

Behavioral Economic Indices and their Relationship to Alcohol Consumption, Motives, and Impulsivity: A Structural Equation Model

by

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Abstract

Alcohol consumption and related negative consequences continues to be a systemic societal problem. College students are a population that has been identified as particularly high risk for a number of negative consequences as they are more likely to engage in binge drinking and heavy episodic drinking even when compared to same age non-college peers, and as a result, are more likely to experience negative consequences such as DUI, assault, rape, or death. Two factors that have shown robust relationships with college student drinking are motives for use and impulsivity. These factors have been shown to be predictive of higher rates of consumption and negative consequences; however a comprehensive model linking these factors has yet to be identified. Behavioral economics provides a framework for quantifying behavioral allocation and has shown strong correlational and predictive relationships with the aforementioned factors. This current study included 844 participants and examined whether alcohol motives mediate the relationship between behavioral economic measures of demand and impulsivity to alcohol consumption. Results indicate overall model fit was mixed and several interesting indirect paths emerged. Overall, impulsivity, elasticity, breakpoint, and intensity differentially predicted alcohol motives, and alcohol consumption was only predicted by four of the five motives examined. Intensity and impulsivity were related to all four motives that related to alcohol consumption. Breakpoint was positively related to both social and enhancement motives, and enhancement motives also included elasticity as a predictor. Overall, this study broadens the

existing literature by providing the start of an integrative framework that makes use of behavioral economics, impulsivity and motives for understanding college student drinking.

Table of Contents

Abstract	ii
List of Tables	v
List of Figures	vi
Introduction	1
Purpose	11
Hypothesis	11
Methods	12
Results	16
Discussion	25
References	39
Appendix A	63
Appendix B	64
Appendix C	65
Appendix D	66
Appendix E	67

List of Tables

Table 1	56
Table 2	57
Table 3	58

List of Figures

Figures 1	59
Figures 2	60
Figures 3	61
Figures 4	62

Behavioral Economic Indices and their Relationship to Alcohol Consumption, Motives, and Impulsivity: A Structural Equation Model

Alcohol is one of the most readily available and pervasively used drugs in our society. According to the 2013 SAHMSA report, over 136 million individuals aged 12 or older (52.2% of the population) reported being current drinkers, with approximately 60 million (22.9% of the population) binge drinkers (i.e., five or more alcoholic beverages within one session), and 16.5 million (6.3% of the population) heavy drinkers (i.e., those that meet binge drinking criteria on five separate occasions during a thirty day period). Nutt, King, and Phillips (2010) named alcohol as one of the most dangerous drugs consumed. This conclusion was reached as a result of a multi-criteria analysis of a drug's impact on various aspects of not only the self (e.g. dependence, injury, drug-specific impairment of mental function), but on several societal factors as well (e.g. crime, environmental damage, economic cost, community). A series of experts rated a variety of drugs based on these criteria, with alcohol obtaining the highest overall score (followed by heroin and crack cocaine). Of particular note, this study found that alcohol was the only drug that derived most of its overall score as a result of ratings received from societal related factors; all other drugs scored higher on items related to harm to the self.

Alcohol Use in College Students

Prevalence and Consequences

As a population, college students are at particular risk for problematic alcohol use. Since 1976, the National Institute on Alcohol Abuse and Alcoholism (NIAAA) has recognized abusive drinking by college students as a problem of note. Although problematic alcohol use occurs across a variety of age ranges, those aged 18-24 have shown not only the highest rates of alcohol

use but also the largest percentage of problem drinkers (Ham & Hope, 2003). Indeed, the Monitoring the Future survey (2014) reported that 63% of college students had consumed alcohol within the past 30 days, a rate higher than their same-aged non-college peers (57%). College students also report more occasions of heavy drinking, being drunk, and daily drinking than their non-college peers (Johnston, O'Malley, Bachman, Schulenberg, & Miech, 2014). National data also estimates that approximately 40% of college students engage in binge drinking, a number that has remained relatively stable over the past decade (Johnston, et al., 2014; Wechsler, Dowdall, Davenport, & Rimm, 1995; Wechsler, Dowdall, Maenner, Gledhill-Hoyt, & Lee, 1998). Binge drinking is of particular importance as multiple studies have indicated that binge drinking episodes are associated with elevated risk of negative consequences such as fatal car crashes, alcohol blackouts, sexual assault, physical injury, as well as various other harms (Bigelow, Heather, Peters, & Stockwell, 2001; Hingson & White, 2012; Johnson, Voas, Kelley-Baker, & Furr-Holden, 2010; Mallett et al., 2013; Read, Kahler, Strong, & Colder, 2006).

In line with the higher rates of alcohol consumption and binge drinking, college students also experience higher rates of alcohol related consequences. Drinking to intoxication has been shown to lead to global impairment across a variety of domains (e.g., cognitive or motor) (Hingson & White, 2012). As a result, 18 to 24 year old college students experience a number of unintentional negative consequences resulting from alcohol use. To start, alcohol related unintentional injuries or deaths have steadily increased over the past decade. Specifically, between 1998 and 2007 death rates increased from 1,442 in 1998 to 1,870 in 2007 for college students (Hingson, Heeren, Winter, & Wechsler, 2005; Hingson & White, 2010, 2012). Most of this increase was in relation to an increase in the number of alcohol-related traffic deaths, but non-traffic alcohol related injury or death has increased as well. Notably, poisoning related to

alcohol use has been identified as the majority of the increase in non-traffic related alcohol injury or death (Hingson & White, 2012).

Death and injury as a result of alcohol use, while being the most severe consequences, are not the only ones experienced by college student drinkers. Some other alcohol related harms include; physical assault, sexual assault, unsafe sex, health problems, suicide attempts, memory loss, academic difficulties, alcohol overdose, and alcohol addiction. With regards to both physical and sexual assault, more than 696,000 students per year are assaulted by another student who has been drinking while more than 97,000 students are the victims of alcohol-related date rape or sexual assault (Hingson, et al., 2005; Hingson & White, 2010, 2012). In addition, over 400,000 students report engaging in risky sexual behavior (e.g., unprotected sex) and more than 100,000 report having been too intoxicated to know if they consented to sex (Hingson, Heeren, Winter, & Wechsler, 2003). More than 150,000 students develop an alcohol-related health problem and heavy episodic drinking has been associated with lowered immunities (e.g., lower resistance to common illnesses) and decreased physical health (Engs & Aldo-Benson, 1995; Ham & Hope, 2003; Hingson, et al., 2005). In addition, 10% of non-binge drinkers, 27% of occasional binge drinkers, and 54% of frequent binge drinkers report experiencing at least one black out in the past year (Wechsler, Lee, Kuo, & Lee, 2000; White, 2003). With regards to alcohol overdose, the Drug Abuse Warning Network indicates that of the nearly 440,000 drug abuse related ED visits in 2011 by individuals 20 or younger almost half involved alcohol (DAWN, 2013). With respect to suicide attempts, 1.2-1.5% of students report a suicide attempt within the past year due to drinking and/or drug use (Presley, Leichliter, & Meilman, 1998). One quarter of students also report experiencing academic consequences as a result of drinking including; missing class, falling behind, performing poorly on exams or papers, and receiving

low grades (NIAAA, 2015; Presley, et al., 1998; Wechsler et al., 2002). Lastly, 19% of college students between the ages of 18 and 24 met the criteria for alcohol use disorder, with only 5% of these students seeking treatment for alcohol problems within the past year (NIAAA, 2015).

While alcohol use among college students is associated with problems that cause harm to the user, it is also associated with significant societal burden. Specifically, alcohol-related harms such as drunken driving, property damage, and police involvement pose a significant overall societal cost. With regards to drunk driving, it is estimated that 4,860,000 students aged 18 to 24 years old drove under the influence within the past year (NIAAA, 2015; SAMHSA, 2014). In addition, as many as 46% of people killed in crashes that involved 18 to 24 year old drinking drivers was someone other than the drinking driver (Hingson & Zha, 2009; Hingson, Zha, & Weitzman, 2009). With over 1,800 college student deaths each year from alcohol related unintentional injuries, and 599,000 unintentional injuries under the influence of alcohol, alcohol use remains one of the leading causes of injury and death within this population (Hingson, et al., 2005; Hingson & White, 2010, 2012; Hingson, et al., 2009). In addition, 25% of administrators from schools with low drinking rates, and over 50% from schools with higher drinking rates, report moderate to major problems with alcohol related property damage on their campuses (Wechsler, Dowdall, Davenport, & Castillo, 1995; Wechsler, et al., 1998). Lastly, estimates of police involvement related to college student drinking are as high as 5 percent of students who attend a four year college, while as many as 110,000 students between the age of 18 and 24 are arrested for violations related to alcohol use (Hingson, et al., 2005; Hingson & White, 2012; Wechsler, et al., 2002). Overall, college students present as a particularly at risk population with regards to alcohol related harms across a variety of contexts.

Motivations for using Alcohol

While quantity, frequency, and alcohol related consequences are important facets in understanding college student alcohol use, other key components have been identified. Arguably, understanding the antecedents and etiology behind college student drinking is an equally important piece of the college student alcohol use puzzle. To this end, a substantial research literature is dedicated to understanding drinking motives. Motivations for consuming alcohol have been conceptualized as a common pathway to its use (Cooper, 1994; Cox & Klinger, 1988; Kuntsche, Knibbe, Gmel, & Engels, 2005). Motivational models posit that a) substance use is often motivated by a desire for specific benefits or outcomes, and b) motives for such outcomes provide a decisional framework for alcohol consumption (Cooper, 1994; Cox & Klinger, 1988). Drinking motives, therefore, have been described as varying on two dimensions; internal reinforcement (i.e., enhancement and coping) versus external reinforcement (i.e., social and conformity), as well as by positive reinforcement (i.e., enhancement and social) versus negative reinforcement (i.e., coping and conformity). This model of motivations has been directly associated with alcohol consumption and the prediction of alcohol related problems (Carey & Correia, 1997; Cooper, 1994; Cooper, Frone, Russell, & Mudar, 1995; Kuntsche, et al., 2005; Martens, Cox, Beck, & Heppner, 2003; C. L. Park & Levenson, 2002).

