to establish the direction of effects. Also, the nature of the inclusion criteria may have generated a sample from which it is difficult to generalize to the wider population of emerging adults. The broader study from which this study was drawn focused on gambling and participants in the current study were selected, in part, based on gambling-related inclusion criteria. This sample of heavy drinkers and gamblers may differ from the general population of heavy drinking emerging adults on important variables, particularly for women who were much less likely to meet the gambling criteria. Additionally, data for this study was collected across two sites. Though we controlled for site in our analyses after determining that the sites differed significantly on relevant variables, the combination of the two samples may have impacted the pattern of results.

Another potential limitation of the study was the use of the BAES as a measure of subjective response. In this measure, “sedation” captures primarily negative sedative effects while “stimulation” captures primarily positively reinforcing stimulant effects. Thus, the measure of positive effects in the current study was limited to positively reinforcing effects. In contrast, previous APM literature has used multiple positive expectancy subscales (e.g. social, global positive) including subscales that tap into low arousal positive effects (e.g. tension reduction). Given that previous literature has shown that negatively reinforcing effects of alcohol (e.g. tension reduction) play an important role in the prediction of drinking behavior, inclusion of a measure that captures this dimension of positive subjective response would be useful. Future research should consider measures such as the SEAS (Morean, Corbin, & Treat, under review) to capture the full valence by arousal space when measuring subjective response. Use of complimentary subscales in both subjective response and expectancy measures, especially those that capture the low arousal positive dimension, would facilitate comparison of expectancies and subjective effects. Future research should also explore the utility of other trait-like characteristics in addition to sensation seeking. The current study was limited in that we used only a measure of sensation seeking, whereas previous studies have used a variety of constructs including positive and negative urgency, impulsivity, and behavioral inhibition and activation. It is possible that different personality constructs would produce different patterns of results.

Although the current study found little support for the hypothesis that subjective response to alcohol might serve as a mediating variable in the APM, there were several important findings. As hypothesized, higher levels of sensation seeking were associated with greater stimulation in the models collapsed across beverage condition. This relation held only in the alcohol condition when the analyses were run separate by beverage condition, indicating that the significant relation seen in the collapsed model was driven largely by the alcohol group, despite the non-significant moderation analyses. This finding is not trivial as it suggests that sensation seeking is a significant predictor of positive subjective response to alcohol (stimulation), potentially above and beyond expectancies. Future studies should explore this possibility further by administering alcohol to a larger sample in a less stimulating context where alcohol effects might be more clearly differentiated from placebo effects. If future studies find support for these preliminary findings, there would be several important implications. First, while personality demonstrates rank order stability and proves difficult to change through intervention efforts, the mechanism through which risk is conferred may be more amenable to change. Thus, efforts to educate individuals who possess "high risk" personality traits (high sensation seeking) about the relation between sensation seeking and increased positive subjective response might provide an opportunity to encourage attention to other more negative aspects of their subjective response, as well as provide insight about motives and expectancies for drinking. Further, these findings may inform choice of intervention. For individuals who report high levels of sensation seeking and strong stimulating alcohol effects, expectancy challenge paradigms may not be an appropriate or efficacious intervention method (given that their positive expectancies appear to be rooted in actual experiences of alcohol effects). For these individuals, alternative approaches (e.g. pharmacological interventions that alter patterns of subjective response) may be more appropriate. Of course, additional studies are needed before applying the findings of the current study to prevention/intervention efforts. We hope the current study will stimulate interest in such research.

REFERENCES

Allsopp, J.F. (1986). Personality as a determinant of beer and cider consumption among young men. *Personality and Individual Differences, 7,* 341-347.

Aluja, A., Garcia, O., & Garica, L.F. (2002). A comparative study of Zuckerman's three structural models for personality through the NEO-PI-R, ZKPQ-III-R, EPQ-RS, and Goldberg's 50-bipolar adjectives. *Personality and Individual Differences, 33,* 713-725.

Armeli, S., Tennen, H., Todd, M., Carney, M.A., Mohr, C., Affleck, G., & Hromi, A. (2003). A daily process examination of the stress-response dampening effects of alcohol consumption. *Psychology of Addictive Behaviors, 17,* 266-276.

Anderson, K.G., Smith, G.T., & Fischer, S.F. (2003). Women and acquired preparedness: Personality and learning implications for alcohol use. *Journal of Studies on Alcohol, 64,* 384-392.

Bardo, M.T., Donohew, R.L., Harrington, N.G. (1996). Psychobiology of novelty seeking and drug seeking behavior. *Behavioural Brain Research, 77,* 23-43.

Bardo, M.T., Williams, Y., Dwoskin, L.P., Moynahan, S.E., Perry, I.B., & Martin, C.A. (2007). The sensation seeking trait and substance use: Research findings and clinical implications. *Current Psychiatry Reviews, 3,* 3-13.

Barnow, S., Schultz, G., Lucht, M., Ulrich, I., Preuss, U.W., & Freyberger, H.J. (2004). Do alcohol expectancies and peer delinquency/substance use mediate the relationship between impulsivity and drinking behavior in adolescence? *Alcohol and Alcoholism, 39,* 213-219.

Baron, R.M. & Kenny, D.A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51,* 1173-1182.

Borsari, B., Murphy, J.G., & Barnett, N.P. (2007). Predictors of alcohol use during the first year of college: Implications for prevention. *Addictive Behaviors*, 32, 2062-2086.

Caspi, Avshalom. Why maladaptive behaviors persist: Sources of continuity across the life course. In *Studying lives through time: Personality and development*, edited by Funder, David C., Parke, Ross D., Tomlinson-Keasey, Carol, Widaman, Keith, 343-376. American Psychological Association, 1993.

Caspi, A., Roberts, B.W., & Shiner, R.L. (2005). Personality development: Stability and change. *Annual Review of Psychology, 56,* 453-484.

Collins, R.L., Parks, G.A., & Marlatt, G.A. (1985) Social determinants of alcohol consumption: The effects of social interaction and model status on the self-administration of alcohol. *Journal of Consulting and Clinical Psychology, 53*, 189-200.

Corbin, W.R., Gearhardt, A., & Fromme, K. (2008). Stimulant alcohol effects prime within session drinking behavior. *Psychopharmacology, 197,* 327 337.

Corbin, W.R., Iwamoto, D.K., & Fromme, K. (2011). A longitudinal test of the acquired preparedness model for heavy drinking and related problems. *Journal of Studies on Alcohol and Drugs, 72,* 602-610.

Costa, P.T, & McCrae, R.R. *The NEO personality inventory-R: Professional Manuel*, 39-55. Odessa, FL: Psychological Assessment Resources, 1992.

Cranford, J.A., Nolen-Hoeksema, S., & Zucker, R.A. (2011). Alcohol involvement as a function of co-occurring alcohol use disorders and a major depressive episode: Evidence from the National Epidemic Survey on Alcohol and Related Conditions. *Drug and Alcohol Dependence, 117,* 145-151.

DeYoung, C. G. (2010). Impulsivity as a personality trait. In K. D. Vohs & R. F. Baumeister (Eds.), *Handbook of Self-Regulation: Research, Theory, and Applications* (Second edition, pp. 485–502). New York: Guilford Press.

Earleywine, M., & Finn, P.R. (1991). Sensation seeking explains the relation between behavioral disinhibition and alcohol consumption. *Addictive Behaviors, 16,* 123-128.

Elkins, I.J., King, S.M., McGue, M., & Iacono, W.G. (2006). Personality traits and the development of nicotine, alcohol, and illicit drug disorders: Prospective links from adolescence to young adulthood. *Journal of Abnormal Psychology, 115,* 26-39.

