2015

Bidirectional Relations of Impulsive Personality and Alcohol Use Over Two Years

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BIDIRECTIONAL RELATIONS OF IMPULSIVE PERSONALITY AND ALCOHOL USE OVER TWO YEARS

DISSERTATION

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

By
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Lexington, Kentucky

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2015

ABSTRACT OF DISSERTATION

BIDIRECTIONAL RELATIONS OF IMPULSIVE PERSONALITY AND ALCOHOL USE OVER TWO YEARS

Impulsive personality traits have been found to be robust predictors of substance use and problems in both cross-sectional and longitudinal research. Studies examining the relations of substance use and impulsive personality over time indicate bidirectional effects, where substance use is also predictive of increases in later impulsive personality. The mechanism(s) accounting for the impact of substance use on later personality remain unknown. The present study sought to explore the bidirectional relations of alcohol use with the impulsive personality traits over three time points, and to examine two potential mechanisms that could account for the impact of alcohol use on personality: the development of alcohol-related problems and social norms for substance use. Participants were 525 college students (48.0% male, 81.1% Caucasian), who completed self-report measures assessing personality traits and a structured interview assessing past and current substance use. Data collection took place at three different time points: the first occurred during participants' first year of college (T1), and follow-ups took place approximately one-year (T2) and two-years (T3) later. Bidirectional relations were examined using structural equation modeling to control for the relations among the variables of interest within time points and the stability of the variables across time. T1 sensation seeking and lack of premeditation predicted higher levels of alcohol use at T3, and T1 alcohol use predicted higher levels of all three impulsive traits at T3. T2 friend norms for drug use were found to significantly mediate the relation between T1 alcohol use and T3 sensation seeking, and T2 alcohol problems were found to significantly mediate the relation between T1 alcohol use and T3 negative urgency. Findings provide greater resolution in characterizing the bidirectional relation between impulsive personality traits and substance use, and demonstrate that sensation seeking and negative urgency are impacted through distinct mechanisms.

KEYWORDS: negative urgency, sensation seeking, alcohol use, alcohol problems, personality change

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July 30, 2015

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ACKNOWLEDGEMENTS

There are many people in my life whose support and encouragement have made this achievement possible. Thank you to my mentor, Dr. Richard Milich, for the invaluable guidance you have provided and for your confidence in me. I would also like to thank the other members of my committee, Dr. Greg Smith, Dr. Ruth Baer, Dr. Richard Charnigo, and Dr. Judith Page, for their support and encouragement. In addition to learning to conduct scientific research, a significant component of my professional development during graduate school has been through the clinical experiences I have had. Thank you to my clinical supervisors, including Dr. Charles Carlson, Dr. MaryBeth McGavran, and Dr. David Susman, whose guidance has allowed me to face new challenges and to grow.

I am grateful for the time I have spent at UK, not just for what it has allowed me to accomplish, but for the relationships I have formed during my time in Lexington. I would like to thank my friends, who have provided support during the stressful times and lots of laughter in between. In particular, thank you to Leila Guller, Kelly Yodanis, Walter Roberts, Mariah Macham, and Jamin Dreyer. Last and certainly not least, I would like to say thank you to my family—Mom, Dad, Emily, Paul, and Grammie. Thank you for your love and encouragement, and for remaining confident in my abilities even when I felt discouraged. I could not have done it without your support.

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Chapter One: Introduction

Impulsivity, generally understood as the tendency to act without adequate consideration for potential consequences, has demonstrated consistent relations with a variety of negative mental health outcomes and risky behaviors. These include substance use and substance use disorders (e.g., Chassin, Flora, & King, 2004; King & Chassin, 2004), aggression and antisocial behavior (e.g., Lynam & Miller, 2004; Miller & Lynam, 2001), risky sexual behavior (e.g., Deckman & DeWall, 2011; Zapolski, Cyders, & Smith, 2009), personality disorders (e.g., Jacob et al., 2010; Swann, Lijffijt, Lane, Steinberg, & Moeller, 2009), and eating disorders (Fischer & Smith, 2008; Fischer, Smith, & Cyders, 2008). Rather than viewing impulsivity as a single construct, a number of general theories of personality (Buss & Plomin, 1975; Eysenck & Eysenck, 1985; Zuckerman, 1994) and theories of impulsive personality (Dickman, 1990; Patton, Stanford, & Barratt, 1995; Whiteside & Lynam, 2001) have instead suggested that impulsivity is better understood as a multidimensional construct, made up of multiple traits which predispose individuals to engage risky behavior. One particularly comprehensive model of impulsive personality is the UPPS model, which was constructed through factor analysis of several well-known measures of impulsive personality (Lynam, Smith, Whiteside, & Cyders, 2006; Whiteside & Lynam, 2001).