The four dimensions of drinking motivations are variably related to alcohol outcomes and problems. Coping motives are when an individual drinks to avoid the experience of negative affective states (Cooper, 1994; Ham & Hope, 2003). Coping motives have been shown to be associated with drinking frequency and problems (Armeli, Conner, Cullum, & Tennen, 2010; Carey & Correia, 1997; Read, Wood, Kahler, Maddock, & Palfai, 2003; Simons, Correia, & Carey, 2000). In addition, coping motives have been associated with the presence of depressed

mood, anxiety, and the use of alcohol as a means of reducing dysphoria (Ham & Hope, 2003; Rousseau, Irons, & Correia, 2011; Stewart & Devine, 2000). Overall, coping motives appear to be related to higher drinking related problems and psychological distress. Conformity motives represent individuals who drink as a means of attaining peer acceptance and social approval. This involves drinking to avoid the experience of social censure (Ham & Hope, 2003; Kuntsche, et al., 2005). Conformity motivated college drinkers have a tendency to be more self-conscious and report using alcohol as a means of coping with feelings of social awkwardness (Stewart & Devine, 2000). Enhancement motives are when an individual endorses drinking to increase positive affect and has been shown to both predict alcohol related problems, and shows a stronger relationship to alcohol consumption (Armeli, et al., 2010; Cronin, 1997; McCabe, 2002; Pedersen, Neighbors, Lee, & Larimer, 2012; Wood, Nagoshi, & Dennis, 1992). Lastly, social motives are when an individual drinks to achieve affiliation with others. Of note, socially motivated drinkers may have increased likelihood of consuming alcohol but do not appear to be at increased risk of problems resulting from drinking (Cronin, 1997; Kassel, Jackson, & Unrod, 2000; Stewart & Devine, 2000). Drinking motives have been shown to be predictive of, as well as mediate the relationship between, alcohol consumption and negative consequences (Jones, Chryssanthakis, & Groom, 2014; Pedersen, et al., 2012; Yurasek, et al., 2011). Overall, research on motivations for engaging in alcohol use has furthered our understanding of both the etiology and maintenance of alcohol consumption.

Impulsivity

Another important factor to consider when examining college student drinking is that of impulsivity. Impulsivity is a broad construct that is commonly operationalized as either a difficulty in inhibiting responses or as a tendency to overvalue immediate relative to delayed

rewards (Madden & Bickel, 2010). Measures of impulsivity have been predictive of substance abuse acquisition and maintenance across both a variety of substances and species (Anker, Perry, Gliddon, & Carroll, 2009; Carroll, Anker, Mach, Newman, & Perry, 2010; Perry & Carroll, 2008; Stanford et al., 2009). In addition, several studies have outlined the impact of impulsivity on substance consumption and the presence of alcohol related problems within the college student population specifically (Day-Cameron, Muse, Hauenstein, Simmons, & Correia, 2009; MacKillop, Mattson, Anderson MacKillop, Castelda, & Donovan, 2007; Petry, 2001; Vuchinich & Simpson, 1998).

The association between alcohol use, impulsivity, and various alcohol related outcomes has been studied extensively with college students. To start, measures of impulsivity have been shown to correlate to, and be predictive of, both alcohol consumption and binge drinking behavior such that greater levels of impulsivity are associated with increased alcohol consumption and more reported binge drinking episodes (Jones, et al., 2014; LaBrie, Kenney, Napper, & Miller, 2014; MacKillop, et al., 2007; Madden & Bickel, 2010; Odum & Rainaud, 2003; A. Park, Kim, Gellis, Zaso, & Maisto, 2014; Richards, Zhang, Mitchell, & de Wit, 1999). Longitudinal data indicates that measures of impulsivity are one of the strongest predictors of drinking variability during the first few weeks of college and are predictive of alcohol consumption during the first year of college (Loxton, Bunker, Dingle, & Wong, 2015). In addition, impulsivity also shows a strong association with college students engaging in risky behavior as well as negative consequences as a result of alcohol use (Diulio, Silvestri, & Correia, 2014; Hustad, Pearson, Neighbors, & Borsari, 2014; Jones, et al., 2014; A. Park, et al., 2014; Simons, Gaher, Correia, Hansen, & Christopher, 2005). Finally, several studies have detailed the mediating roles of motives when examining the relationship between alcohol use and impulsivity

(Anderson, Briggs, & White, 2013; Jones, et al., 2014; Kuntsche, et al., 2005; Stewart & Devine, 2000; Yurasek, et al., 2011). Overall, impulsivity appears to have an important influence in elucidating the etiology and maintenance of problematic alcohol consumption within the college student population.

Behavioral Economics

While alcohol consumption, motives, and impulsivity have provided important etiological pieces to the puzzle of problematic college student drinking, they fall short in providing a full explanation for increased alcohol consumption. Behavioral economics is a theoretical model that seeks to bridge this gap. Behavioral economics is the study of the allocation of behavior within a system of constraint, and examines conditions that influence the consumption of a given commodity (Bickel, Johnson, Koffarnus, MacKillop, & Murphy, 2014; Bickel, Madden, & Petry, 1998). Combining the basic principles of operant conditioning and choice behaviors with consumer demand theory principles has yielded a framework for expanding our understanding of behavior allocation within complex choice systems. Building off of behavioral choice work from Premack (1965) and Herrnstein (1970) and the law of demand from microeconomics (i.e., the inverse relationship between consumption of any commodity and its price; (J. G. Murphy, MacKillop, Skidmore, & Pederson, 2009) behavioral economics has constructed a means of quantifying behavioral allocation (Hursh, 1984, 1993; Hursh & Silberberg, 2008).

The behavioral economic framework has been particularly of use in the study of substance abuse (Bickel, et al., 2014; Correia, Murphy, & Butler, 2011; J. G. Murphy, Barnett, & Correia, 2012; J. G. Murphy, et al., 2009). Within this framework, patterns of substance use can

be studied as they develop and change over time within the context of fluctuations in reinforcer availability (J. G. Murphy, MacKillop, Vuchinich, & Tucker, 2012). The value a person places on a substance is examined as a cost/benefit ratio, where drug use is more likely to occur when there are minimal constraints on drugs and substantial constraints on access to valued substance-free reinforcers (J. G. Murphy, MacKillop, et al., 2012; Vuchinich & Tucker, 1998). Variables such as income, price, availability of alternative reinforcers, and reinforcement delay have been identified as important influences on this choice (Correia, Murphy, & Barnett, 2012). For example the frequency, quantity, and negative consequences of alcohol use are associated with reinforcement derived from substance-free activities within the college student population (Correia, Carey, & Borsari, 2002; Correia, Carey, Simons, & Borsari, 2003; Skidmore, Murphy, & Martens, 2014).

Demand is one of the primary dependent variables in behavioral economics research (J. G. Murphy, MacKillop, et al., 2012). Demand provides a means of quantifying the amount of a commodity purchased in relation to other commodities (or cost) with the consumption of a commodity inversely relating to its cost (Vuchinich & Heather, 2003; Vuchinich & Tucker, 1988, 1998, 2003). Elasticity of demand provides a means of quantifying the sensitivity of commodity consumption to price change, such that, consumption patterns can vary based on price, commodity, and individual assessed. In addition to cost, a choice between reinforcers often interacts with the relative immediacy of each reinforcer (Bickel et al., 2012). One strategy for assessing demand is a hypothetical purchasing task (Jacobs & Bickel, 1999). This task presents the participant with hypothetical scenarios pertaining to how much of a substance they would purchase and consume at a variety of different prices (J. G. Murphy & MacKillop, 2006). Demand curves are then generated to provide a nonlinear model of demand as a function of unit

price (Hursh & Silberberg, 2008). The purchasing tasks and subsequent demand curves are typically used to derive five behavioral economic demand indices; 1) breakpoint (the first price at which consumption is zero); 2) demand intensity (substance consumption at the lowest price point); 3) *O*max (output maximum, or the maximum financial expenditure on each of the substances); 4) *P*max (price maximum, or the price at which expenditure is maximized); 5) elasticity of demand (sensitivity of substance consumption to increases in cost) (see Figure 1 for depiction). Lastly, factor analysis indicates that the five indices cluster into two latent constructs; “Persistence” which represents sensitivity to escalating price and “Amplitude” which reflects the amount consumed and spent (MacKillop et al., 2009; Skidmore, et al., 2014) (Figure 2).

Many indices derived from behavioral economics are sensitive to changes in addiction severity and can be used as a means of assessing treatment outcome (Tucker, Foushee, & Black, 2008; Tucker, Roth, Vignolo, & Westfall, 2009; Tucker, Vuchinich, Black, & Rippens, 2006; Tucker, Vuchinich, & Rippens, 2002). Of particular note, many of these indices have been shown to be significantly associated with severity of substance misuse, particularly within the college student population. For example, alcohol demand has been significantly associated with the severity of alcohol misuse among young adults (J. G. Murphy & MacKillop, 2006; J. G. Murphy, et al., 2009; Skidmore & Murphy, 2010; Skidmore, et al., 2014). In addition, alcohol demand has been shown to predict response to brief alcohol interventions such that increased demand for alcohol is associated with decreased response to intervention (MacKillop & Murphy, 2007). Overall, behavioral economics has shown to be a reliable and valid means of assessing substance use pathology across a number of facets.

Purpose

Overall, motives and impulsivity are important components of understanding patterns of alcohol consumption among college students. In addition, behavioral economics has also emerged as a conceptual framework from which behavioral choice allocation can be both measured and used as a means of assessing substance use pathology. While each of these facets have been independently tested within the college student population, and several studies exist examining the interplay between one or more, no study has examined all of these components concurrently or using latent variable modeling. As such, the current study intends to use latent variable modeling to analyze a proposed structural equation model. This model examines how the relationship between five common behavioral economic indices as well as impulsivity with alcohol consumption may be mediated by motives within a college student population (Figure 3).

Hypotheses

First we hypothesized that the observed and derived behavioral economic indices would significantly correlate with consumption, impulsivity, and motives. Based on prior work examining the relationships between alcohol consumption, behavioral economics, impulsivity, and motives we hypothesized that the five latent variables associated with drinking motives would mediate the relationship between the latent facets of the five derived behavioral economic indices (i.e., persistence and amplitude) and impulsivity with alcohol consumption. That is, we hypothesized that individuals who report higher levels on the behavioral economic facets and greater impulsivity would show a positive relationship with the five latent motivation facets, and that these variables would fully mediate the relationship between the behavioral economic latent variables and impulsivity with our outcome variable. In addition we hypothesized that the latent

facets related to behavioral economic variables and impulsivity would be significantly correlated with one another.

Methods

Participants

Participants in this study were recruited from a sample of undergraduate students enrolled in a large public Southeastern university. Recruitment occurred online through the SONA system and the survey was hosted and administered through the Qualtrics survey website. Participants were provided with an informed consent to review, and once consent was provided, were able to access the survey. All participants were at least 18 years old and were compensated for their time with extra credit for the psychology courses. Data collection through the fall 2015 semester resulted in a sample of 1030 participants (77.7% female, M_{age} : 19.3, 90.5% White/Non-Hispanic, 52.1% Greek affiliated). The final sample was made up of the 844 (80.2%) participants who endorsed having ever consumed an alcoholic beverage at some time in their life.

Measures

Demographic Questionnaire. The measure assessed basic demographic information including; sex, age, year of school completed, Greek membership, ethnicity, and current residence.

Daily Drinking Questionnaire. (DDQ-R; Collins, Parks, & Marlatt, 1985): The DDQ was used to assess alcohol use during the previous 28 days. Participants reported the “number of drinks” and “number of hours drinking” for each day of a typical week and heaviest drinking week during the past 28 days. The DDQ is widely used with college students and has

demonstrated strong psychometric properties (Kivlahan, Marlatt, Fromme, Coppel, & Williams, 1990).