Fritz, M.S. & MacKinnon, D.P. (2007). Required sample size to detect the mediated effect. *Psychological Science, 18,* 233-239.

Fu, A.T., Ko, H.C., Wu, J.Y., Cherng, B.L., & Cheng, C.P. (2007). Impulsivity and expectancy in risk for alcohol use: Comparing male and female college students in Taiwan. *Addictive Behaviors, 32,* 1887-1896.

Fulker, D.W., Eysenck, S.B.G., & Zuckerman, M. (1980). A genetic and environmental analysis of sensation seeking. *Journal of Research in Personality, 14*, 261-281.

Grant, B.F., Dawson, D.A, Stinson, F.S., Chou, S.P., Dugour, M.C., & Pickering, R.P. (2004). The 12-month prevalence and trends in DSM-IV alcohol abuse and dependence: United States, 1991-1992 and 2001-2002. *Drug and Alcohol Dependence, 74,* 223-234.

Grant, B.F., Hasin, D.S., Stinson, F.S., Dawson, D.A., Ruan, W.J., Goldstein, R.B…Huang, B. (2005). Prevalence, correlates, comorbidity, and comparative disability of DSM-IV generalized anxiety disorder in the USA: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Psychological Medicine, 35,* 1747-1759.

Ham, L. S., & Hope, D. A. (2003). College students and problematic drinking: A review of the literature. *Clinical Psychology Review*, *23*, 719–759.

Hingson, R., Heeren, T., Winter, M., & Wechsler, H. (2005). Magnitude of alcohol-related mortality and morbidity among U.S. college students ages 18-24: Changes from 1998 to 2001. *Annual Review of Public Health, 26,* 259-279.

Houben, K. & Wiers, R.W. (2008). Implicitly positive about alcohol? Implicit positive associations predict drinking behavior. *Addictive Behaviors, 33,* 979-986.

Joireman, J. & Kuhlman, D.M. (2004). The Zuckerman-Kuhlman personality questionnaire: Origin, development, and validity of a measure to assess an alternative five-factor model of personality. In R.M. Stelmack (Ed.), *On the Psychobiology of Personality: Essays in Honor of Marvin Zuckerman* (49-64). New York: Elsevier.

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

Kashdan, T.B., Vetter, C.J., & Collins, L.R. (2005). Substance use in young adults: Associations with personality and gender. *Addictive Behaviors, 30,* 259-269.

King, A.C., de Wit, H., McNamara, P.J., & Cao, D. (2011). Rewarding, stimulant, and sedative alcohol responses and relationship to future binge drinking. *Archives of General Psychiatry, 68,* 389-399.

King, A.C., Houle, T., de Wit, H., Holdstock, L., & Schuster, A. (2002). Biphasic alcohol response differs in heavy versus light drinkers. *Alcoholism Clinical and Experimental Research, 26,* 827-835.

Knopick, V.S., Heath, A.C., Madden, P.A., Bucholz, K.K., Slutske, W.S., Nelson, E.C., Statham, D., Whitfield, J.B., & Martin, N.G. (2004). Genetic effects on alcohol-dependence risk: re-evaluating the importance of psychiatric and other heritable risk factors. *Psychological Medicine, 34,* 1519-1530.

Koopmans, J.R., Boomsma, D.I., Heath, A.C., & van Doornan, L.J. (1995). A multivariate genetic analysis of sensation seeking. *Behavioral Genetics, 25,* 349-356.

Larsen, H., Engels, R.C.M.E., Wiers, R.W., Granic, I., & Spijkerman, R. (2012). Implicit and explicit alcohol cognitions and observed alcohol consumption: Three studies in (semi) naturalistic drinking settings. *Addiction, 107,* 1420-1428.

Leeman, R.F., Corbin, W.R., & Fromme, K. (2009). Craving predicts within session drinking behavior following placebo. *Personality and Individual Differences, 46,* 693-698.

Littlefield, A.K., Sher, K.J., & Wood, P.K. (2009). Is "maturing out" of problematic alcohol involvement related to personality change? *Journal of Abnormal Psychology, 118,* 360-374.

Lui, I.C., Blacker, D.L., Xu, R., Fitzmaurice, G., Lyons, M.J., & Tsuang, M.T. (2004). Genetic and environmental contributions to the development of alcohol dependence in male twins. *Archives of General Psychiatry, 61,* 897-903.

MacKinnon, D. P., Warsi, G., & Dwyer, J. H. (1995). A simulation study of mediated effect measures. Multivariate Behavioral Research, 30, 41-62.

Marlatt. G. A. & Rohsenow, D. J. Cognitive processes in alcohol use: Expectancy and the balanced placebo design. In N. K. Mello (Ed.), *Advances in substance abuse: Behavioral and biological research.* Greenwich, Conn.: JAI Press, 1980.

Martin, C. S., Earleywine, M., Musty, R. E., & Perrine, M. W. (1993). Development and validation of the biphasic alcohol effects scale. *Alcoholism: Clinical and Experimental Research, 17*(1), 140-146.

Martin, E.D., & Sher, K.J. (1994). Family history of alcoholism, alcohol use disorders and the five factor model of personality. *Journal of Studies on Alcohol, 55,*81-90.

McCarthy, D.M., Kroll, L.S., & Smith, G.T. (2001a). Integrating disinhibition and learning risk for alcohol use. *Experimental and Clinical Psychopharmacology, 9,* 389-398.

McCarthy, D.M., Miller, T.L., Smith, G.T., & Smith, J.A. (2001b). Disinhibition and expectancy in risk for alcohol use: Comparing Black and White college samples. *Journal of Studies on Alcohol, 62,* 313-321.

McCrae, R.R., Costa, P.T., Jr., Ostendorf, F., Angleitner, A., Hrebickova, M., Avia, M.D. et al. (2000). Nature over nurture: Temperament, personality, and life span development. *Journal of Personality and Social Psychology, 78,* 173-186.

Morean, M.E., & Corbin, W.R. (2010). Subjective response to alcohol: A critical review of the literature. *Alcoholism: Clinical and Experimental Research, 34,* 385-395.

Newlin, D.B., & Thomson, J.B. (1990). Alcohol challenge with sons of alcoholics: A critical review and analysis. *Psychological Bulletin, 108,* 383-402.

Preacher, K.J. & Hayes, A.F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40,* 879-891.

Quinn, P.D. & Fromme, K. (2011). Subjective response to alcohol challenge: A quantitative review. *Alcoholism: Clinical and Experimental Research, 35,* 1759-1770.

Raynor, D.A., & Levine, H. (2009). Associations between the five-factor model of personality and health behaviors among college students. *Journal of American College Health, 58,* 73-81.

Reich, J.H., & Vasile, R.G. (1998). Effect of personality disorders on the treatment outcome of axis 1 conditions: An update. *Journal of Nervous and Mental Disease, 181,* 475-484.

Roberts, B.W., & DelVecchio, W.F. (2000). The rank-order consistency of personality traits from childhood to old age: A quantitative review of longitudinal studies. *Psychological Bulletin, 126,* 3-25.

Roberts, J.H., Walton, K.E., & Viechtbauer, W. (2006). Patterns of mean-level change in personality traits across the life course: A meta-analysis of longitudinal studies. *Psychological Bulletin, 132,* 1-25.

Rohsenow, D.J., & Marlatt, G.A. (1981). The balanced placebo design: Methodological considerations. *Addictive Behaviors, 6,* 107-122.