The UPPS model specifies five distinct impulsive traits: (lack of) premeditation, the tendency to act without consideration of potential outcomes; sensation seeking, the tendency to seek out novel or exciting experiences and a willingness to take risks to do so; (lack of) perseverance, difficulty persisting on dull tasks; negative urgency, the tendency to act rashly when experiencing negative affect; and positive urgency, the

tendency to act rashly when experiencing positive affect. A multi-dimensional model offers advantages beyond a single construct if it improves our understanding of the relation between personality and important outcomes, and meaningful differences among the UPPS facets in relation to outcomes of interest support the utility of the model. For example lack of premeditation has been shown to be particularly relevant for antisocial/deviant behavior (Lynam & Miller, 2004; Miller, Flory, Lynam & Leukefeld, 2003), whereas eating disorders (Fischer et al., 2008) and borderline personality disorder (Peters, Upton, & Baer, 2013; Whiteside, Lynam, Miller, & Reynolds, 2005) are characterized by high levels of negative urgency.

Impulsive Personality: Concurrent and Prospective Relations with Substance Use

As mentioned above, impulsivity has consistently been found to relate to substance use and substance use disorders. This is true in studies using behavioral task-measures of impulsivity (Dougherty, Mathias, Tester, & Marsh, 2004; Kollins, 2003; Petry, 2001) and a variety of different self-report measures. Years before the development of the UPPS model, personality theorists conceptualized impulsive personality in two distinct ways: the tendency to seek out novel, exciting experiences (referred to as sensation seeking, venturesomeness) versus the tendency to act without adequate consideration of potential consequences (referred to as impulsiveness, constraint) (Eysenck & Eysenck, 1975; Tellegen, 1982). The two conceptualizations of impulsive personality correspond closely with UPPS sensation seeking and lack of premeditation, and thus of the five impulsive traits identified in the UPPS model, these two have the longest histories in the substance use field. For both traits, a large number of studies have found a concurrent association with substance use and problems (Ball,

Carroll, & Rounsaville, 1994; Carlson, Johnson, & Jacobs, 2010; Fischer & Smith, 2008; Grau & Ortet, 1999; Lynam & Miller, 2004; Magid, McClean & Colder, 2007; Milich et al., 2000; Miller, et al., 2003: Puente, Gutiérrez, Abellán, & López, 2008; Schepis et al., 2008; Verdejo-García, Bechara, Recknor, & Pérez-García, 2007; Vuchinich & Simpson, 1998).The more recently-identified positive urgency (Cyders, Smith, Spillane, Fischer, & Annus, 2007; Verdejo-García et al., 2010) and negative urgency (Fischer, Anderson, & Smith, 2004; Fischer & Smith, 2008; Kaiser, Milich, Lynam, & Charnigo, 2012; Magid & Colder, 2007; Miller et al., 2003; Settles et al., 2012; Verdejo-García et al., 2007; Verdejo-García et al., 2010) have also been found to relate to substance use and problems in cross-sectional samples. The findings for lack of perseverance have been inconsistent, with some studies showing a significant relation (Verdejo-García et al., 2010; Verdejo-García et al., 2007) and others showing no relation (Fischer & Smith, 2008; Lynam & Miller, 2004) or even a negative relation (Miller et al., 2003) with substance use and problems.

One limitation of cross-sectional research is that it cannot tell us whether impulsive personality puts individuals at risk for the development of problematic substance use, or if the association is reflective of some other process. Fortunately, a number of studies have examined impulsivity in longitudinal samples and among at-risk individuals, and results have supported a view of impulsivity as a risk factor. Sensation seeking (Horvath, Milich, Lynam, Leukefeld, & Clayton, 2004), lack of premeditation (Corbin, Iwamoto, & Fromme, 2011), positive urgency (Cyders, Flory, Rainer, & Smith, 2009; Settles, Cyders, & Smith, 2010; Zapolski et al., 2009), negative urgency (Settles et al., 2010) and other self-reported disinhibited traits (Sher, Bartholow, & Wood, 2000)

have all demonstrated prospective relations with substance use and problems. Similarly, teacher-rated disinhibition (McGue, Iacano, Legrand, Malone, & Elkins), self-reported self-control (King & Chassin, 2004; Wills & Stoolmiller, 2002), and composite measures of disinhibition (Tarter et al., 2003) have also demonstrated prospective relations with substance use and problems. Further support for the role of impulsivity in the development of problematic substance use comes from studies of individuals identified as at-risk for substance dependence based on family history, who have been found to be more impulsive on self-report (Handley et al., 2011), behavioral (Acheson, Richard, Mathias, & Dougherty, 2011), and composite measures (Tarter et al., 2003). Together these findings provide strong support for impulsive personality's role as a risk factor for the development of problematic substance use.