Hypothetical Alcohol Purchasing Task (APT; Murphy & Mackillop, 2006): The APT presents participants with a hypothetical party scenario and asks them how many drinks they would purchase and consume at 17 different price points (J. G. Murphy & MacKillop, 2006). The APT includes the following instructions:

In the questionnaire that follows we would like you to pretend to purchase and consume alcohol. Imagine that you and your friends are at a party on a weekend night from 9:00p.m. until 2:00a.m. to see a band. The following questions ask how many drinks you would purchase at various prices. The available drinks are standard size domestic beers (12 oz.), wine (5 oz.), shots of hard liquor (1.5 oz.), or mixed drinks containing one shot of liquor. Assume that you did not drink alcohol or use drugs before you went to the party, and that you will not drink or use drugs after leaving the party. You cannot bring your own alcohol or drugs to the party. Also, assume that the alcohol you are about to purchase is for your consumption only. In other words, you can't sell the drinks or give them to anyone else. You also can't bring the drinks home. Everything you buy is, therefore, for your own personal use within the 5 hour period that you are at the party. Please respond to these questions honestly, as if you were actually in this situation.

Participants were then asked “How many drinks would you consume if they were ____ each?” at the following 17 price points; \$0, \$0.25, \$0.50, \$1, \$1.50, \$2, \$2.50, \$.3, \$4, \$5, \$6, \$7, \$8, \$9, \$10, \$15, and \$20. Reported consumption was then plotted as a function of price. Expenditures at each price point were calculated by multiplying reported consumption by the

price point. A Cronbach's alpha of .95 indicated high internal reliability for the raw purchasing task data.

Demand curves were then generated to provide a nonlinear model of demand as a function of unit price (Hursh & Silberberg, 2008). The purchasing tasks and subsequent demand curves were used to derive five behavioral economic demand indices; 1) breakpoint (the first price at which consumption is zero); 2) demand intensity (substance consumption at the lowest price point); 3) O_{max} (output maximum, or the maximum financial expenditure on each of the substances); 4) P_{max} (price maximum, or the price at which expenditure is maximized); 5) elasticity of demand (sensitivity of substance consumption to increases in cost). Estimations for elasticity of demand were generated by fitting participant's reported consumption across prices to Hursh and Silberberg's (2008) exponential demand curve equation: $\ln Q := \ln Q_0 + k(e^{-aP} - 1)$.

Drinking Motives Questionnaire – Revised (DMQ-R; Grant, Stewart, O'Connor, Blackwell, & Conrod, 2007): The DMQ-R was used to assess motivations associated with alcohol use. The 28 item DMQ-R measured five different motives for use; social (e.g., as a way to celebrate), coping-anxiety (e.g., because it helps me when I am feeling nervous), coping-depression (e.g., to cheer me up when I'm in a bad mood), enhancement (e.g., because it makes me feel good), and conformity (e.g., so that others won't kid me about not using). Items were measured on a 5-point likert-type scale ranging from 0 (almost never/never) to 4 (almost always/always). As each subscale had a different number of questions, the range of possible scores varied by subscale. The social, enhancement, and conformity subscales (5 items each) ranged from 0 to 20, coping-anxiety (4 items) ranged from 0 to 16, and coping-depression (9 items) ranged from 0 to 36. The DMQ-R has displayed adequate psychometric properties in prior

studies with college students (Grant, et al., 2007) and was internally consistent within this sample ($\alpha = .87$)

Barratt Impulsiveness Scale (BIS; Stanford, et al., 2009): The BIS, a 30-item self-report questionnaire, was used to assess state/trait impulsivity. Participants responded on a likert-type scale (1=*Rarely/Never* and 4 = *More than 10 Times*), and a total score was generated by assigning the individual's responses a numeric value based on a rubric provided with the BIS and individual responses were summated to achieve a total score. The total score was used as a general indicator of the overall personality/behavioral construct of impulsivity. Prior work has demonstrated that the BIS has strong psychometric properties with the college student population (Stanford, et al., 2009). This measure was internally consistent within this sample ($\alpha = .95$)

Data Coding and Analysis

Prior to conducting analyses, the data was cleaned and inspected for missing values and outliers. Univariate outliers and missing data were handled using a Robust Maximum Likelihood estimator (MLR) (Muthén & Muthén, 1998-2012a). Next, item sets related to each variable were combined and internal reliability of each scale was assessed. Following, the five behavioral economic indices were computed. Intensity, breakpoint, O_{max} , and P_{max} were all directly observed from the raw consumption and expenditure data (J. G. Murphy, et al., 2009). Elasticity, however, cannot be observed from raw data and has to be derived. Estimations for elasticity of demand were generated by fitting participants' consumption across price points to the Hursh and Silberg (2008) exponential demand curve equation: $\ln Q := \ln Q_0 + k(e^{-aP} - 1)$. Variables in this equation are defined as follows; Q is the quantity consumed, k specifies the range of the dependent variable (drug consumption) in logarithmic units, and a specifies the rate of change in

consumption with changes in price (elasticity). The value of k (in natural log units) is a constant across all curve fits, and for this particular study was held constant at 2.8. As such, individual differences in elasticity are defined by a single parameter (a) which is both standardized and independent of reinforcer magnitude. The magnitude of the a parameter is then interpreted such that a larger a value reflects greater price sensitivity (elasticity). Several criteria were used to judge whether individual purchasing task data was deemed viable for the calculation of elasticity values. Based on prior research, individuals who had less than five reported consumption values, reported a single value for all prices at which they would drink, or had more than one missing value among reported consumption data were omitted from the initial analysis (Hursh & Silberberg, 2008; MacKillop & Murphy, 2007; J. G. Murphy, Correia, Colby, & Vuchinich, 2005). Additionally, individuals who had an R^2 value of .30 or less for their demand curve were also excluded from the final analysis as the exponential demand function was deemed an unsuitable fit for these participants (J. G. Murphy, et al., 2009). Once all criteria were accounted for, viable elasticity data was derived for 641 of the 844 participants.

Pearson correlations were then calculated between the five behavioral economic indices, consumption, motives, and impulsivity. Once all behavioral economic indices were derived, the structural associations between the latent factors of alcohol consumption, persistence, amplitude, motives, and impulsivity were explored (see figure 3 for a depiction of the model).

Results

Alcohol Consumption

Of the 844 individuals who reported having ever consumed alcohol, 73.7% ($n=610$) of individuals within this sample reported consuming an alcoholic beverage at least once within the

past month. Participants reported consuming about 6.6 ($SD=7.3$) drinks during a typical week and 10.5 ($SD=11.4$) drinks during their heaviest drinking days over the past 30 days. Males reported both significantly greater typical weekly drinking compared to females (8.3 and 6.2 respectively) [$t(826)=3.51, p<0.001$] as well as significantly greater consumption on heavier drinking days (15.4 and 10.1 respectively) [$t(823)=4.05, p<0.001$].

Associations between primary model constructs

Pearson correlations were calculated between the primary model constructs. Observed total scores for a measure's latent construct were used to ascertain the correlative relationships between each of these variables. Results presented in Table 1 indicate several interesting significant and non-significant relationships. As expected, total scores for each of the alcohol motive subtypes were significantly correlated with one another (r 's ranging from 0.31 to 0.77, $p<0.01$). In addition, motive subtypes were also significantly correlated with total impulsivity scores and all six constructs showed significant positive relationships with both drinking outcome variables (Table 1).

With regards to the behavioral economic indices, all of the observed behavioral economic variables (i.e., breakpoint, intensity, O_{max} , and P_{max}) were significantly correlated with one another (r 's ranging from 0.16 to 0.78, $p<0.01$). These indices were also all significantly correlated with impulsivity, the five motivation factors, and the two drinking outcome variables (Table 1). Elasticity, our derived variable, showed significant negative correlations with each of the observed indices (r 's ranging from -0.36 to -0.64, $p<0.01$). As the a parameter used as a measure of elasticity is larger for individuals with more elastic demand (i.e., their consumption drops at a rate that is greater than the increasing cost of the commodity) this finding is consistent

with prior literature (J. G. Murphy & MacKillop, 2006; J. G. Murphy, et al., 2009; Pickover, Messina, Correia, Garza, & Murphy, 2015; Skidmore, et al., 2014). This variable showed moderate negative correlations with both the mediating and outcome variables with two notable exceptions. Elasticity was only weakly correlated with coping–depression motives ($r=-0.08$, $p<0.05$) and no significant correlation was observed with the conformity motives variable ($r=-0.05$, $p=ns$). Overall, these results indicated that the majority of the factors being tested within the proposed model showed significant correlative relationships with one another.

Model Testing

MPLUS version 7.2 and a robust maximum likelihood estimator were used to analyze the associations between the latent constructs of impulsivity, behavioral economics, motives, and alcohol consumption (Muthén & Muthén, 1998-2012b). Overall model fit was assessed by examining the fit indices of chi-square, Root Mean Square Error of Approximation (RMSEA) and its confidence interval, Comparative Fit Index (CFI), and Standardized Root Mean Square Residual (SRMR) (Brown, 2012). Recommended cut off values were used for each of the aforementioned fit indices. Specifically, a non-significant chi-square value, RMSEA near or below 0.06, RMSEA CI lower bound below 0.05, RMSEA CI upper bound below 0.10, CFI near or above 0.95, and SRMR near or below 0.08 were considered evidence of good or close overall fit (Brown, 2012; Hu & Bentler, 1999; Kline, 2011b). These fit indices were considered in whole in order to balance the relative strengths and weaknesses of each approach (Brown, 2012; Hu & Bentler, 1999).

Initially, the model presented in Figure 3 was examined. Within this model, the impulsivity variable was constructed from the 30 items of the BIS loading onto a single latent

factor, the behavioral economic variables were modeled as represented in Figure 2, the latent facets of drinking motives were modeled using the items that make up each construct as indicators, and alcohol consumption using reported weekly drinking and reported maximum drinking (Monday through Sunday) as indicators for a latent consumption construct. When this model was attempted MPLUS indicated a failure to converge. Failures of convergence are often related to variables in the model being measured on different scales, poor starting values, and/or a model being estimated that is inappropriate for the data (Muthén & Muthén, 1998-2012b).

These scenarios result in items within the covariance matrix that have variance ratios greater than 10, indicating that they are ill scaled (Kline, 2011a). As SEM is an iterative process, where estimates are adjusted over multiple iterations in an attempt to improve overall fit, if observed variables have variances that are very different in magnitude estimate adjustments will disproportionately affect each of these variables (Kline, 2011a). That is to say, an estimate adjustment in this scenario that may result in a small change within one variable would simultaneously result in a large change in the other variable.

After examining the covariance matrices and item scales it was determined that elasticity was the most likely problematic variable as elasticity values tend to range in the hundredths to thousandths decimal place. In order to correct for elasticity's small variance relative to other variables, elasticity was rescaled by performing a linear transformation where the elasticity was multiplied by a constant (in this case 1000) to bring its scale variance in line with the other variables in the model. Once the transformation was conducted the model was again tested using the new transformed elasticity variable but again failed to converge.

Once the model failed to converge a second time, an iterative process to determine the cause of the convergence problem was conducted. To start, a purely path analytic model using

total scores for all relevant variables was tested. The behavioral economic variables were modeled as distinct entities and the total drinking scores for both typical and maximum DDQ responses were used as separate outcome variables. This model succeeded in converging but the overall model fit was poor ($\chi^2(22) = 1568.18, p < 0.001; RMSEA = 0.29, 90\% CI [0.28, 0.30]; CFI = 0.43; SRMR = 0.15$).