Ruiz, M.A., Pincus, A.L., & Dickinson, K.A. (2003). NEO PI-R predictors of alcohol use and alcohol-related problems. *Journal of Personality Assessment, 81,* 226-236.

Sayette, M.A. (1999). Does drinking reduce stress? *Alcohol Research and Health, 23,* 250-255.

Schuckit, M.A. (1980). Self-rating of alcohol intoxication by young men with and without family histories of alcoholism. *Journal of Studies on Alcohol, 41,* 242-249.

Schuckit, M.A. (1984). Subjective responses to alcohol in sons of alcoholics and control subjects. *Archives of General Psychiatry, 41,* 879-884.

Schuckit, M.A. (1994). Low level of response to alcohol as a predictor of future alcoholism. *American Journal of Psychiatry, 151,* 184-189.

Schuckit M.A. (1998). Biological, psychological, and environmental predictors of the alcoholism risk: a longitudinal study. *Journal of Studies on Alcohol, 59,* 485-494.

Schuckit, M.A. (1999). New findings on the genetics of alcoholism. *Journal of the American Medical Association, 281,* 1875-1876.

Schuckit, M.A. (1998). Biological, psychological and environmental predictors of the alcoholism risk: a longitudinal study. *Journal of Studies on Alcohol, 59,* 485-494.

Schuckit, M.A. & Smith, T.L. (2000). The relationships of a family history of alcohol dependence, a low level of response to alcohol and six domains of life functioning to the development of alcohol use disorders. *Journal of Studies on Alcohol, 61,* 827-835.

Schuckit, M.A., Smith, T.L., Danko, G.P., Pierson, J., Hesselbrock, V., Bucholz, K.K…& Chan,G. (2007). The ability of the self-rating of the effects of alcohol (SRE) scale to predict alcohol-related outcomes five years later. *Journal of Studies on Alcohol and Drugs, 68,* 371-378.

Settles, R.F., Cyders, M., & Smith, G.T. (2010). Longitudinal validation of the acquired preparedness model of drinking risk. *Psychology of Addictive Behaviors, 24,* 198-208.

Shannon, E.E., Staniforth, E.R., McNamara, J., Bernosky-Smith, K.A., & Liguori, A. (2011). Response inhibition impairments predict alcohol-induced sedation. *Alcohol and Alcoholism, 46,* 33-38.

Sher, K. (1991). *Children of alcoholics: A critical appraisal of theory and research*. Chicago: University of Chicago Press.

Sher, K.J., & Levenson, R.W. (1982). Risk for alcoholism and individual differences in the stress response-dampening effect of alcohol. *Journal of Abnormal Psychology, 91,* 350-367.

Sher, K.J., & Walitzer, K.S. (1986). Individual differences in the stress-response-dampening effect of alcohol: A dose-response study. *Journal of Abnormal Psychology, 95,* 159-167.

Simons, J.S., Carey, K.B., & Gaher, R.M. (2004). Labiality and impulsivity synergistically increase risk for alcohol-related problems. *The American Journal of Drug and Alcohol Abuse, 30,* 685-694.

Slutske, W.S., Heath, A.C., Madden, P.A.F., Bucholz, K.K., Statham, D.J., & Martin, N.G. (2002). Personality and genetic risk for alcohol dependence. *Journal of Abnormal Psychology, 111,* 124-133.

Smith, G. T. & Anderson, K. G. (2001). Adolescent risk for alcohol problems as acquired preparedness: A model and suggestions for intervention. In P. M. Monti, S. M. Colby, & T. A. O'Leary (Eds.), *Adolescents, alcohol, and substance abuse: Reaching teens through brief interventions* (pp. 109-144). New York: Guilford Press.

Smith, G.T., Williams, S.F., Cyders, M.A., & Kelley, S. (2006). Reactive

Personality-Environment Transactions and Adult Developmental Trajectories. *Developmental Psychology, 42,* 877-887.

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

Stacy, A.W., Newcomb, M.D., & Bentler, P.M. (1993). Cognitive motivations and sensation seeking as long-term predictors of drinking problems. *Journal of Social and Clinical Psychology 12*, 1–24.

Steinberg, L., Albert, D., Cauffman, E., Banich, M., Graham, S., & Wollard, J. (2008). Age differences in sensation seeking and impulsivity as indexed by behavior and self-report: Evidence for a dual systems model. *Developmental Psychology, 44*, 1764-1778.

Steinberg, L. (2010). A dual systems model of adolescent risk taking. *Developmental Psychobiology, 52,* 216-224.

Stoel, R.D., De Geus, E.J.C., & Boomsma, D.I. (2006). Genetic analysis of sensation seeking with an extended twin design. *Behavioral Genetics, 36,* 229-237.

Testa, M., Fillmore, M.T., Norris, J., Abbey, A., Curtin, J.J., Leonard, K.E., Mariano, K.A., Thomas, M.C., Nomensen, K.J., George, W.H., VanZile-Tamsen, C., Livingston, J.A., Saenz, C., Buck, P.O., Zawacki, T., Parkhill, M.R., Jacques, A.J., & Lenwood, W. (2005). Understanding alcohol expectancy effects: Revisiting the placebo condition. *Alcoholism: Clinical and Experimental Research*, *30,* 339-348.

Theakston, J.A., Stewart, S.H., Dawson, M.Y., Knowlden-Loewen, S.A.B., Lehman, D.R. (2004). Big-Five personality domains predict drinking motives. *Personality and Individual Differences*, 37, 971-981.

Thomas, S.E., Drobes, D.J., Voronin, K., & Anton, R.F. (2004). Following alcohol consumption, nontreatment-seeking alcoholics report greater stimulation but similar sedation compared with social drinkers. *Journal of Studies on Alcohol, 65,* 330-335.

Vollrath, M., & Torgerson, S. (2002). Who takes health risks? A probe into 8 personality types. *Personality and Individual Differences, 32,* 1185-1197.

Wechsler, H., Lee, J. E., Kuo, M., Seibring, M., Nelson, T. F., & Lee, H. (2002).

Trends in college binge drinking during a period of increased prevention efforts. *Journal of American College Health, 50*, 203–210.

White, H.R., & Labouvie, E.W. (1989). Towards the assessment of adolescent problem drinking. *Journal of Studies on Alcohol, 50*, 30-37.

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

Wiers, R.W., Van Woerden, N., Smulders, F.T.Y., & De Jong, P.J. (2002). Implicit and explicit alcohol-related cognitions in heavy and light drinkers. *Journal of Abnormal Psychology, 111*, 648-658.

Zuckerman, M. (1979). *Sensation seeking: beyond the optimal level of arousal*. Erlbaum, Hillsdale CA.

Zuckerman, M. (1994). *Behavioral expressions and biosocial bases of sensation seeking*. Cambridge, Cambridge UK.

Zuckerman, M., Kuhlman, D.M., Joireman, J., Teta, P., & Kraft, M. (1993). A comparison of three structural models for personality: The big three, the big five, and the alternative five. *Journal of Personality and Social Psychology*, *65*, 757-768.

APPENDIX A

INSTITUTIONAL REVIEW BOARD APPROVAL

ASU Knowledge Enterprise Development

Office of Research Integrity and Assurance

To:	William Corbin
From:	Mark Roosa, Chair Soc Beh IRB
Date:	04/06/2012
Committee Action:	**Renewal**
Renewal Date:	04/06/2012
Review Type:	Expedited F7
IRB Protocol #:	0904003873
Study Title:	Cognitive Effects of Alcohol on Decision Making
Expiration Date:	03/21/2013

The above-referenced protocol was given renewed approval following Expedited Review by the Institutional Review Board.