Some researchers have concluded that impulsivity primarily represents a risk factor as opposed to being a result of problematic substance use (Verdejo-García, Lawrence, & Clark, 2008) while others have suggested that the relation may in fact be bidirectional (Lejuez et al., 2010). Recent findings support the view that impulsive personality and substance use can be mutually influential, with impulsivity both increasing risk for, and being impacted by, substance use. In a longitudinal study beginning in early adolescence and continuing through early adulthood, sensation seeking and substance use were found to mutually influence one another, with sensation seeking in 9th or 10th grade predicting substance use at age 19 or 20, and substance use in 9th or 10th grade predicting sensation seeking at age 19 or 20, controlling for current use (Horvath et al., 2004). Similarly, a longitudinal study of college students found that sensation seeking and lack of premeditation were predictive of later heavy drinking, and

that heavy drinking was predictive of changes in sensation seeking and lack of premeditation across time (Quinn, Stappenbeck, & Fromme, 2011). No known studies have examined the longitudinal impact of substance use on the other UPPS traits.

As discussed above, the various impulsive personality traits assessed by the UPPS have demonstrated both similarities and differences in their relations with outcomes of interest, with some traits being more relevant to particular outcomes (e.g. negative urgency and eating disorder symptomatology). These differential relations suggest that substance use may impact the various UPPS variables in different ways. Because urgency includes an affective component that the other impulsive personality traits assessed by the UPPS do not, reinforcement seem likely to be significant contributors to its relation to alcohol use and subsequent changes in impulsive personality. For individuals high in negative urgency, engaging in heavy drinking while experiencing strong affect may serve to reduce negative emotions, increasing the likelihood that they will engage in alcohol use or other impulsive behavior when experiencing strong affect in the future.

In considering the bidirectional relation of impulsive personality and substance use, a remaining question is what mechanisms account for the influence of substance use on later impulsivity. Understanding *how* alcohol use leads to changes in personality may improve our ability to reduce risk and counteract maladaptive personality change as a result of substance use. Based on their conceptual and empirical distinctions, it is likely that the impulsive traits assessed by the UPPS would be impacted through distinct mechanisms.

Social-Environmental Effects on Personality Change

One way in which substance use may impact subsequent personality is by shaping an individual's social context. A variety of research has demonstrated that social-environmental factors can exert a significant influence on personality development. Although personality demonstrates a significant degree of stability over time (Neyer & Asendorpf, 2001), research findings indicate that personality change occurs throughout the life span (Ardelt, 2000). Personality change has been observed at the population level; for example, as they age individuals in general tend to become less neurotic, more agreeable, and more conscientious (McGue, Bacon, & Lykken, 1993; Roberts, Walton, & Viechtbauer, 2006; Robins, Fraley, Roberts, & Trzesniewski, 2001). At the same time, just as individuals vary in terms of personality at any given time point, trajectories of personality change across the lifespan also vary (Johnson, Hicks, Mcgue, & Iacano, 2007; Roberts, Caspi, & Moffitt, 2001; Vaidya, Gray, Haig, Mroczek, & Watson, 2008), and variation in trajectories of impulsive traits across time has been observed (Harden & Tucker-Drob, 2011). Social-environmental influences appear to play a role in both mean-level and individual differences in personality change. Personality change at the population level has been suggested to result from role transitions that occur during adulthood (e.g., increased occupational responsibilities, parenthood) (Roberts & Wood, 2006), and from "mature" personality traits allowing for more adaptive functioning in one's environment (Caspi, Roberts, & Shiner, 2005; Hogan & Roberts, 2004). At the level of individual differences, variability in personality change appears to be influenced by life experiences, such as beginning a romantic relationship (Neyer & Asendorpf, 2001), marriage and having children (Helson & Moane, 1987, Roberts, Helson, &

Klohnen, 2002), occupational experiences (Helson & Moane, 1987; Helson & Picano, 1990; Roberts, Caspi, & Moffitt, 2003; Roberts et al., 2000), negative changes in life circumstances (Costa, Herbst, McCrae, & Siegler, 2000), neighborhood poverty (Hart, Atkins, & Matsuba, 2008), and work and relationship satisfaction (Scollon & Diener, 2006).