Following, latent models of each of the variables were independently tested to assess issues of convergence. First, the impulsiveness variable was again modeled as a latent construct with all other variables remaining observed. This model also failed to converge. Given that the BIS has an established multilevel factor structure (Stanford, et al., 2009) a second attempt via modeling the BIS as a multilevel latent factor, with six first order factors and three second order factors was conducted. This too failed to converge and it was determined that the BIS would remain an observed construct in the final model.

Next, a model using the behavioral economic latent variables was examined; this model did converge with all relevant indicators loading significantly on to their latent factors for the behavioral economic indices. Though this model offered a better overall fit than the purely path analytic one, the fit was still poor ($\chi^2(44) = 678.51, p < 0.001; RMSEA = 0.13, 90\% CI [0.12, 0.14]; CFI = 0.83; SRMR = 0.10$). A model using drinking motives as latent constructs was then examined. This model did converge, and the overall model fit met established cut points for several of the fit indices ($\chi^2(536) = 3508.503, p < 0.001; RMSEA = 0.082, 90\% CI [0.079, 0.084]; CFI = 0.87; SRMR = 0.074$). A final model examining whether our outcome variable, drinks consumed, was causing convergence issues was examined. This model also converged but again the model fit was poor ($\chi^2(236) = 4037.74, p < 0.001; RMSEA = 0.094, 90\% CI [0.09, 0.097]; CFI = 0.57; SRMR = 0.13$).

Based on the individual model testing the impulsivity latent factor was determined to be the potential cause of the remaining convergence issues. The next step taken was testing several iterations of models with multiple latent and observed factors. The first model tested was one with latent behavioral economic and motives variables with observed drinking outcomes which failed to converge. It was determined that one final model examining both latent motives and a latent drinking variable would be tested. This model, however, also failed to converge. Given that there exist a body of evidence in the behavioral economic literature indicating that these five indices may be measuring distinct constructs rather than having a shared latent structure, the final model retained the five variables as observed (Dennhardt & Murphy, 2013; J. G. Murphy, et al., 2009). In addition, while a model with a latent drinking variable did converge, its overall model fit was extremely poor. As a result, the final retained model included observed behavioral economic variables, impulsivity scores, as well as observed maximum and typical number of drinks consumed while retaining the motivation subtypes as latent variables (Figure 4).

Final Model

As previously stated, overall model fit met established cut points for several of the fit indices ($\chi^2(536) = 3508.503, p < 0.001$; $RMSEA = 0.082, 90\%CI[0.079, 0.084]$; $CFI = 0.87$; $SRMR = 0.074$). Of particular note, fit indices appeared to follow a pattern of either just meeting criteria (e.g., $SRMR = 0.074$) or being just below criteria (e.g., $CFI = 0.87$). However, since several of these fit statistics were violated any interpretation of said model should be taken with caution.

To start, the behavioral economic variables and impulsivity were all significantly correlated within this model (Table 2). In addition, the motive mediators were also all significantly correlated with one another (Table 3). When examining the significant pathways to

the motivations mediators a few interesting findings emerge. Within this final model impulsivity as well as three of the behavioral economic indices, breakpoint (i.e., the first price at which consumption is zero), elasticity (i.e., sensitivity to substance consumption with increasing cost), and intensity (i.e., consumption at the lowest price point) were differentially predictive of the motives subtypes. The other two variables, P_{max} (i.e., price at which expenditure is maximized, and O_{max} (i.e., maximum financial expenditure) did not significantly predict any of the drinking motives.

Impulsivity total scores positively predicted each of the latent drinking motives; enhancement ($B=0.017$, $STDYX=0.167$, $p<0.001$), conformity ($B=0.010$, $STDYX=0.168$, $p<0.001$), coping-anxiety ($B=0.019$, $STDYX=0.298$, $p<0.001$), coping-depression ($B=0.026$, $STDYX=0.355$, $p<0.001$), and social ($B=0.005$, $STDYX=0.070$, $p<0.05$). Intensity also positively predicted the majority of drinking motives; enhancement ($B=0.073$, $STDYX=0.293$, $p<0.001$), coping anxiety ($B=0.031$, $STDYX=0.202$, $p<0.001$), coping depression ($B=0.031$, $STDYX=0.172$, $p<0.001$), and social ($B=0.050$, $STDYX=0.274$, $p<0.001$) but did not predict conformity motives. Breakpoint positively predicted only two drinking motives; enhancement ($B=0.036$, $STDYX=0.191$, $p<0.01$), and social ($B=0.041$, $STDYX=0.300$, $p<0.001$). Finally, elasticity was negatively associated with enhancement motives ($B=-0.016$, $STDYX=-0.100$, $p<0.05$).

Motivation subtypes also differentially predicted both of the drinking related outcomes. Social motives ($B=16.18$, $STDYX=1.83$, $p<0.001$), coping–depression motives ($B=32.01$, $STDYX=3.60$, $p<0.001$), and enhancement motives ($B=6.45$, $STDYX=0.50$, $p<0.05$) showed positive relationships with typical weekly alcohol consumption, while coping-anxiety motives negatively predicted this outcome ($B=-52.93$, $STDYX=-5.14$, $p<0.001$). This same pattern was also observed with maximum weekly alcohol consumption. Social ($B=24.47$, $STDYX=1.76$,

$p < 0.001$), coping–depression motives ($B = 49.30$, $STDYX = 3.53$, $p < 0.001$), and enhancement ($B = 10.04$, $STDYX = 0.97$, $p < 0.05$) motives positively predicted maximum weekly alcohol consumption and again coping-anxiety motives negatively predicted this outcome ($B = -81.16$, $STDYX = -5.01$, $p < 0.001$). Conformity motives did not significantly predict either drinking outcome measured.

Based on these findings, twenty-two potential indirect pathways were examined. Indirect effects were tested using the bootstrapping procedure available in MPLUS. Bootstrapping is considered the more powerful test of mediation as it makes no assumptions about the shape of the distribution of the indirect effect nor does it assume large sample sizes (Preacher & Hayes, 2008). The bootstrapping procedure uses a large number of samples of the same size that are created randomly by sampling your existing sample and allowing for replacement. The indirect effect is computed for each of these random samples and 95% confidence intervals are used to determine the presence of significant indirect effects. Using a bias-corrected bootstrapping procedure is typically recommended as it tends to perform best compared to the default percentile bootstrapping procedure (Mallinckrodt, Abraham, Wei, & Russell, 2006).

As such, bias corrected bootstrapping with a sample criterion of 5000 was used to test the twenty-two indirect pathways. Using this analysis resulted in significant findings for each of the twenty-two indirect paths examined. To start, significant indirect paths were observed between impulsivity and typical weekly drinking through enhancement motives ($CI_{95\%}[0.02, 0.27]$), coping-anxiety motives ($CI_{95\%}[-1.75, -0.61]$), coping-depression motives ($CI_{95\%}[0.50, 1.38]$), and social motives ($CI_{95\%}[0.02, 0.22]$). Breakpoint's relationship to typical weekly alcohol consumption was also significantly mediated by enhancement ($CI_{95\%}[0.05, 0.75]$) and social ($CI_{95\%}[0.36, 1.38]$) motives. Enhancement ($CI_{95\%}[0.10, 1.18]$), coping-depression

($CI95\%[0.51, 2.02]$), coping-anxiety($CI95\%[-3.46,-0.88]$), and social ($CI95\%[0.43, 1.60]$) motives mediated the relationship between intensity and typical weekly alcohol consumption. Finally, enhancement motives ($CI95\%[-0.34, -0.01]$) mediated the relationship between elasticity and typical weekly alcohol consumption.

A similar pattern of results was observed when testing indirect paths between the exogenous variables and maximum alcohol consumption. Enhancement ($CI95\%[0.04, 0.412]$), coping-depression ($CI95\%[0.77, 2.21]$), social ($CI95\%[0.026, 0.332]$), and coping-anxiety ($CI95\%[-2.81, -0.91]$) motives significantly mediated the relationship between impulsivity and maximum alcohol consumption. In addition, the relationship between breakpoint and maximum alcohol consumption had significant indirect effects through enhancement ($CI95\%[0.071, 1.13]$) and social ($CI95\%[0.53, 2.16]$) motives. Enhancement ($CI95\%[0.17, 1.89]$), coping-depression ($CI95\%[0.80, 3.20]$), coping-anxiety ($CI95\%[-5.61, -1.33]$), and social ($CI95\%[0.64, 2.50]$) motives significantly mediated the pathway between intensity and maximum alcohol consumption. Lastly, the relationship between elasticity and maximum alcohol consumption was significantly mediated by enhancement motives ($CI95\%[-0.51, -0.01]$).

Discussion

The current study sought to provide a model that would help bridge the gap between the impulsivity, behavioral economics, and motivations literature as well as provide a basis with which researchers could begin constructing a more global understanding of the path between various theoretically informed distal factors and the decision to engage in alcohol consumption. College students continue to be at particularly high risk for negative consequences related to alcohol consumption and examination of potential antecedents to alcohol consumption within

more comprehensive models is warranted. Factors such as impulsivity and motives for use have shown robust relationships with college student drinking (Dunne, Freedlander, Coleman, & Katz, 2013; Kuntsche, et al., 2005; Loxton, et al., 2015). Additionally, behavioral economics has emerged as another important facet for understanding college student alcohol consumption (J. G. Murphy, Correia, & Barnett, 2007; J. G. Murphy, Skidmore, et al., 2012; Skidmore, et al., 2014). The current study sought to test a theoretical model that examined the causal relationships between these facets. Specifically, this model sought to examine the relationship between impulsivity and behavioral economics to alcohol consumption through the Cox and Klinger (1988) theoretical model which places alcohol motives as a universal mediator. As such, this study sought to examine this theoretical framework with the addition of the aforementioned antecedent variables as a means of providing a more comprehensive model for substance use, as well as examine how these components coalesce within a single model.

As hypothesized, total observed scores for each of the constructs examined and the behavioral economic indices were correlated with one another (Table 1). As evidenced in prior work, total scores for each of the motive subtypes were significantly correlated with one another as well as with measures of alcohol consumption (Blackwell & Conrod, 2003; Kuntsche, et al., 2005). In addition, this study also replicated significant correlations between the motive subtypes and impulsivity (Jones, et al., 2014). A novel finding from this study was found with the correlations between the behavioral economic variables and the motive subtypes. In this study, significant correlations between the behavioral economic variables and each of the motives were observed. Breakpoint, intensity, O_{max} , and P_{max} showed significant positive correlations with each of the motive subtypes. Elasticity, however, showed significant negative correlations with motives with the exception of conformity motives which was non-significant. This was

consistent with an observed trend among the correlation matrix, where the behavioral economic variables showed a tendency to correlate with similar strengths depending on the motive examined (Table 1). The behavioral economic variables had the strongest relationships with social and enhancement motives, while conformity motives correlated the weakest. To date, only one other study has examined these relationships, though it found different results than the current analysis (Yurasek, et al., 2011). Notably, the prior study only examined coping and enhancement motives, but found that they demonstrated non-significant relationships with P_{max} , elasticity, and breakpoint. Given the disparity in findings, further study is warranted. Finally, as repeated in several previous studies, each of the behavioral economic variables replicated significant correlations with both impulsivity, and alcohol consumption (Acker, Amlung, Stojek, Murphy, & MacKillop, 2012; Gray & MacKillop, 2014; Jones, et al., 2014; MacKillop, et al., 2007; Messina et al., 2014). The results of the current and previous studies add to the evidence supporting the validity of the behavioral economic measures of alcohol demand.