It is the Principal Investigator's responsibility to obtain review and continued approval of ongoing research before the expiration noted above. Please allow sufficient time for reapproval. Research activity of any sort may not continue beyond the expiration date without committee approval. Failure to receive approval for continuation before the expiration date will result in the automatic suspension of the approval of this protocol on the expiration date. Information collected following suspension is unapproved research and cannot be reported or published as research data. If you do not wish continued approval, please notify the Committee of the study termination.

This approval by the Soc Beh IRB does not replace or supersede any departmental or oversight committee review that may be required by institutional policy.

Adverse Reactions: If any untoward incidents or severe reactions should develop as a result of this study, you are required to notify the Soc Beh IRB immediately. If necessary a member of the IRB will be assigned to look into the matter. If the problem is serious, approval may be withdrawn pending IRB review.

Amendments: If you wish to change any aspect of this study, such as the procedures, the consent forms, or the investigators, please communicate your requested changes to the Soc Beh IRB. The new procedure is not to be initiated until the IRB approval has been given.

Please retain a copy of this letter with your approved protocol.

APPENDIX B

MEASURES

Zuckerman-Kuhlman Personality Questionnaire (ZKPQ) - Sensation Seeking Scale

<u>Directions</u>: The following is a series of statements that persons might use to describe themselves. Read each statement and decide whether or not it describes you, or is mostly true or false as applied to you.

If you agree with a statement or decide that it mostly describes you, please click on the word "TRUE." If you disagree with a statement or feel that it is mostly not descriptive of you, please click on the word "FALSE."

5. I like to have new and exciting experiences and sensations.	TRUE	FALSE
7. I would like to take off on a trip with no preplanned or definite routes or timetables.	TRUE	FALSE
9. I like doing things just for the thrill of it.	TRUE	FALSE
10. I tend to change interests frequently.	TRUE	FALSE
11. I sometimes like to do things that are a little frightening.	TRUE	FALSE
12. I'll try anything once.	TRUE	FALSE
13. I would like the kind of life where one is on the move and traveling a lot, with lots of change and excitement.	TRUE	FALSE
14. I sometimes do "crazy" things just for fun.	TRUE	FALSE
15. I like to explore a strange city or section of town by myself, even if it means getting lost.	TRUE	FALSE
16. I prefer friends who are excitingly unpredictable.	TRUE	FALSE
19. I like "wild" uninhibited parties.	TRUE	FALSE

Biphasic Alcohol Effects Scale (BAES)

Instructions: The following adjectives describe feelings that are sometimes produced by drinking alcohol. Please rate the extent to which drinking alcohol has produced these feelings in you at the present time.

	Not At All				Moderately					Extremely	
Difficulty Concentrating	0	1	2	3	4	5	6	7	8	9	10
Down	0	1	2	3	4	5	6	7	8	9	10
Elated	0	1	2	3	4	5	6	7	8	9	10
Energized	0	1	2	3	4	5	6	7	8	9	10
Excited	0	1	2	3	4	5	6	7	8	9	10
Heavy Head	0	1	2	3	4	5	6	7	8	9	10
Inactive	0	1	2	3	4	5	6	7	8	9	10
Sedated	0	1	2	3	4	5	6	7	8	9	10
Slow Thoughts	0	1	2	3	4	5	6	7	8	9	10
Sluggish	0	1	2	3	4	5	6	7	8	9	10
Stimulated	0	1	2	3	4	5	6	7	8	9	10

Talkative	0	1	2	3	4	5	6	7	8	9	10
Up	0	1	2	3	4	5	6	7	8	9	10
Vigorous	0	1	2	3	4	5	6	7	8	9	10

Timeline Follow-Back (TLFB) -Weekly Drinking

The 30-day interval begins with the day prior to the run (i.e., yesterday). **Be sure to check the top of the calendar before you start—make sure it is marked with the <u>correct day of the week</u> and <u>today's date</u>.**

Instructions:

"The purpose of this task is to gather information about your drinking experiences during the past month. Using this calendar, we'll be starting with your more recent drinking episodes and go backward until the ____ of _____ (insert appropriate day and month). *For each drinking episode, I'll ask you how many standard drinks you consumed, and over what period of time. A conversion scale for standard drinks is listed here* (point to conversion scale). *Before we begin, do you have any questions?"* (Answer them as you are able, or consult supervisor). *Okay, let's begin."*

1. *"When was your most recent drinking experience?"*

    - Identify a specific date. Use key dates (e.g. holidays, university events) if he/she is unsure of date. Circle that number on the calendar.

2. *"Remembering the definition of a standard drink we just discussed, please tell me how many standard drinks you consumed. As before, please refer to the drink conversion chart to help you make this determination.*

    - Use conversion table and follow up questions for the specific type of drink to determine the number of standard drinks to the nearest ¼ drink

      (e.g., 2 ¼ drinks is recorded as 2.25).

    <u>Follow-up Questions by Beverage Type</u>

    Beer – Use the conversion chart to show them the various sizes of beer that are commonly served with 12 oz representing 1 standard drink.

    Bottles and Cans (12 oz, 16 oz tall boy)

Cups (8 oz, 12 oz, and 16 oz)

Glasses (12 oz, 16 oz, 22 oz)

Wine – Use the conversion chart to show them the various quantities of wine that are commonly served with 5 oz representing 1 standard drink.

Glass (5 oz, 3 oz fortified)

Bottles (25 oz bottle = 5 standard drinks, 40 oz or 25 oz fortified bottle = 8 standard drinks)

Malt Liquors - Use the conversion chart to show them the various quantities of malt liquor that are served with 12 oz representing 1 standard drink.

Bacardi Silver, Smirnoff Ice (12 oz)

Mike's hard lemonade (11.2 oz, 24oz)

12 oz Mickey = 8 standard drinks, 25 oz (Liter) = 17 standard drinks, 40oz = 27 standard drinks

Mixed Drinks - Use the conversion chart to show them the glass sizes.

Also, point out the four factors (see below) to consider when estimating standard drinks for mixed drinks. Provide the following instruction the first time the participant reports consuming mixed drinks. Repeat this instruction as needed for the remaining drinking days.

"*Remember that the number of standard drinks in a mixed drink depends on the following factors. 1) size of the glass, 2) type of alcohol, 3) type of drink, and 4) strength of the drink. Please keep these factors in mind when estimating the number of standard drinks you consumed on each day.*"

3. *"Over what period of time did you drink?"*

    - Identify a specific length of time to the nearest ½ hour. If the participant gives a more specific time frame ask them to indicate to the nearest 30-minute interval (e.g., 3 1/2 hours is recorded as 3.5).

Rutgers Alcohol Problem Index (RAPI)

NEVER / 1 TO 2 TIMES / 3 TO 5 TIMES / 6 TO 10 TIMES / MORE THAN 10 TIMES	Directions: How many times did the following things happen to you <u>while</u> you were drinking or <u>because of</u> your alcohol use during the **last 3 months**? Circle the number corresponding to your answer.
1 2 3 4 5	1. Not able to do your homework or study for a test?
1 2 3 4 5	2. Got into fights, acted bad, or did mean things?
1 2 3 4 5	3. Missed out on other things because you spent too much money on alcohol?
1 2 3 4 5	4. Went to work or school high or drunk?
1 2 3 4 5	5. Caused shame or embarrassment to someone?
1 2 3 4 5	6. Neglected your responsibilities?
1 2 3 4 5	7. Relative avoided you?
1 2 3 4 5	8. Felt that you needed more alcohol than you used to use in order to get the same effect?
1 2 3 4 5	9. Tried to control your drinking by trying to drink only at certain times of the day or in certain places?
1 2 3 4 5	10. Had withdrawal symptoms, that is, felt sick because you stopped or cut down on drinking?
1 2 3 4 5	11. Noticed a change in your personality?
1 2 3 4 5	12. Felt that you had a problem with alcohol?
1 2 3 4 5	13. Missed a day (or part of a day) of school or work?
1 2 3 4 5	14. Tried to cut down or quit drinking?
1 2 3 4 5	15. Suddenly found yourself in a place that you could not remember getting to?