Social-environmental factors have been proposed to influence personality by shaping environmental contingencies, providing opportunities for observational learning (Caspi & Roberts, 2001), and through effects on the social roles and goals that individuals adopt moment-to-moment (Heller, Perunovic, & Reichman, 2009). It may be the case that substance use serves as a social-environmental context, and leads to changes in impulsive personality in much the same way that other kinds of life experiences lead to personality change. For college students, a particularly important aspect of this social-environmental context seems to be the attitudes and behaviors of members of an individual's social group. Peer norms for substance use have been found to influence individuals' substance use behaviors both concurrently and prospectively (Andrews, Tildesley, Hops, & Li, 2002; Fergusson, Swain-Campbell, & Horwood, 2001), and it is plausible that the influence of peers on substance use behavior may translate into changes in personality.

Peer norms may be particularly relevant in considering the impact of substance use on later sensation seeking. Individuals tend to have friends whose levels of sensation seeking are similar to their own (Yanovitsky, 2005; Yanovitsky, 2006), and individuals with high levels of sensation seeking tend to have friends with higher rates of substance use (Romer & Hennessy, 2007). Friends' sensation seeking also appears to play a role in

an individuals' own substance use; a study of adolescents found that individuals' levels of sensation seeking influenced later substance use indirectly, with individuals tending to choose friends with similar levels of sensation seeking, and friends' sensation seeking impacting later substance use behavior (Donohew et al., 1999). The Corresponsive Principle (Caspi et al., 2005) suggests that the traits that draw individuals to particular life experiences tend to be in-turn reinforced and deepened by these experiences. This principle may be useful to understanding the relation between sensation seeking and substance use. Sensation seeking may make it more likely that individuals select into high-risk social contexts (i.e. high sensation seeking peer groups, where others are using substances heavily), which could in turn increase an individuals' own sensation seeking.

The Impact of Mental Health on Personality

Another way in which alcohol use might influence impulsive personality is through its impact on mental health—specifically through the development of alcohol-related problems or alcohol use disorders. Particular personality traits have been found to be associated with mental health diagnoses like mood and anxiety disorders (Kotov, Gamez, Schmidt, & Watson, 2010), and have been found to change along with changes in psychopathology. For example, changes in personality have been found to co-occur with symptom reduction of mood (Corruble, Duret, Pelissolo, Falissard, & Guelfi, 2002; Stuart, Simons, Thase, & Pilkonis, 1992), anxiety (Brown, Svrakic, Przybeck, & Cloninger, 1992) and personality (Davenport, Bore, & Campbell, 2010) disorders. In terms of substance use disorders specifically, changes in personality following recovery have been identified, for example individuals in recovery from substance dependence show significant decreases in negative affect traits like depression, anxiety and

worthlessness (Sutherland, 1997), and individuals who have recovered have been found to differ from those with current substance use disorders on a number of traits, including impulsivity (Hopwood et al., 2011; Östlund, Spak, & Sundh, 2004).

In interpreting these findings, a remaining question is to what degree these relations are reflective of the influence of psychopathology on personality versus the influence of personality on psychopathology risk. Recent research has begun to address this issue, and findings suggest that specific personality traits are altered at the onset of a substance use disorder. In a longitudinal study, the development of an alcohol use disorder was associated with a significant increase in verbal aggression and impulsiveness (Östlund, Hensing, Sundh, & Spak, 2007). Thus, it may be that observed longitudinal changes in impulsive personality as a result of substance use are reflective of the onset of substance-related problems.

Although prior research indicates that impulsivity may be impacted by the onset of substance-related problems, it is unclear whether different impulsive traits are affected similarly. Of the five UPPS impulsive traits, negative urgency seems to be the most relevant to personality change resulting from substance use pathology. Although other impulsive traits have demonstrated stronger relations with use itself (Lynam & Miller, 2004; Magid & Colder, 2007; Miller et al., 2003; Zapolski et al., 2009), negative urgency demonstrates robust relationships with substance use disorders and substance related problems (Fischer et al., 2004; Fischer & Smith, 2008; Settles et al., 2012; Verdejo-García et al., 2007). One way to understand this pattern of findings is that they illustrate the impact of substance use on impulsive personality, specifically on negative urgency, as opposed to only reflecting negative urgency's role as a risk factor for substance use

pathology. Additional support for the hypothesis that negative urgency will be most impacted by substance use comes from a study of college students, which found that, while negative urgency related to drinking to cope with negative affect cross-sectionally, initial levels were not predictive of drinking to cope at follow-up (Anestis, Selby, & Joiner, 2007). Changes in drinking to cope from the first time point to the second were associated with changes in negative urgency across the same time period, which may be reflective of changes in impulsive personality resulting from changes in problematic drinking.