The Final Model

The final retained model included observed impulsivity total scores, independent behavioral economic variables, latent motives, and two observed drinking outcomes. Given the plethora of convergence issues, this particular model retained the highest fidelity to the hypothesized model while having better overall fit when compared to the other viable models examined. That being said, this model still violated several fit indices' established cut points (e.g., CFI, RMSEA, $90\%CI_{RMSEA}$ lower bound) and, as previously stated, any interpretation should be taken with caution. Further discussion of model fit can be found in the limitations section.

Overall, several interesting findings were observed when examining the retained model. To start, two of the exogenous variables, impulsivity and intensity, showed robust relationships with drinking motives. Impulsivity was directly related to all five motives while intensity was directly related to all but conformity motives. Of note, Intensity showed the stronger loadings to motives compared to impulsivity. Demand intensity is associated with the number of drinks one would consume at the lowest price point (i.e., free). Results indicate that this number of drinks consumed at the zero price point appears to be robustly related to a variety of drinking motives. Additionally, intensity and impulsivity were the only two exogenous variables that had significant causal pathways to the two coping motives (depression and anxiety), suggesting that individuals who have higher self-reported impulsivity and would consume a greater number of alcoholic beverages at zero cost are more likely to be motivated to drink to cope. These findings replicate prior work examining components of the overall model proposed within this study. Only one other study has examined behavioral economic indices as exogenous predictor variables that are mediated through motives (Yurasek, et al., 2011). Findings from this study showed a mediated pathway between the two motivation subtypes examined (e.g., enhancement and coping) and intensity as well as *Omax*. However, the model examined by Yurasek et al., (2011) only included two of the motivations and two behavioral economic indices. Prior work within behavioral economics has indicated that, of the five indices typically examined, intensity and *Omax* have demonstrated particular clinical significance (MacKillop & Murphy, 2007; J. G. Murphy, et al., 2007). The current study findings replicate past results regarding demand intensity but also indicate that when all behavioral economic indices, as well as impulsivity, are examined through each of the theoretical motives, *Omax* becomes non-significant. This suggests

that in light of a multifaceted model predicting relative alcohol consumption, *Omax* may have a more direct effect on total consumption rather than a mediated one through alcohol motives.

This study also provides support to prior work that has implicated impulsivity as a variable of particular importance when accounting for coping motives (Gonzalez, Reynolds, & Skewes, 2011; Jones, et al., 2014; Loxton, et al., 2015). Findings from this work implicate impulsivity and intensity as two variables of particular importance in predicting drinking to cope. Coping motives have been shown to be associated with drinking frequency, problems, depressed mood, anxiety, and use of alcohol as a means of reducing dysphoria (Armeli, et al., 2010; Ham & Hope, 2003; Read, et al., 2003; Stewart & Devine, 2000). As coping motives show significant relationships with a number of negative drinking consequences, means of which to identify those who would drink to cope are warranted. Findings from this study provide support for the use of measures of impulsivity and behavioral economics (specifically intensity) as a means of identifying individuals who are at risk for drinking to cope.

Breakpoint was predictive of both social and enhancement motives while elasticity was also predictive of enhancement motives. Breakpoint is the price at which consumption reaches zero, with those that consume for social or enhancement reasons reporting a higher price at which consumption reaches this threshold. Results suggest that those who drink for social reasons are more likely to consume alcohol at higher prices than those who are motivated for coping or conformity reasons. That is to say, individuals who engage in consumption of alcohol for social reasons have greater relative alcohol demand as well as a willingness to purchase alcohol at greater prices. This relative price insensitivity is reflected further with enhancement motives. Elasticity was found to be significantly negatively related to this motivation suggesting that those who have an inelastic response pattern are more likely to drink for enhancement

motives. Prior findings suggest that individuals who drink to enhance their mood and surrounding environment may experience relative drink price insensitivity (Yurasek, et al., 2011). This is consistent with the behavioral economic research literature as breakpoint and elasticity have been shown significant relationships with weekly and heavy drinking as well as significant prediction of greater alcohol consumption following a brief intervention (MacKillop & Murphy, 2007; J. G. Murphy, et al., 2007; J. G. Murphy & MacKillop, 2006; J. G. Murphy, et al., 2009; J. G. Murphy, Skidmore, et al., 2012).

This differentiation between social and enhancement motives can be explained using the Cooper (1994) four factor model of motivation. This model posits that enhancement and social motives both result in positive reinforcing effects for the individual albeit through different mechanisms (Cooper, 1994). Social motives posit that reinforcement is derived externally from the organism (i.e., from others in the environment) while enhancement motives' reinforcement is derived from internal mechanisms (i.e., physiological reactions to alcohol) (Cooper, 1994; Cox & Klinger, 1988). From a conceptual standpoint individuals motivated by social motives may show price insensitivity and demonstrate unit-elastic demand as the primary function of alcohol is the facilitation of external reinforcement. That is to say, for those motivated for social reasons, alcohol is not the primary reinforcement but a means of attaining a secondary reinforcer (i.e., social contact). As such, these individuals may be willing to purchase a small amount of alcohol at a greater price point to access these social reinforcers, with that consumption falling in a unit-elastic manner. This is consistent with findings from the literature that demonstrate while those who engage in socially motivated drinking are more likely to consume alcohol they do not appear to be at increased risk for alcohol related problems (Cronin, 1997; Kassel, et al., 2000; Kuntsche, et al., 2005). As those that consume for enhancement reasons are seeking the internal

reinforcement attained through alcohol consumption, it follows that these individuals would not only be willing to pay a greater price for alcohol, but show relative insensitivity to these increasing prices. For these individuals, access to the mood enhancing effects is not significantly impeded by drink price (Yurasek, et al., 2011). This is supported by findings that those who engage in enhancement drinking motives demonstrate both greater alcohol consumption and more alcohol related negative consequences (Armeli, et al., 2010; Kuntsche, et al., 2005; Wood, et al., 1992). This study provides the first piece of evidence that behavioral economic variables can distinguish between individuals who engage in social and enhancement motives.

Two behavioral economic variables, P_{max} and O_{max} showed no direct causal relationships with the motives variables, though they were significantly correlated with all other exogenous variables. Only one other study has an approximate examination of these variables mediated through motives, with this study finding disparate results. Yurasek et al., (2011) found significant partial indirect effects for O_{max} and a latent variable that included P_{max} and O_{max} through two motivation subtypes (i.e., enhancement and coping) to alcohol consumption in two separately tested models. In the current study, neither P_{max} nor O_{max} significantly relate to any of the motives examined. Prior work has demonstrated the importance of P_{max} and O_{max} as they are significantly related to heavy drinking, greater alcohol consumption at 6-month follow-up, alcohol related consequences, and alcohol craving (MacKillop et al., 2010; MacKillop & Murphy, 2007; J. G. Murphy, et al., 2007; J. G. Murphy & MacKillop, 2006; J. G. Murphy, et al., 2009). While Yurasek et al., (2011) found partial mediation for O_{max} and for a latent P_{max} variable through motives to alcohol consumption; it is possible that when O_{max} and P_{max} are modeled independently, and with multiple exogenous variables, the indirect relationships becomes non-significant. Given the support for O_{max} and P_{max} as robust predictors of multiple

drinking outcomes, as well as findings from this study, future work should examine models where these components directly predict alcohol consumption.

Finally, all motives with the exception of conformity were predictive of the drinking outcome variables. Those that drink for conformity reasons do so to attain negative reinforcement from external sources (e.g., reduction of social pressures to drink) (Cooper, 1994). While there is evidence that individuals who drink for conformity reasons show greater anxiety sensitivity, greater self-consciousness, and greater overall anxiety there is little evidence to state that they have greater alcohol consumption relative to their peers (Cooper, 1994; Ham & Hope, 2003; Stewart & Devine, 2000). As such, findings from this study are consistent with the literature, where all other motives are associated with increased alcohol consumption. While conformity may not significantly predict alcohol consumption in the present model it is possible that alternative models, that include factors that have been previously implicated with conformity motivations as exogenous variables, may better elucidate this motivation's part in understanding alcohol consumption.

While these findings help to shed some light on the interplay between all of these components, it is the examination of the indirect effect testing where some interesting patterns begin to emerge. This study sought to examine a model based on the Cox and Klinger (1988) hypothesis of motives acting as a universal mediator towards alcohol consumption. To this end, full mediation indirect effects were tested, and all paths examined were found to be significant. This evidence provides support for the idea that motivators act as a unifying mediator between potential exogenous variables and the decision to consume alcohol. In addition, several interesting indirect path clusters based on motivations emerged. For example, coping-depression and coping-anxiety related motives were predicted by the impulsivity and intensity exogenous

variables, however, an inverse effect is observed for the path between coping-anxiety and the endogenous variables. This suggests that while these two variables predict each of the different coping motives their impact on subsequent drinking changes depending on the motivation subtype. That is to say, when individuals are motivated to consume in order to cope with anxiety we observe an inversion of the relationship between impulsivity and intensity with the drinking outcomes. In other words, when the relationship between intensity and impulsivity to alcohol consumption is mediated through coping-anxiety, we observed that increases in impulsivity and intensity are associated with reduced alcohol consumption. This differs from coping-depressive motives, which show the same relationships with the exogenous variables, but when coping-depressive motives are the mediator impulsivity and intensity are associated with increased alcohol consumption. Prior work purports that coping-depressive motives are more robustly related with alcohol consumption than coping-anxiety, though both demonstrate a strong relationship with negative consequences (Blackwell & Conrod, 2003; Dawson, Grant, Stinson, & Chou, 2005; Graham, Massak, Demers, & Rehm, 2007; Grant, et al., 2007; Stewart, Morris, Mellings, & Komar, 2006). Indeed at least one study noted that coping with anxiety motives may be negatively related to alcohol consumption despite its positive relationship with alcohol problems and dependence (Morris, Stewart, & Ham, 2005). This may be due to the wide variety of anxiety disorders and the likelihood that one would be both in the presence of their anxiety related stimulus as well as have access to alcohol. That is to say, while one might drink in order to cope with feelings of anxiety, alcohol consumption may not be their primary coping mechanism.