1 2 3 4 5	16. Passed out or fainted suddenly?
1 2 3 4 5	17. Had a fight, argument or bad feelings with a friend?
1 2 3 4 5	18. Had a fight, argument or bad feelings with a family member?
1 2 3 4 5	19. Kept drinking when you promised yourself not to?
1 2 3 4 5	20. Felt you were going crazy?
1 2 3 4 5	21. Had a bad time?
1 2 3 4 5	22. Felt physically or psychologically dependent?
1 2 3 4 5	23. Was told by a friend or neighbor to stop or cut down drinking?
1 2 3 4 5	24. Drove shortly after having more than two drinks?
1 2 3 4 5	25. Drove shortly after having more than four drinks?

APPENDIX C

EIGHT MODELS SEPARATE BY BEVERAGE CONDITION

Mediation Models for Weekly Drinking in the Alcohol Condition

The first model tested the hypothesis that the relation between SS and weekly use would be mediated by BAES stimulation for participants in the alcohol condition. First, age, sex, ethnicity, site, and SS were entered as simultaneous predictors of weekly use, accounting for significant variability (14.9%), F (5, 102) = 3.559, p = .005. Only site was a significant predictor of use, β = -.247, p =.009. No additional individual predictors were significant: Sensation Seeking, β = .164, p = .103, age, β = -.141, p = .134, sex, β = -.177, p =.079, and ethnicity, β = .153, p =.099. These variables were then examined as predictors of BAES stimulation, with the addition of BAES baseline stimulation included to control for baseline differences. These variables accounted for significant variability in stimulation (31.9%), F (6, 100) = 7.808, p < .001. Sensation Seeking, β = .217, p = .018, and baseline BAES stimulation, β = .495, p < .001 were both significant predictors of BAES stimulation with higher levels of SS and baseline stimulation associated with more BAES stimulation after alcohol. Age, β = .090, p = .295, sex, β = .013, p =.887, ethnicity, β = -.015, p = .856, and site, β = .014, p = .867 were not significant predictors. In the full mediation model, the predictor variables accounted for 16.4% of the variance in weekly use, F (7, 99) = 2.769, p =.011. Only site was a significant predictor, β = -.256, p = .008. All other individual predictors were non-significant: Sensation Seeking, β = .143, p = .168, Baseline BAES stimulation, β = .005, p =.963, age, β = -.164, p =.091, sex, β = -.174, p =.086, and ethnicity, β = .170, p =.075. Importantly, BAES stimulation did not emerge as a significant predictor of weekly use when controlling for SS and the covariates, β= .125, p =.266. Therefore, the hypothesis that the relation between SS and weekly use would be mediated by BAES stimulation in the alcohol group was unsupported, as BAES stimulation did not predict weekly use when entered with SS and the other covariates (b path).

The second model tested the hypothesis that the relation between SS and use would be mediated by BAES sedation for participants in the alcohol group. The c path (SS to weekly drinking) was already tested in the previous set of analyses, demonstrating that SS did not account for significant variability in weekly use, β = .164, p = .103. In the model with BAES sedation as the outcome (a path), the predictor variables accounted for significant variability (29.6%), F (6, 94) = 6.596, p < .001. Baseline BAES sedation, β = .468, p < .001 and sex β = .258, p =.007 were both significant predictors of BAES sedation with women and individuals with higher levels of baseline sedation reporting more BAES sedation after alcohol. Sensation Seeking, β = .047, p = .617, age, β = -.172, p = .057, ethnicity, β = .000, p = .996, and site, β = -.021, p = .809 were not significant predictors. In the full mediation model, the predictor variables accounted for 16.0% of the variance in weekly use, F (7, 93) = 2.532, p =.020. Only site was a significant predictor, β = -.248, p = .012. No other predictors were significant: Sensation Seeking, β = .167, p = .108, Baseline BAES sedation, β = .057, p =.611, age, β = -.176, p =.081, sex, β = -.155, p =.153, and ethnicity, β = .150, p =.125. Importantly, BAES sedation did not emerge as a significant predictor of weekly use when controlling for SS and the covariates, β = -.088, p =.439. Therefore, the hypothesis that the relation between SS and weekly use would be mediated by BAES sedation in the alcohol group was unsupported, as SS was not a significant predictor of BAES sedation (a path) and BAES sedation did not predict weekly use when entered with SS and the other covariates (b path).

Mediation Models for Weekly Drinking in the Placebo Condition

The first model tested the hypothesis that the relation between SS and use would be mediated by BAES stimulation (positive expectancies) among participants in the placebo group. Age, sex, ethnicity, site, and SS were entered as simultaneous predictors, accounting for significant variability (16.0%) in weekly use, F (5, 108) = 4.127, p = .002. Sensation Seeking, β = .252, p = .007, and sex, β = -.233, p = .012 were both significant predictors of weekly drinking, with men and those with higher levels of sensation seeking reporting more weekly use. Age, β = .063, p =.484, ethnicity, β = .086, p =.337, and site, β = .002, p = .979, were not significant predictors. These variables were then examined as predictors of BAES stimulation (ascending limb), with the addition of BAES baseline stimulation included to control for baseline differences. These variables accounted for significant variability in BAES stimulation after placebo (59.5%), F (6, 104) = 25.486, p < .001. Baseline BAES stimulation, β = .713, p < .001 was a significant predictor with higher levels of baseline stimulation associated with more stimulation. Sensation Seeking, β = .128, p = .052, Age, β = .085, p = .181, sex, β = -.094, p =.158, ethnicity, β = .055, p = .381, and site, β = .018, p = .788 were not significant predictors. In the full mediation model, the predictor variables accounted for 16.8% of the variance in weekly use, F (7, 103) = 2.972, p =.007. Sensation Seeking, β = .256, p = .009 and sex, β = -.211, p =.029 were both significant predictors of weekly drinking with men and those higher in sensation seeking reporting higher levels of weekly drinking. Baseline BAES stimulation, β = .128, p =.335, age, β = .068, p =.460, ethnicity, β = .086, p =.347, and site, β = -.022, p = .816 were not significant predictors. Importantly, BAES stimulation after placebo did not emerge as a significant predictor of weekly use when controlling for SS and the covariates, β = -.028, p =.844. Therefore, the relation between SS and weekly use was not mediated by BAES stimulation in the placebo group.