The Current Study

The purpose of the current study was to 1) explore the bidirectional relations of impulsive personality with alcohol use, including both the impact of personality on drinking and the impact of drinking on personality, and 2) examine whether social influence and the occurrence of alcohol-related problems contribute to changes in impulsive personality. To accomplish these aims, college students were assessed at three time points spaced one year apart with the first session occurring during their first year of college. Heavy substance use during young adulthood (Hasin, Stinson, Ogburn, & Grant, 2007) and among college students specifically (Ford, 2007; Knight et al., 2002), and the high amount of personality change that occurs during young adulthood relative to other developmental periods (Roberts et al., 2006) suggest that a college student sample may be ideal for answering questions of the impact of alcohol use on personality. Alcohol rather than drug use was examined, based on the higher rates of binge drinking as compared to drug use (Cranford, Eisenberg, & Serras, 2009). The three-year timespan of

the study allowed for observation of changes in personality and alcohol use, and the three-wave design enabled testing of the proposed mediating mechanisms.

The final model included the following variables at each of the three time points: alcohol use, negative urgency, sensation seeking, lack of premeditation, friend norms, and alcohol problems. Positive urgency was not included in the model due to its high degree of overlap with negative urgency, and concerns about the interpretability of the findings. As discussed above, lack of perseverance has demonstrated inconsistent relations with substance use in comparison to the other UPPS variables, and thus it was also not included in the model. Two different models were specified, with friend norms defined differently in each. In the first model the friend substance use norms variable was defined as individuals' reports of their friends' use of *alcohol* while in the second model it was defined as individuals' reports of their friends' use of illegal drugs.

Study Aims

1) The first aim of the study was to examine the impact of impulsive personality on subsequent alcohol use. Based on prior research demonstrating the longitudinal impact of impulsivity on substance use, it was predicted that each of the three traits would predict higher levels of subsequent alcohol use. That is, impulsive personality at the first time point (T1) would predict alcohol use at the second and third time point (T2 and T3), and impulsive personality at T2 would predict alcohol use at T3.
2) The next aim of the study was to examine the impact of alcohol use on subsequent personality. It was predicted that increases in both negative urgency and sensation seeking would be predicted earlier alcohol use. Specifically, alcohol use at T1

would predict both traits at T2 and T3, and alcohol use at T2 would predict both traits at T3. Though a previous study found that heavy alcohol use predicted later lack of premeditation (Quinn et al., 2011), negative urgency was not accounted for. It was hypothesized that including negative urgency in the model would result in the alcohol-lack of premeditation relation not being significant.

3) Next, the study sought to examine whether social influence (i.e. friend group norms for substance use) accounted for the relation between T1 alcohol use and T3 impulsive personality. It was predicted that T2 friend group norms for alcohol use and for drug use would mediate the relation between T1 alcohol use and T3 sensation seeking, but would not mediate the relation of T1 alcohol use with T3 negative urgency.
4) The last aim of the study was to examine whether alcohol-related problems accounted for the relation between T1 alcohol use and T3 impulsive personality. It was predicted that T2 alcohol-related problems would mediate the relation of T1 alcohol use and T3 negative urgency, but would not mediate the relation of T1 alcohol use with T3 sensation seeking.

Chapter Two: Methods

Participants

Participants at T1 were 525 college students (48.0% male; mean age = 18.95 years, *sd* = 0.77) from a public university in the southern United States. The ethnic distribution of the sample was as follows: 81.1% Caucasian, 12.4% African-American, 2.5% Asian, 1.5% Hispanic/Latino, 1.9% Biracial, 0.2% American Indian/Alaska Native, 0.2% Native Hawaiian/Pacific Islander, and 0.2% "Other." Participants were recruited in two cohorts, one year apart, from the undergraduate research pool. "High risk" participants were oversampled to ensure sufficient variability in substance use, and made up 23.1% of the sample. Previous research has found disruptive behavior in childhood and adolescence to be associated with later substance use disorders (e.g., Harford & Muthén, 2000; Kuperman et al., 2001), so delinquent behavior during adolescence was assessed in order to identify "high risk" participants. Although these "high risk" subjects were specifically invited to participate, any first-year student enrolled in introductory psychology was eligible for study participation. To enroll in the study, students signed up using an online recruitment system. Of the 525 individuals who participated at T1, 459 (87%) participated again at T2 and 417 (79%) participated at T3. The total number of individuals who participated in data collection at all three time points was 407. Procedures for handling missing data are discussed in the data analysis section. The project has been approved by the Institutional Review Board (IRB) of the University of Kentucky.