Paths through social and enhancement motives provide another set of interesting findings. To start, while both of these motives mediate impulsivity and intensity as well, enhancement

motives also mediate elasticity and both show significant indirect pathways with breakpoint to alcohol consumption. This creates different clusters of exogenous variables that are mediated by each of the different motivators. For example, those whose substance use is mediated through the enhancement motive show greater impulsivity, higher intensity, greater breakpoint, and inelastic demand. Those whose substance use is mediated through social motives tend to show a similar pattern, though their demand is closer to elastic/unit-elastic rather than inelastic. These findings support that various motivations are caused by different clusters of exogenous variables, and provide support those motives mediate the relationship between these variables and alcohol consumption. To date, only one other study has looked at a model with similar variables (Yurasek, et al., 2011). This study, however, did not view the behavioral economic variables in a concurrent model, nor did they examine each motivation subtype, choosing instead to restrict just to enhancement and coping motives. In one model, Yurasek et al., (2011) found significant partial mediation of intensity and O_{max} to alcohol consumption whereas the current study provides support for full mediation of intensity and non-significant pathways for O_{max} . A second model examined replaced intensity and O_{max} for a latent “Persistence” variable comprised of O_{max} , P_{max} , elasticity, and breakpoint. This model found significant partial mediation for the persistence latent variable through enhancement motives but not coping. Findings from this prior work are somewhat inconsistent with the current study, albeit, given the relatively large disparities in the models tested direct comparisons between said works is difficult. In addition, the aforementioned study only published two fit indices (i.e. CFI=.90 and Incremental Fit Index (IFI)=.91) which limits direct model fit comparisons. However, given that the model proposed within this study found comparable fit statistics to the one’s provided in the

prior study (CFI=.87) within a single more complex model, rather than across two separate models, the current study may provide a more comprehensive explanation of said phenomenon.

Limitations

While findings from this study help us to expand on the overall college student drinking literature and provide the start to a more comprehensive model of drinking behavior, several limitations to its findings do exist. To start, the current sample was fairly homogenous, and while this study was directed towards understanding college student drinking, the results may not generalize to other campuses, such as one's in different geographic regions or historically black colleges and universities. Without sampling more diverse individuals from a variety of campuses in different geographic locations caution should be exercised when generalizing these findings. Additionally, this was a cross sectional study, and while statistical techniques such as the one's used in this study, work with cross-sectional data they cannot directly affirm causal relationships between constructs (Kazdin, 2003). Additional work using longitudinal data with multiple time points assessed is needed to further validate this model. This study also utilized a single measure to assess demand. The hypothetical purchasing task is only one means of measuring demand and only offers a portion of the variables considered within behavioral economics. Purchasing tasks only assess price and expenditure as a means of modeling cost for a given behavior. Alternative measures, such delay reward discounting (DRD, (Bickel, et al., 2014)) or the Adolescent Reinforcement Survey Schedule (ARSS, (J. G. Murphy, et al., 2005)) examine cost in terms of time and availability of alternative reinforcement respectively. Future models should consider the addition of these components as a means of examining their overall fit into a larger behavioral economic model of alcohol consumption.

Another limitation within this study was the issues with model convergence. As detailed in the results section the original proposed model, as well as several subsequent models, failed to converge. These failures to converge may indicate that some of these constructs do not amend themselves to latent variable work. For some constructs, such as the behavioral economic indices, this is consistent with existing literature as several papers propose these may in fact be distinct constructs (MacKillop, et al., 2010; J. G. Murphy, Dennhardt, et al., 2012; J. G. Murphy, et al., 2009; J. G. Murphy, MacKillop, et al., 2012). Additionally, the study examining the factor structure of the behavioral economic indices used a Principle Component's Analysis (PCA) rather than an Exploratory Factor Analysis (EFA). While PCA is of a similar vain to EFA there are several important differences. Notably, PCA does not parse out shared and unique variance accounted for by the indicators; rather PCA is more of an item reductionist technique that is less likely to be replicated with a CFA. EFA, on the other hand, examines both shared and unique variance for a set of indicators as a means of measuring an underlying latent construct and the relative contribution of each indicator for that construct. Future work can focus on using EFA to examine both the shared and unique variance of these facets. A failure to converge was also observed with the BIS. While the BIS does show strong psychometric properties, the construct of impulsivity might be too broad for this singular measure. Future work should consider using multiple measures of impulsivity in order to provide a more comprehensive representation of impulsivity.

A third limitation to this study has to do with model fit. The final model presented violated several model fit indices' cut points. To start, our chi-square test of exact fit was significant, indicating that this model was not an exact fit for the data. This can result from several different sources including model misfit, multivariate non-normality, and large sample

sizes (Bentler & Bonett, 1980; Hooper, Coughlan, & Mullen, 2008; Hu & Bentler, 1999). There is disagreement in the literature regarding the importance of the chi-square test in evaluating model fit. For example, Brown (2012) argues that the chi-square test is overly stringent and should be ignored while Kline (2011) advocates that ignoring chi-square tests is a poor practice and views it as unacceptable. One of the key limitations highlighted with chi-square tests are their sensitivity to large sample sizes. Indeed, some work indicates that sample sizes above 400 almost always violate this fit index (Bentler & Bonett, 1980; Hooper, et al., 2008; Kenny, 2015; Tanaka, 1987). The RMSEA cut point of .08 for mediocre model fit was also violated by this model, albeit only by a small amount ($RMSEA=0.082$) (Hu & Bentler, 1999). In addition, discrepant findings for the 90%CI for RMSEA were observed as both the nulls for good and poor fit were retained. Finally, disparate fit was also observed with a CFI violating the suggested cut point, albeit by a small margin, and SRMR was within acceptable levels. Of note the majority of the violated fit indices were approximate of their recommended values, which could mean that additional alternative modeling may bring fit to acceptable levels. In addition, issues of potential multicollinearity between the coping motives may have contributed to poor model fit. Given the sizeable correlation between these two variables, future models should consider modeling coping as a single unitary construct. Overall, with such discordance among fit indices any model interpretation runs the risk of being erroneous, and as such, should be taken with caution.

Concluding Statements

This study adds to the literature by examining a previously untested model of college student drinking and offers some validation of the Cox and Klinger (1988) theory of motivations. The study proposed two hypotheses; a) that behavioral economic indices, impulsivity, motivations, and alcohol consumption would be significantly correlated with one another, and b)

that using latent variable modeling, motives would fully mediate the relationship between behavioral economics and alcohol consumption. This study found strong support for the first hypothesis in that all but one correlation between these items was significant in the predicted direction. In addition, results from this study demonstrated previously unobserved correlative relationships between behavioral economics and motives, providing support for the interrelation of these variables.

Support for the second hypothesis was also found within this study. Indirect effects testing indicated evidence of indirect pathways between several of the behavioral economic variables and impulsivity to alcohol consumption. While studies exist that have examined parts of this model (Yurasek, et al., 2011), no study to date has looked at how each of these components coalesce within a single model. Overall model fit was mixed, however several interesting clusters of paths emerged. First, two of the exogenous behavioral economic variables (P_{max} and O_{max}) showed no significant direct paths with motivations, suggesting that these indices may have a more direct causal effect on the college students' decision to consume alcohol. Second, conformity motives showed no significant direct pathways to either drinking outcome though this is unsurprising as this motive subtype had the weakest correlations among all variables examined. This finding provides additional evidence to prior work establishing that those who drink to conform do not show increased alcohol consumption compared to non-conforming peers (Cooper, 1994; Ham & Hope, 2003; Stewart & Devine, 2000). Finally, motivations subtypes differentially mediated several exogenous variables. Coping related motivations only mediated impulsivity and intensity, social motives included an indirect path from breakpoint as well, and enhancement motives additionally implicated both breakpoint and elasticity. This variability in loading provides support that various aspects of alcohol valuation

differentially relate to motivations, and subsequent alcohol consumption, and provides some of the first of evidence of behavioral economics variables ability to distinguish these differences. Overall, this model was able to provide evidence for some of the antecedent factors that influence the decision for one to consume alcohol.

Given the limitations and potential implications of these findings, follow-up work is warranted. As previously stated, model fit indices were mixed and any interpretation should be taken with caution. Future work should focus on testing alternative models that include direct paths from the non-implicated behavioral economics variables to drinking outcomes. Next, several of the factors examined failed to converge into latent constructs. Follow-up work can focus on expanding and diversifying the indicators for these constructs (e.g., impulsivity) in order to both better model and understand these complex phenomena. While findings from the current study have implications regarding alcohol consumption, one of the main target areas for both assessment and intervention is alcohol related negative consequences (Jones, et al., 2014). Future work can expand on this model by testing alternative models that include alcohol related negative consequences. The current study also failed to examine the intertemporal relationships and stability of these constructs as it was a cross-sectional design. Future work using a longitudinal research design is warranted to examine the interactive nature of these constructs. The current study provides evidence for the necessity of further research in to this complex phenomenon to help elucidate both the relationships between behavioral economics, motives, impulsivity, and alcohol consumption as well as the implications of additional antecedent factors. Lastly, research examining how models, such as the one from the current study, can help inform and be applied to the assessment and treatment of problematic drinking is warranted to address this systemic problem.

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Table 1

Bivariate Correlations for Behavioral Economics, Motives, Impulsivity, and Consumption

Correlations between the BIS, Behavioral Economic Variables, and Drinking Variables.
Correlations

	Breakpoint	Intensity	Omax	Pmax	Elasticity	BIS (Total)	DMQ (Social)	DMQ (Coping-A)	DMQ (Coping-D)	DMQ (Enhance)	DMQ (Conformity)	DDQ (Typical)	DDQ (Max)
Breakpoint	-	-	-	-	-	-	-	-	-	-	-	-	-
Intensity	0.38**	-	-	-	-	-	-	-	-	-	-	-	-
Omax	0.73**	0.56**	-	-	-	-	-	-	-	-	-	-	-
Pmax	0.78**	0.16**	0.51**	-	-	-	-	-	-	-	-	-	-
Elasticity	-0.58**	-0.37**	-0.64**	-0.36**	-	-	-	-	-	-	-	-	-
BIS (Total)	0.13**	0.21**	0.16**	0.12**	-0.15**	-	-	-	-	-	-	-	-
DMQ (Social)	0.46**	0.42**	0.43**	0.32**	-0.22**	0.15**	-	-	-	-	-	-	-
DMQ (Coping - A)	0.25**	0.32**	0.28**	0.22**	-0.14**	0.32**	0.62**	-	-	-	-	-	-
DMQ (Coping - D)	0.14**	0.27**	0.20**	0.13**	-0.08*	0.39**	0.37**	0.77**	-	-	-	-	-
DMQ (Enhancement)	0.40**	0.44**	0.40**	0.29**	-0.24**	0.27**	0.73**	0.70**	0.54**	-	-	-	-
DMQ (Conformity)	0.11**	0.11**	0.12**	0.08*	-0.05	0.19**	0.36**	0.52**	0.53**	0.31**	-	-	-
DDQ (Typical)	0.39**	0.58**	0.51**	0.21**	-0.32**	0.23**	0.49**	0.34**	0.24**	0.52**	0.11**	-	-
DDQ (Max)	0.37**	0.55**	0.51**	0.19**	-0.32**	0.19**	0.46**	0.33**	0.23**	0.51**	0.09*	0.85**	-

Notes: DDQ = Daily Drinking Questionnaire, DMQ-R = Drinking Motives Questionnaire - Revised, BIS = Barratt Impulsiveness Scale.