The second model tested the hypothesis that the relation between SS and weekly use would be mediated by BAES sedation in the placebo group. The model for the c path was already tested in the prior set of analyses, confirming that sensation seeking was a significant predictor, β = .252, p = .007. In the model predicting BAES sedation after placebo, the predictor variables accounted for significant variability (38.9%), F (6, 102) = 10.831, p < .001. Baseline BAES sedation, β = .344, p < .001, sex β = .178, p =.028, ethnicity, β = .260, p =.001, and site, β = -.275, p = .001 were each significant predictors of BAES sedation with women, those reporting higher levels of baseline sedation, Caucasians, and participants from Yale reporting more sedation. Sensation Seeking, β = .102, p = .216, and age, β = -.113, p = .153 were not significant predictors. In the full mediation model, the predictor variables accounted for 17.4% of the variance in weekly use, F (7, 101) = 3.033, p =.006. Sensation Seeking, β = .221, p = .024, and sex, β = -.265, p =.007 remained significant predictors with men and those with higher levels of sensation seeking reporting heavier weekly drinking. Baseline BAES sedation, β = .054, p =.602, age, β = .046, p =.621, ethnicity, β = .095, p =.328, and site, β = .041, p = .689 were not significant predictors. Importantly, BAES sedation after placebo did not emerge as a significant predictor of weekly use when controlling for SS and the covariates, β = .000, p = .998. Thus, BAES sedation did not mediate the relation between SS and weekly drinking as SS was not a significant predictor of BAES sedation (a path) and BAES sedation did not significantly predict weekly drinking (b path).

Mediation Models for Alcohol-related Problems in the Alcohol Condition

The first model tested the hypothesis that the relation between SS and alcohol-related problems would be mediated by BAES stimulation among participants in the alcohol condition. Age, sex, ethnicity, site, weekly drinking, and SS were entered as simultaneous predictors, accounting for significant variability (25.0%) in alcohol problems, F (6, 101) = 5.617, p < .001. Sensation Seeking, β = .204, p = .035 and weekly drinking, β = .432, p <.001, were significant univariate predictors, with higher levels of sensation seeking and weekly drinking associated with more alcohol-related problems. Age, β = -.106, p = .238, sex, β = .115, p =.230, ethnicity, β = -.110, p =.212, and site, β = .008, p =.930 were not significant predictors. When the same variables and baseline

BAES stimulation were examined as predictors of BAES stimulation after alcohol, they accounted for significant variability (32.8%), F (7, 99) = 6.888, $p <$ .001. Sensation Seeking, β = .200, p = .031, and baseline BAES stimulation, β = .489, p < .001 were both significant predictors of BAES stimulation after alcohol with higher levels of SS and baseline stimulation associated with more BAES stimulation. Weekly drinking, β = .100, p = .266, age, β = .105, p = .227, sex, β = .030, p =.742, ethnicity, β = -.032, p = .709, and site, β = .040, p =.652 were not significant predictors. In the full mediation model, the predictor variables accounted for 25.3% of the variance in problems, F (8, 98) = 4.155, p <.001. Weekly drinking remained a significant individual predictor, β = .435, p <.001, and sensation seeking, β = .193, p = .053, Baseline BAES stimulation, β = -.064, p =.543, age, β = -.099, p =.288, sex, β = .111, p =.253, ethnicity, β = -.122, p =.184, and site, β = .016, p =.865, were not significant predictors. Importantly, BAES stimulation did not emerge as a significant predictor of problems when controlling for SS and the covariates, β= .020, p =.854, Therefore, the hypothesis that the relation between SS and alcohol problems would be mediated by BAES stimulation in the alcohol group was unsupported.

The second model tested the hypothesis that the relation between SS and alcohol-related problems would be mediated by BAES sedation in the alcohol group. The c path was already tested in the previous set of analyses, indicating that SS was a significant predictor of alcohol-related problems, β = .204, p = .035. When these same variables and baseline BAES sedation were examined as predictors of BAES sedation after alcohol, they accounted for significant variability in sedation (30.1%), F (7, 93) = 5.716, $p < .001$. Baseline BAES sedation, $\beta = .469$, $p < .001$, age, $\beta = -.183$, $p = .045$, and sex $\beta = .245$, $p =.012$ were each significant predictors of BAES sedation with women, those reporting higher levels of baseline sedation, and younger participants reporting more BAES sedation after alcohol. Sensation Seeking, $\beta = .059$, $p = .537$, weekly drinking, $\beta = -.073$, $p = .439$, ethnicity, $\beta = .011$, $p = .907$, and site, $\beta = -.039$, $p =.667$, were not significant predictors. In the full mediation model, the predictor variables accounted for 31.1% of the variance in problems, F (8, 92) = 5.199, $p <.001$. Sensation Seeking, $\beta = .197$, $p = .040$, Baseline BAES sedation, $\beta = .240$, $p =.021$, and weekly drinking, $\beta = .456$, $p <.001$ were significant predictors with higher levels of sensation seeking, baseline sedation, and weekly drinking associated with more alcohol-related problems. Age, $\beta = -.099$, $p =.286$, sex, $\beta = .162$, $p =.105$, ethnicity, $\beta = -.153$, $p =.091$, and site, $\beta = .021$, $p =.821$, were not significant predictors. Importantly, BAES sedation did not emerge as a significant predictor of problems when controlling for SS and the covariates, $\beta= -.068$, $p =.513$. Therefore, the hypothesis that the relation between SS and problems would be mediated by BAES sedation in the alcohol group was unsupported, as BAES sedation was not a significant predictor of problems when included with SS and the covariates (b path).

Mediation Models for Alcohol-related Problems in the Placebo Condition

The first model tested if the relation between SS and alcohol-related problems was mediated by BAES stimulation in the placebo group. Age, sex, ethnicity, site, weekly drinking and SS were entered as simultaneous predictors, accounting for significant variability (27.7%) in problems, F (6, 107) = 6.824, p <.001. Sensation Seeking, β = .306, p = .001, weekly drinking, β = .339, p < .001, Sex, β = .176, p = .046, and site, β = -.222, p =.010, were each significant predictors of problems, with those higher in sensation seeking, those with higher levels of weekly drinking, women, and those from Yale reporting more alcohol-related problems. Age, β = -.154, p =.068, and ethnicity, β = -.086, p =.305 were not significant predictors. When these same variables and baseline BAES stimulation were examined as predictors of BAES stimulation after placebo, they accounted for significant variability (59.5%), F (7, 103) = 21.646, p < .001. Baseline BAES stimulation, β = .714, p < .001 was a significant predictor of BAES stimulation, with higher levels of baseline stimulation associated with more stimulation following placebo. Sensation Seeking, β = .132, p = .055, weekly drinking, β = -.014, p = .844, Age, β = .086, p = .180, sex, β = -.096, p =.157, and ethnicity, β = .056, p = .376 were not significant predictors. Therefore, the “a” path did not hold in this model. In the full mediation model the predictor variables accounted for 28.3% of the variance in problems, F (8, 102) = 5.041, p <.001. Sensation Seeking, β = .300, p = .002, weekly drinking, β = .345, p < .001, and site, β = -.210, p = .019, were each significant predictors with higher levels of sensation seeking, higher levels of weekly drinking, and being a member of the sample from Yale associated with more alcohol-related problems. Baseline BAES stimulation, $\beta = -.108$, $p = .403$, age, $\beta = -.156$, $p = .074$, sex, $\beta = .167$, $p = .071$, and ethnicity, $\beta = -.093$, $p = .277$ were not significant predictors. Importantly, BAES stimulation did not emerge as a significant predictor of problems when controlling for SS and the covariates, $\beta = .029$, $p = .828$. Therefore, the relation between SS and problems was not mediated by BAES stimulation in the placebo group.