Measures

Impulsive personality. Impulsive personality was assessed using the UPPS-P Impulsive Behaviors Scale (Lynam et al., 2006; Whiteside & Lynam, 2001), a 59-item self-report inventory designed to measure negative urgency, (lack of) premeditation, (lack of) perseverance, sensation seeking, and positive urgency. Participants were instructed to rate their agreement with each item using a four-point Likert scale, with agree strongly at one end, and disagree strongly at the other. Internal consistency reliability for the impulsive traits in the sample was good, with alphas ranging from .84 (sensation seeking at T1) to .89 (sensation seeking at T3). Test-retest reliability was high, with Pearson correlations ranging from .66 (lack of premeditation and T1 and T3) to .88 (sensation seeking at T2 and T3). Participants' average scores for negative urgency, lack of premeditation, and sensation seeking were used for analyses.

Alcohol use. Participants' alcohol use was assessed using selected items from the Life History Calendar (LHC; Caspi, Moffitt, Thornton, & Freedman, 1996). This measure has been validated and proven reliable as a method of obtaining retrospective data; as such, it is commonly used in studies to evaluate health-risk behaviors among adolescents. Tests of reliability and validity for this measure have demonstrated good agreement between the measure and other reports of substance use, with average kappas of 0.46 to 0.56 and average correlation of 0.53 to 0.64 (Miller et al., 2003). At T1, participants filled out the LHC on the computer with the assistance of a trained experimenter, reporting on four month periods dating back to fall of 7^{th} grade to the current time. At T2 participants reported on one-month periods dating back to the month of their T1 participation, and at T3 they reported on one-month periods dating back to the month of their T2 participation.

For each period, data were collected regarding use, frequency, average amount, and highest amount for tobacco, alcohol, marijuana, cocaine, inhalants, amphetamines, acid/LSD, ecstasy/MDMA and club drugs.

Of interest for the current study was the reported average weekly alcohol use at T1, T2, and T3. The calendar year was divided into four different three month time periods (i.e., August to October, November to January, and so on) and the average weekly alcohol use for T1 was calculated for the three month time period in which an individual participated in the first wave of data collection. Average weekly alcohol use for T2 and T3 was calculated for the same three-month time period in the second wave and third wave respectively. Average weekly alcohol use was estimated using the LHC items "Which of the following best describes how frequently you used alcohol during each of the months you drank?" and "Which of the following describes, on average, how much alcohol you used during the months that you drank?". The frequency and average episodic amount were multiplied to create one variable, average weekly alcohol use, which was an estimate of the number of drinks participants consumed on average in a week.

Friend group norms. Friend group norms for substance use were assessed using the Peer Substance Use Questionnaire, a measure created by the Center for Drug Abuse Research Translation (CDART) for use in the present study. At each time point participants were asked to select their three closest friends and then asked questions regarding their friends' use and attitudes toward use of various substances (alcohol, marijuana, tobacco, stimulants, cocaine, amphetamines, acid/LSD, ecstasy/MDMA, and club drugs). Of interest for the present study were descriptive norms for use, which refer

to participants' perceptions of their friends' substance use behavior (Cialdini, Reno, & Kallgren, 1990). Friend norm variables were calculated for both alcohol and drug use. Participants were asked if their friends drank alcohol, and if applicable how much/often their friends drank. For the amount/frequency item, participants were asked to select from seven possible responses which included both frequency and amount, ranging from "less than once a month" (1) to "almost everyday, sometimes in large amounts" (7). This item was scored 0 if participants indicated that the selected friend did not drink alcohol. The average score for a participant's three friends was used as an indicator of friend alcohol norms for the analyses. The number of friends who the participant reported used drugs was used as an indicator of friend drug norms. Participants were asked if their friend used marijuana (yes/no), amphetamines (yes/no) or other illegal drugs (yes/no). In the first wave of data collection (cohort 1, T1) participants were asked about all illegal drugs other than marijuana and amphetamines in one item, while in subsequent waves participants were asked about each other illegal drug of use separately. In order to make the friend norm variable equivalent across waves, the drug use items were combined into one composite score; specifically how many of their friends participants reported used any illegal drugs.