* $p < .05$

** $p < .01$

Table 2

Model Correlations between Exogenous Variables

Correlations between the Exogenous Variables in Final Model

	Correlations					
	Breakpoint	Intensity	Omax	Pmax	Elasticity	BIS (Total)
Breakpoint	-	-	-	-	-	-
Intensity	0.38**	-	-	-	-	-
Omax	0.73**	0.56**	-	-	-	-
Pmax	0.78**	0.16**	0.51**	-	-	-
Elasticity	-0.58**	-0.47**	-0.71**	-0.50**	-	-
BIS (Total)	0.13**	0.21**	0.16**	0.12**	-0.15**	-

Notes: BIS = Barratt Impulsiveness Scale.** $p < .001$

Table 3

Model Correlations between Mediator Variables

Correlations between Motivation Subtypes in Final Model

	Correlations				
	DMQ (Social)	DMQ (Coping-A)	DMQ (Coping-D)	DMQ (Enhance)	DMQ (Conformity)
DMQ (Social)	-	-	-	-	-
DMQ (Coping - A)	0.66**	-	-	-	-
DMQ (Coping - D)	0.31**	0.91**	-	-	-
DMQ (Enhancement)	0.80**	0.70**	0.43**	-	-
DMQ (Conformity)	0.38**	0.60**	0.53**	0.24**	-

Notes: DMQ-R = Drinking Motives Questionnaire - Revised

** $p < .001$

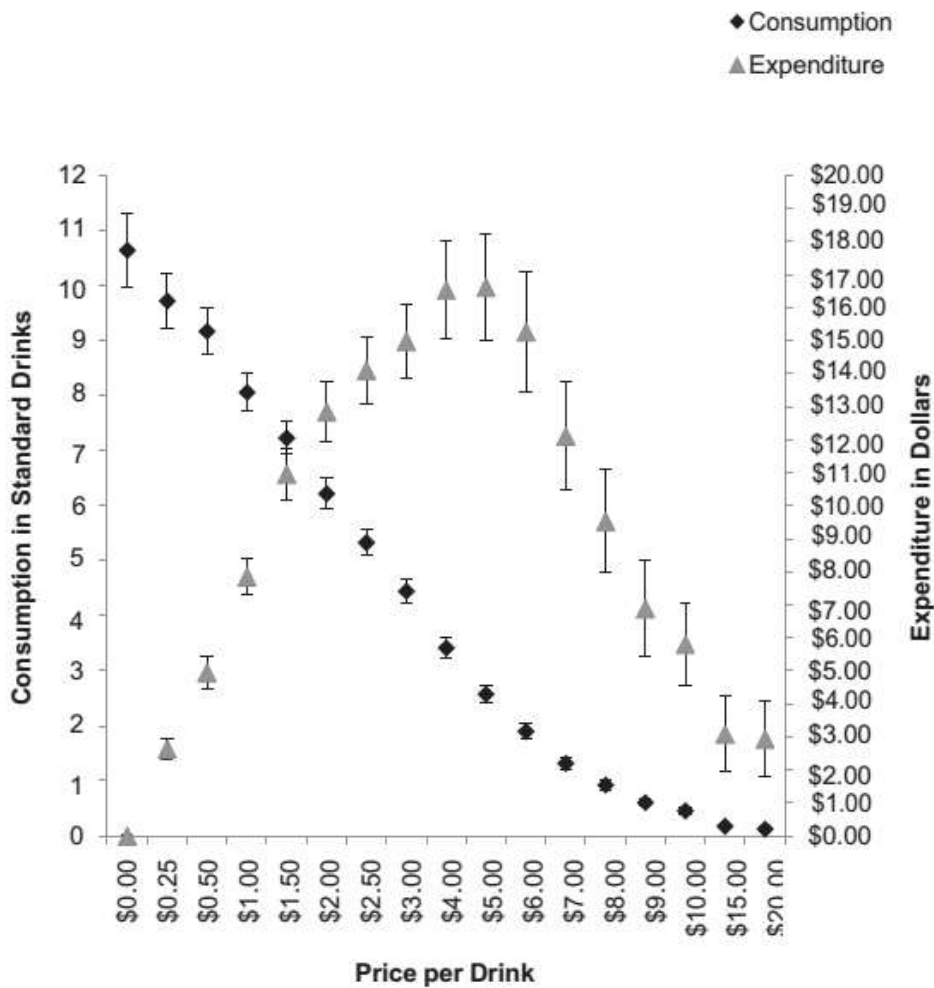


Figure 1 Demand and expenditure curves. Means and standard errors for hypothetical alcohol consumption (left axis) and expenditures (right axis) at 17 levels of price. Consumption is represented with diamonds and expenditures with triangles. Reprinted from “Behavioral Economic Measures of Alcohol Reward Value as Problem Severity Indicators in College Students” by J.R. Skidmore, J.G. Murphy, and M.P. Martens, 2014, *Experimental and Clinical Psychopharmacology*, Vol. 22, No. 3, 198-210. Copyright 2014 by the American Psychological Association

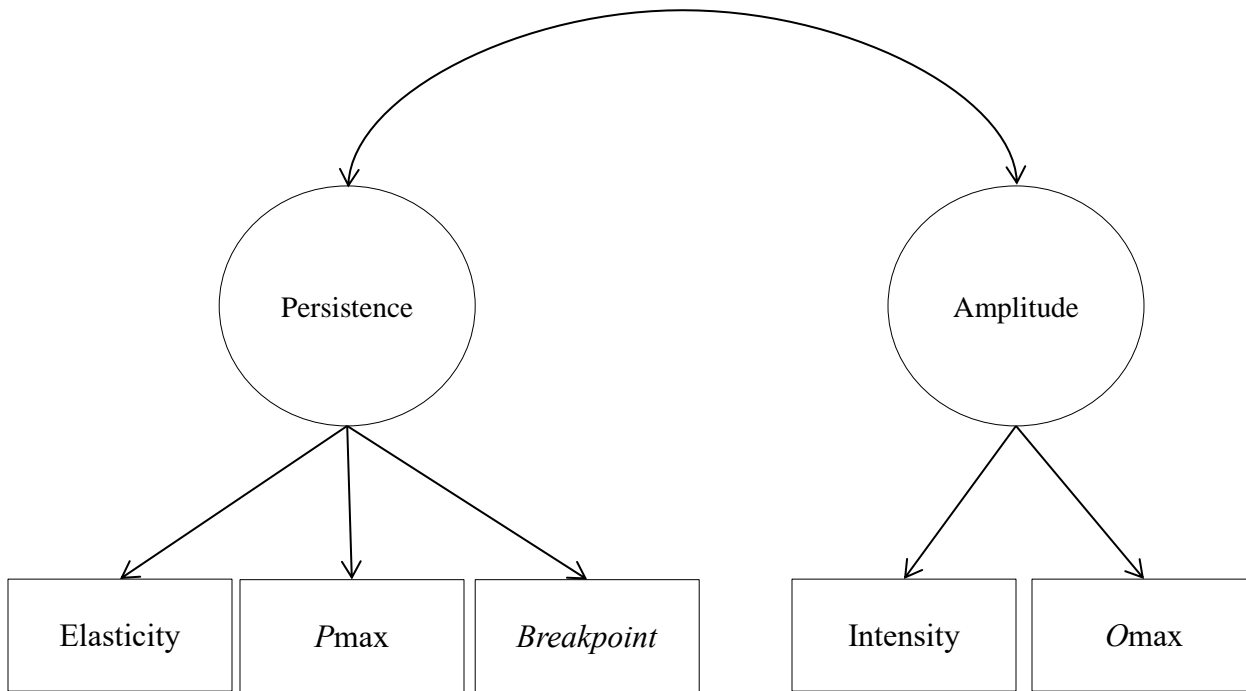


Figure 2: Factor Analytic model of the five primary behavioral economic indices.

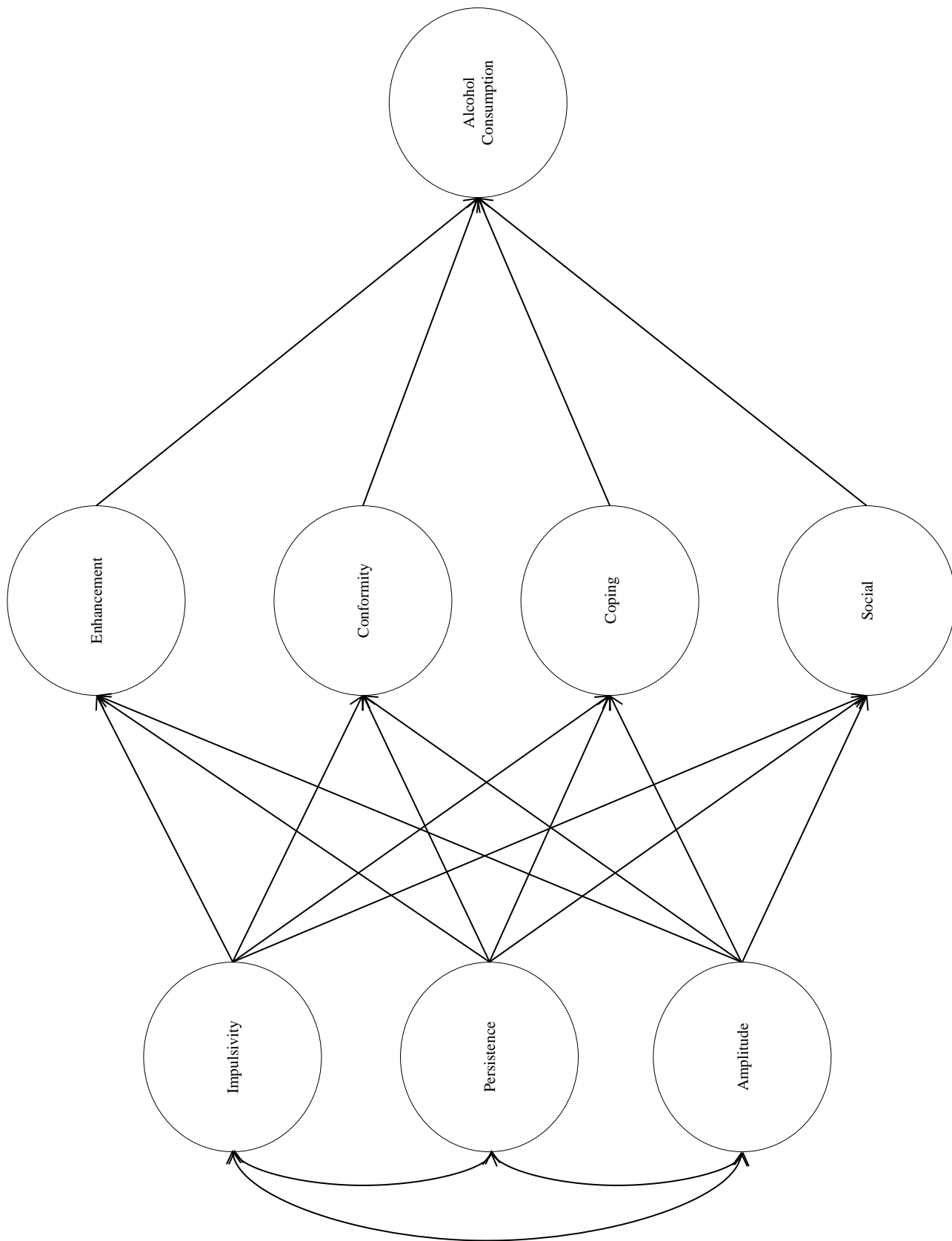


Figure 3. The association between alcohol consumption, behavioral economic latent variables, impulsivity, motives, and negative alcohol related consequences. Correlations between mediators not depicted.