The second model tested if the relation between SS and problems was mediated by BAES sedation in the placebo group. The c path (SS to problems) was already tested in the prior analyses, confirming that sensation seeking was a significant predictor of alcohol-related problems, $\beta = .306$, $p = .001$. In the model predicting BAES sedation after placebo, the predictor variables accounted for significant variability (38.9%), F (7, 101) = 9.193, $p < .001$. Baseline BAES sedation, $\beta = .344$, $p < .001$, sex $\beta = .178$, $p = .035$, ethnicity, $\beta = .260$, $p = .001$, and site, $\beta = -.275$, $p = .001$, were each significant predictors of sedation with women, those reporting higher levels of baseline sedation, Caucasians, and participants from Yale reporting more BAES sedation. Sensation Seeking, $\beta = .102$, $p = .230$, weekly drinking, $\beta = .000$, $p = .998$ and age, $\beta = -.113$, $p = .155$ were not significant predictors. In the full mediation model, the predictor variables accounted for 35.4% of the variance in problems, F (8, 100) = 6.843, $p < .001$. Sensation Seeking, $\beta = .272$, $p = .003$, ethnicity, $\beta = -.173$, $p = .048$, and weekly drinking, $\beta = .373$, $p < .001$ were each significant predictors with Caucasians and individuals reporting higher levels of sensation seeking and weekly drinking reporting more alcohol-related problems. Age, β = -.113, p =.175, sex, β = .166, p =.064, and baseline BAES sedation, β = .088, p =.338 were not significant predictors. Further, descending limb sedation was not a significant predictor of alcohol problems when controlling for the covariates in the model, β= .195, p =.060. Therefore, the relation between SS and problems was not mediated by BAES sedation in the placebo group.

Table 1. Zero-Order Correlations for SS, Stimulation, Sedation, Weekly Drinking, RAPI, and Demographics Collapsed Across Beverage Condition

	ZKPQ SS	T0 Stimulation	T2 Stimulation	T0 Sedation (log)	T4 Sedation (log)	Weekly Drinking (log)	RAPI (log)	Age	Sex	Ethnicity
T0 Stimulation	.035									
T2 Stimulation	.189**	.646**								
T0 Sedation (log)	.019	-.159*	-.081							
T4 Sedation (log)	-.025	-.167*	-.072	.474**						
Weekly Drinking (log)	.250**	.088	.142*	.072	-.016					
RAPI total (log)	.283**	-.052	-.007	.231**	.195**	.382**				
Age	.061	.042	.102	.000	-.141*	.035	-.102			
Sex	-.263**	-.143*	-.208**	-.024	.189**	-.252**	.045	-.137*		
Ethnicity	.058	-.101	-.004	.143*	.217**	.103	-.032	-.032	.001	

Note. ZKPQ SS =ZKPQ Sensation Seeking; T0 Stimulation = BAES stimulation at baseline; T2 Stimulation = BAES stimulation on ascending limb; T0 Sedation (log) = BAES sedation at baseline log transformed; T4 Sedation (log) = BAES sedation on descending limb log transformed; Weekly Drinking (log) = Time Line Follow-Back Interview number of weekly drinks log transformed; RAPI Total (log) = Rutgers Alcohol Problem Index total number of consequences experienced in the last three months log transformed; sex coded men = 0 women = 1; ethnicity coded non-Caucasian = 0, Caucasian = 1. **p* < .05; ***p* < .01,

Table 2. Partial Correlations for SS, Stimulation, Sedation, Weekly Drinking, and RAPI Collapsed Across Beverage Condition

	Mean (SD) Range	SS	T0 Stimulation	T2 Stimulation	T0 Sedation (log)	T4 Sedation (log)	Weekly Drinking (log)
SS	6.9435 (2.620) 0-11						
T0 Stimulation	26.97 (14.53) 0-64	-.048					
T2 Stimulation	31.61 (14.93) 0-65	.144*	.617**				
T0 Sedation (log)	14.20 (11.98) 0-55	.047	-.092	-.053			
T4 Sedation (log)	16.01 (13.69) 0-58	.093	-.107	-.039	.441**		
Weekly Drinking (log)	13.79 (11.20) .23-63.23	.191**	.083	.111	.029	-.023	
RAPI total (log)	8.68 (7.21) 0-52	.319**	-.065	.034	.245**	.165*	.431**

Note. Partial correlations controlling for age, sex, ethnicity and site; means, SD, and Range used raw variables; partial correlation used log transformed variables as indicated. Sample size for correlations = 208; SS= Zuckerman-Kuhlman Personality Questionnaire Sensation Seeking Subscale, T0 Stimulation = BAES stimulation at baseline; T2 Stimulation = BAES stimulation on ascending limb; T0 Sedation = BAES sedation at baseline; T4 Sedation = BAES sedation on descending limb, Weekly Drinking = Time Line Follow-Back Interview number of weekly drinks; RAPI total = total number of consequences experienced in the last three months.
** p <.01, * p<.05

Table 3. Partial Correlations for SS, Stimulation, Sedation, Weekly Drinking, and RAPI in Placebo Beverage Condition

	Mean (SD) Range	SS	T0 Stimulation	T2 Stimulation	T0 Sedation (log)	T4 Sedation (log)	Weekly Drinking (log)
SS	6.8017 (2.613) 0-11						
T0 Stimulation	26.12 (15.13) 0-63	-.020					
T2 Stimulation	28.25 (15.00) 0-62	.109	.727**				
T0 Sedation (log)	13.45 (12.90) 0-55	.144	-.091	-.058			
T4 Sedation (log)	13.87 (13.20) 0-49	.169	-.108	-.063	.399**		
Weekly Drinking (log)	13.93 (11.65) .23-63.23	.233*	.098	.061	.088	.060	
RAPI total (log)	9.00 (7.79) 0-52	.390**	-.051	.024	.278**	.271**	.438**

Note. Partial correlations controlling for age, sex, ethnicity and site; means, SD, and Range used raw variables; partial correlation used log transformed variables as indicated. Sample size for correlations = 108; SS= Zuckerman-Kuhlman Personality Questionnaire Sensation Seeking Subscale, T0 Stimulation = BAES stimulation at baseline; T2 Stimulation = BAES stimulation on ascending limb; T0 Sedation = BAES sedation at baseline; T4 Sedation = BAES sedation on descending limb, Weekly Drinking = Time Line Follow-Back Interview number of weekly drinks; RAPI total = total number of consequences experienced in the last three months.
** p <.01, * p<.05

Table 4. Partial Correlations for SS, Stimulation, Sedation, Weekly Drinking, and RAPI in Alcohol Beverage Condition

	Mean (SD) Range	SS	T0 Stimulation	T2 Stimulation	T0 Sedation (log)	T4 Sedation (log)	Weekly Drinking (log)
SS	7.0877 (2.633) 0-11						
T0 Stimulation	27.83 (13.90) 0-64	-.117					
T2 Stimulation	35.09 (14.08) 2-65	.167	.470**				
T0 Sedation (log)	14.97 (10.98) 0-45	-.076	-.084	-.089			
T4 Sedation (log)	18.25 (13.90) 0-58	-.010	-.146	-.124	.473**		
Weekly Drinking (log)	13.65 (10.78) .35-58.68	.161	.063	.175	.004	-.060	
RAPI total (log)	8.34 (6.60) 0-44	.237*	-.074	.073	.193	.022	.466**

Note. Partial correlations controlling for age, sex, ethnicity and site; means, SD, and Range used raw variables; partial correlation used log transformed variables as indicated. Sample size for correlations = 100; SS= Zuckerman-Kuhlman Personality Questionnaire Sensation Seeking Subscale, T0 Stimulation = BAES stimulation at baseline; T2 Stimulation = BAES stimulation on ascending limb; T0 Sedation = BAES sedation at baseline; T4 Sedation = BAES sedation on descending limb, Weekly Drinking = Time Line Follow-Back Interview number of weekly drinks; RAPI total = total number of consequences experienced in the last three months.
** $p < .01$, * $p < .05$