Alcohol problems. Alcohol problems were measured using the Alcohol Use Disorders Identification Test (AUDIT; Babor, Higgins-Biddle, Saunders, & Monteiro, 2001), a screening instrument for identifying individuals at risk for hazardous drinking. It consists of 10 questions that produce a composite score representing the individual's risk. Questions assess alcohol consumption (e.g. "How often do you have a drink containing alcohol?"), drinking behavior (e.g. "How often during the last year have you found that

you were not able to stop drinking once you had started?"), adverse psychological reactions (e.g. "How often during the last year have you been unable to remember what happened the night before because of your drinking?") and drinking-related consequences (e.g. "Have you or someone else been injured as a result of your drinking?"). For eight of the questions, participants are asked to rate frequency on a five-point scale. For the remaining two questions, which assess the presence of drinking-related consequences, participants are asked to select a response from a three-point scale. Eight of the 10 AUDIT items were used to create a composite score which was used in the analyses. The two items omitted from the composite score assessed frequency and average amount of alcohol use, and were not included due to the importance of distinguishing between alcohol use and alcohol problems in the analyses. The composite score had acceptable internal consistency, with alphas ranging from .72 (T1) to .75 (T3).

Procedure

Screening and recruitment. T1 screening took place during a department-wide screening session in introductory psychology classes. Students completed a 19-item questionnaire assessing past participation in delinquent, pro-social, and neutral behaviors. They were also asked to indicate their age and gender. Composite scores based on the 12 delinquent items were computed, and these scores were used to create a distribution for males and a distribution for females. Individuals whose scores fell within the top 25% for their gender were invited to participate in the study by email but any first-year student in introductory psychology was eligible for study participation. All participants signed up for the study using a recruitment website. To ensure that the sample included the correct proportions of high risk participants and participants of each gender, the recruitment

website indicated at times that only certain individuals were eligible to sign up. For example, if more high risk participants were needed, the website temporarily indicated that only those who had received an email invitation could sign up for the study.

Study protocol. Participants completed the first session of the study protocol individually, with the whole session taking roughly 2.5 hours. At the beginning of the session, participants completed a consent form and a research assistant provided an overview of the study procedures. Then, participants filled out self-report measures and completed behavioral tasks on a computer. Behavioral tasks and self-report questionnaires that are not relevant to the research questions of interest were administered during the protocol; these measures are not described in detail, but are available upon request. The questionnaires and tasks were split up into two blocks. After the first block, the research assistant administered a structured interview assessing use of various substances and substance use problems. Next, participants were offered a short break. After the break, participants completed the second block of self-report questionnaires and tasks. At the end of the session, participants filled out a short form with their contact information (phone number, email address, and home address), which was to be used to contact them for follow-up sessions. Lastly, participants were debriefed and compensation for study participation was provided (3 hours of research credit and $30).

Follow-up sessions occurred approximately one-year (Time 2) and two-years (Time 3) following initial participation. The study protocol was nearly identical during these follow-up sessions, with the exception of contact information form, which was not administered at the last session. Because participants were no longer enrolled in introductory psychology at follow-up, they received increased payment in exchange for

their time. They received $50 at their second and third sessions, and if they had participated at all three time points received an additional $50 during the third session.

Follow-up and retention. Shortly after their initial participation, study participants received thank-you cards signed by the research assistant with whom they worked. During the year, they received birthday cards and holiday cards in the mail from the research team. The goal of these mailings was to provide a reminder of the study between research sessions in order to make it more likely that individuals would participate in follow-up sessions. Around eleven months after the initial session (i.e. one month before desired T2 participation), participants received an email or phone call inviting them to come in for a follow-up session. The email or call briefly explained study participation and compensation, and provided information on how to set up an appointment, either by phone or email. If participants did not contact the research team to set up on follow-up session, they were contacted again by phone three times, with calls spaced one-week apart. A similar procedure was followed for the third follow-up session, with initial contact by email or phone occurring around one-month prior to desired T3 participation.

Participants who did not complete the protocol at T2 were eligible to participate at T3, and were contacted using the procedure outlined above. Although the aim was to complete sessions one-year apart, this was flexible to increase participant retention.