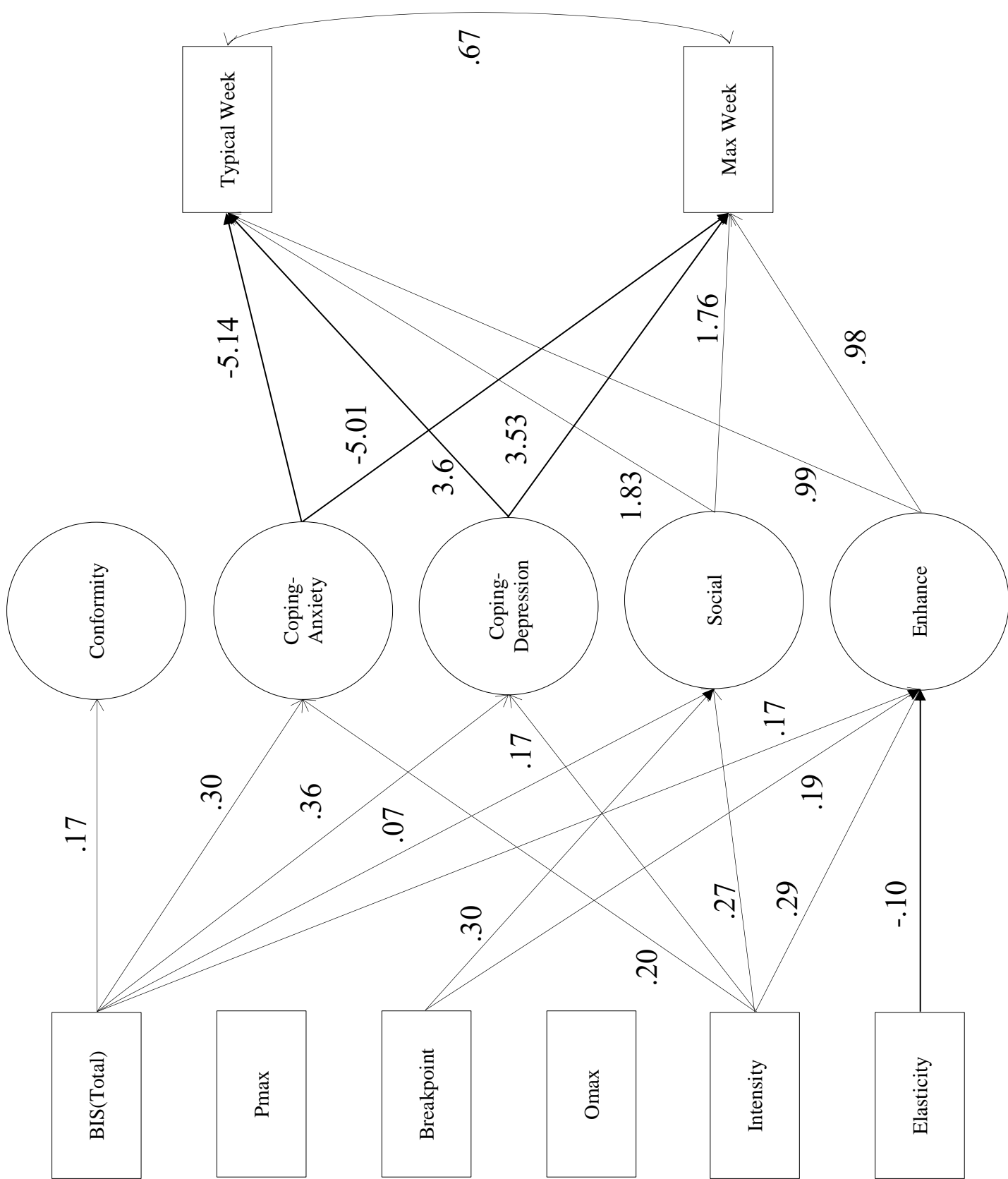


Figure 4: The final retained model based on model fit. Not pictured are factor loadings, disturbances, correlations between exogenous factors, and mediator correlations. All factor loadings depicted are standardized and statistically significant.

Appendix A

Demographics

Do not place your name or any other identifying information on this questionnaire

1. Please indicate your gender: _____ Male (1) _____ Female (2)

2. How old are you? _____ years.

3. What is your class standing:

1. Freshman 2. Sophomore 3. Junior 4. Senior 5. Other

4. Are you a member of a fraternity or sorority? _____ Yes (1) _____ No (2)

5. Please check one of the following Ethnic categories:

_____ Hispanic or Latino (1) _____ Not Hispanic or Latino (2)

6. Please check as many of the following Racial categories that apply to you:

_____ American Indian or Alaska Native _____ Asian

_____ Black or African American _____ Native Hawaiian or Other Pacific Islander

_____ White

7. Where do you currently reside?

_____ Off campus house or apartment (1) _____ At home with parents/guardians (2)

_____ Fraternity House (3) _____ Campus dormitory (4)

_____ Sorority House (5) _____ Other : _____ (6)

Appendix B

DDQ-R (Collins, et al., 1985)

Height: _____ ' (feet) _____ " (inches)

Weight: (lbs)

IN THE BLANKS BELOW, PLEASE FILL-IN YOUR DRINKING RATE AND TIME DRINKING DURING A TYPICAL WEEK IN THE LAST 30 DAYS First, think of a typical week in the last 30 days you. (Where did you live? What were your regular weekly activities? Where you working or going to school? Etc.) Try to remember as accurately as you can, how much and for how long you typically drank in a week during that one month period? For each day of the week in the boxes below, fill in the number of standard drinks typically consumed on that day in the upper box and the typical number of hours you drank that day in the lower box.

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Number of Drinks							
Number of Hours Drinking							

IN THE BLANKS BELOW, PLEASE FILL-IN YOUR DRINKING RATE AND TIME DRINKING DURING YOUR HEAVIEST DRINKING WEEK IN THE LAST 30 DAYS First, think of a heaviest drinking week in the last 30 days. (Where did you live? What were your regular weekly activities? Where you working or going to school? Etc.) Try to remember as accurately as you can, how much and for how long did you drink during your heaviest drinking week in that one month period? For each day of the week in the boxes below, fill in the number of standard drinks typically consumed on that day in the upper box and the typical number of hours you drank that day in the lower box.

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Number of Drinks							
Number of Hours Drinking							

- 1) During the last 28 days, on how many days did you drink alcohol? _____
- 2) During the last 28 days, on how many days did you drink beer? _____
- 3) During the last 28 days, on how many days did you drink wine? _____
- 4) During the last 28 days, on how many days did you drink a shot of hard liquor? _____
- 5) During the last 28 days, on how many days did you drink a mixed-drink? _____
- 6) During the last 28 days, on how many days have you been drunk? _____

Appendix C

DMQ-R (Grant, et al., 2007)

The following is a list of reasons people sometimes give for using alcohol. Thinking of all the times you use alcohol, how often would you say that you use for each of the following reasons?

	Almost Never/Never	Some of the time	Half of the time	Most of the time	Almost Always/Always
As a way to celebrate.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To relax.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Because I like the feeling.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Because it is what most of my friends do when we get together.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To forget my worries.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Because it is exciting.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To be sociable.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Because I feel more self-confident or sure of myself.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To get a high.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Because it is customary on special occasions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Because it helps when I am feeling nervous.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Because it's fun.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Because it makes a social gathering more enjoyable.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To cheer myself up when I'm in a bad mood.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To be liked.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To numb my pain.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Because it helps when I'm feeling depressed.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
So that others won't kid me about not using.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To reduce my anxiety.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To stop from dwelling on things.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To turn off negative thoughts about myself.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To help feel more positive about things in my life.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To stop from feeling so hopeless.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Because my friends pressure me to use.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To fit in with a group I like.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Because it makes me feel good.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To forget painful memories.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
So I won't feel left out.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix D

BIS (Stanford, et al., 2009)

DIRECTIONS: People differ in the ways they act and think in different situations. This is a test to measure some of the ways in which you act and think. Read each statement and select the appropriate circle on the right side of this page. Do not spend too much time on any statement. Answer quickly and honestly.

	Rarely/Never	Occasionally	Often	Almost Always/Always
I plan tasks carefully.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I do things without thinking.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I make-up my mind quickly.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am happy-go-lucky.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I don't "pay attention."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have "racing" thoughts.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I plan trips well ahead of time.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am self controlled.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I concentrate easily.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I save regularly.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I "squirm" at plays or lectures.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am a careful thinker.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I plan for job security.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I say things without thinking.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I like to think about complex problems.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I change jobs.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I act "on impulse."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I get easily bored when solving thought problems.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I act on the spur of the moment.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am a steady thinker.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I change residences.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I buy things on impulse.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can only think about one thing at a time.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can only think about one thing at a time.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I spend or charge more than I earn.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I often have extraneous thoughts when thinking.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am more interested in the present than the future.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am restless at the theater or lectures.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I like puzzles.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am future oriented.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix E

Hypothetical Alcohol Purchasing Task (J. G. Murphy & MacKillop, 2006)

In the questionnaire that follows we would like you to pretend to purchase and consume alcohol. Imagine that you and your friends are at a party on a weekend night from 9:00 PM until 2:00 AM to see a band. The following questions ask how many drinks you would purchase at various prices. The available drinks are standard size domestic beers (12 oz.), wine (5 oz.), shots of hard liquor (1.5 oz.), or mixed drinks containing one shot of liquor. Assume that you did not drink alcohol or use drugs before you went to the party, and that you will not drink or use drugs after leaving the party. You cannot bring your own alcohol or drugs to the party. Also, assume that the alcohol you are about to purchase is for your consumption only. In other words, you can't sell the drinks or give them to anyone else. You also can't bring the drinks home. Everything you buy is, therefore, for your own personal use within the 5 hour period that you are at the party. **Please respond to these questions honestly, as if you were actually in this situation.**

How many drinks would you have if they were free? _____

How many drinks would you have if they were \$.25 each? _____

How many drinks would you have if they were \$.50 each? _____

How many drinks would you have if they were \$1.00 each? _____

How many drinks would you have if they were \$1.50 each? _____

How many drinks would you have if they were \$2.00 each? _____

How many drinks would you have if they were \$2.50 each? _____

How many drinks would you have if they were \$3.00 each? _____

How many drinks would you have if they were \$4.00 each? _____

How many drinks would you have if they were \$5.00 each? _____

How many drinks would you have if they were \$6.00 each? _____

How many drinks would you have if they were \$7.00 each? _____

How many drinks would you have if they were \$8.00 each? _____

How many drinks would you have if they were \$9.00 each? _____

How many drinks would you have if they were \$10.00 each? _____

How many drinks would you have if they were \$15.00 each? _____

How many drinks would you have if they were \$20.00 each? _____