Table 5. Regression Analyses for BAES Stimulation as a Mediator of the Relation between Sensation Seeking and Weekly Drinking

		TLFB Weekly Drinking (Log)		
		n= 218		
Predictor	R^2	B	SE	β
	.131**			
Age		-.005	.009	-.039
Sex		-.136**	.049	-.191**
Ethnicity		.088	.049	.118
Site		-.077	.042	-.123
SS		.251**	.090	.193**
T0 Stimulation		.001	.002	.047
T2 Stimulation		.001	.002	.059

Note. Sex coded men = 0 women = 1; ethnicity coded non-Caucasian = 0, Caucasian = 1, site coded Yale = 0 ASU = 1; *p < .05; **p < .01

Table 6. Regression Analyses for BAES Sedation as a Mediator of the Relation between Sensation Seeking and Weekly Drinking

		TLFB Weekly Drinking (Log) $n = 210$		
Predictor	R^2	B	SE	β
	.131**			
Age		-.007	.009	-.057
Sex		-.147**	.050	-.211**
Ethnicity		.096	.050	.131
Site		-.063	.043	-.102
SS		.248**	.088	.194**
T0 Sedation (Log)		.032	.051	.047
T4 Sedation (Log)		-.040	.049	-.065

Note. Sex coded men = 0 women = 1; ethnicity coded non-Caucasian = 0, Caucasian = 1; Site coded Yale =0, ASU=1. *$p < .05$; **$p < .01$

Table 7. Regression Analyses for BAES Stimulation as a Mediator of the Relation between Sensation Seeking and Alcohol Problems

	RAPI TOTAL (Log) *n* = 218			
Predictor	R^2	B	SE	β
	.251**			
Age		-.019*	.009	-.132*
Sex		.117*	.051	.151*
Ethnicity		-.080	.050	-.099
Site		-.075	.043	-.110
SS		.365**	.093	.258**
TLFB Weekly Drinking (log)		.399**	.070	.366**
T0 Stimulation		-.002	.002	-.078
T2 Stimulation		.000	.002	.003

Note. Sex coded men = 0 women = 1; ethnicity coded non-Caucasian = 0, Caucasian = 1; Site coded Yale = 0 ASU =1; TLFB Weekly Drinking = Time Line Follow-Back Interview number of weekly drinks log transformed. *$p < .05$; **$p < .01$

Table 8. Regression Analyses for BAES Sedation as a Mediator of the Relation between Sensation Seeking and Alcohol Problems

	RAPI TOTAL (Log) *n* = 210			
Predictor	R^2	B	SE	β
	.321**			
Age		-.015	.009	-.106
Sex		.128*	.050	.164*
Ethnicity		-.124*	.050	-.151*
Site		-.049	.043	-.070
SS		.341**	.089	.239**
TLFB Weekly Drinking (log)		.444**	.070	.396**
T0 Sedation (log)		.148**	.051	.196**
T4 Sedation (log)		.050	.049	.072

Note. Sex coded men = 0 women = 1; ethnicity coded non-Caucasian = 0, Caucasian = 1; Site coded as Yale = 0 ASU = 1.**p* <.05, ***p*<.001.

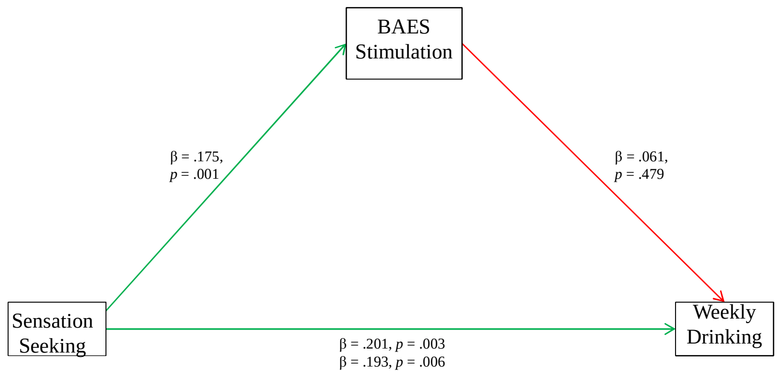

Figure 1. Mediation Analysis for BAES Stimulation as a Mediator of the Relation between Sensation Seeking and Weekly Drinking

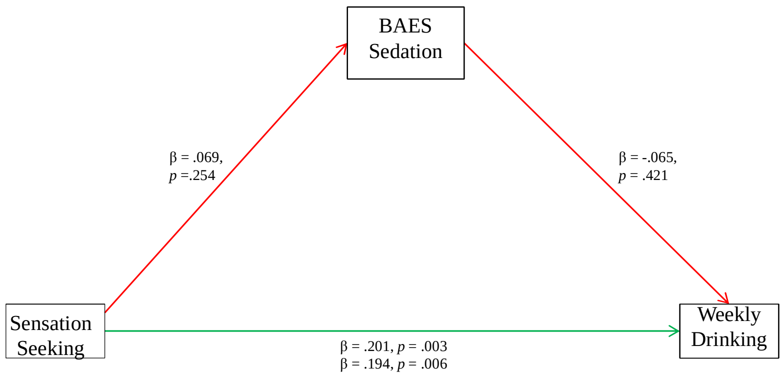

Figure 2. Mediation Analysis for BAES Sedation as a Mediator of the Relation between Sensation Seeking and Weekly Drinking

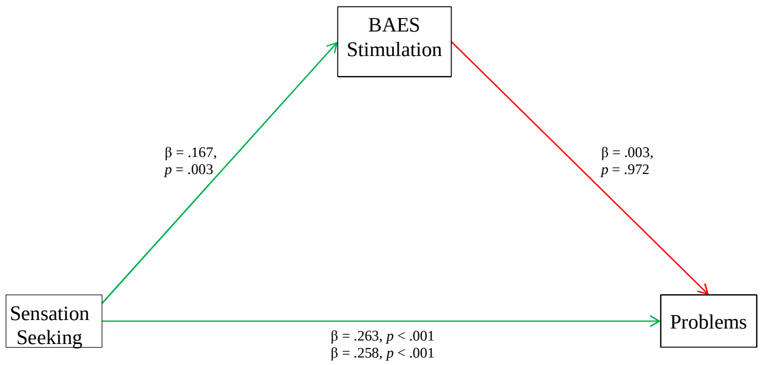

Figure 3. Mediation Analyses for BAES Stimulation as a Mediator of the Relation between Sensation Seeking and Alcohol Problems

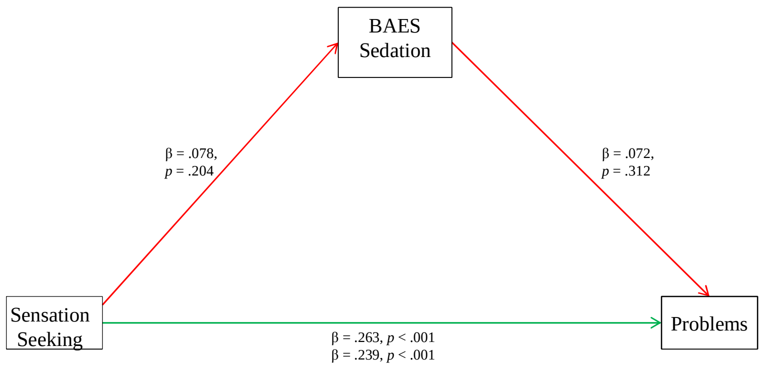

Figure 4. Mediation Analysis for BAES Sedation as a Mediator of the Relation between Sensation Seeking and Alcohol Problems