Data Analyses

The research questions were examined using longitudinal structural equation modeling (SEM). AMOS 22 was used to perform the SEM analysis. Each variable of interest was regarded as the sole observable indicator of an underlying construct. Because

excluding participants with incomplete data could bias results, the expectation maximization (EM) method was used to estimate missing values. Thirty-eight participants who abstained from alcohol use at all three time points were excluded from the analyses due to concerns regarding zero-inflation. The model included six variables at each of the three time points: negative urgency, sensation seeking, lack of premeditation, average weekly alcohol use, friend norms, and alcohol problems. Two models were constructed. In the first model (A) friend norms for alcohol use were tested as a mediator of the alcohol-impulsivity relation and in the second model (B) friend norms for drug use was tested instead. In both models average weekly alcohol use was square-root transformed to make its distribution of scores more normal. The six T1 variables were allowed to covary, as were the error terms among the T2 variables and the error terms among the T3 variables. Variables and error terms were not allowed to covary across time points.

The models were constructed in a stepwise fashion. In the first step the three personality traits and alcohol use were entered into the model, with pathways specified from each variable to itself at the next time point. In the second step pathways were added from each of the T1 personality variables to T2 alcohol use, and from each of the T2 personality variables to T3 alcohol use. Pathways from T1 alcohol use to each of the T2 personality variables and from T2 alcohol use to each of the T3 personality variables were added in step three. In step four, the predicted mediators (friend norms for either alcohol or drug use, and alcohol problems) were added in at each of the three time points and pathways were added in connecting each variable to itself at the next time point. In step five pathways were specified from T1 alcohol use to the T2 friend norms and alcohol

problems, T2 alcohol use to T3 friend norms and alcohol problems, T1 friend norms and alcohol problems to T2 alcohol use, and T2 friend norms and alcohol problems to T3 alcohol use. Pathways from T1 personality to T2 friend norms and alcohol problems, and from T2 personality to T3 friend norms and alcohol problems were added in step six. In step seven pathways were specified from T1 friend norms and alcohol problems to T2 personality, and from T2 friend norms and alcohol problems to T3 personality. Pathways from T1 and T2 alcohol problems to T2 and T3 friend norms respectively, and from T1 and T2 friend norms to T2 and T3 alcohol problems respectively were also added in step seven. Step seven is considered to be the "full model," as it includes all the potential relations of interest.

Pathways that were found to be non-significant in the full models were removed in order to improve fit, though this resulted in additional pathways becoming insignificant for both model A and model B. For model A, a total of four additional non-significant pathways were removed resulting in a "simplified model," which contained only significant pathways. For model B two additional non-significant pathways were removed to create the simplified model. In full model B, the pathway from T1 alcohol problems to T2 negative urgency had approached significance ($\beta = 0.08$, $p = .052$) but had been removed along with other non-significant pathways. Once the two additional non-significant pathways were removed, this relation was identified as one that could be added back in to the model to improve model fit, which none of the other pathways from the full model (in both A and B) were. Thus, this pathway was added back in, and was found to be statistically significant ($\beta = 0.13$, $p < .001$). The final simplified model A contains all pathways identified as statistically significant in the full model except for the

relations that became non-significant (T1 negative urgency to T2 alcohol use, T2 premeditation to T3 alcohol use, T2 friend alcohol norms to T3 alcohol use, and T2 friend norms to T3 alcohol problems). The final simplified model B contains all pathways identified as statistically significant in the full model plus the pathway from T1 alcohol problems to T2 negative urgency in model B, and not including the pathways from T1 sensation seeking and T1 negative urgency to T2 alcohol use. Unless otherwise specified, results discussed below come from the simplified models.

To address the research questions, the statistical significance of the specified direct pathways and of the indirect effects were examined. Overall model fit was assessed using four indices: the Comparative Fit Index (CFI), the Normative Fit Index (NFI), the root mean square error of approximation (RMSEA), and the relative chi-square (CMIN/df). CFI and NFI values above .95 represent a very good fit (Hu & Bentler, 1999), while RMSEA values of .08 or lower indicate acceptable fit (Little, 2013). CMIN/df values below 3 are considered to be adequate fit (Kline, 1998).

Chapter Three: Results

Preliminary Analyses

Means and standard deviations for the variables of interest at T1, T2, and T3 are listed in Table 1, and correlations are listed in Tables 2 and 3. Almost all of the correlations across the three time points were statistically significant; the only exceptions were the correlations of T1 negative urgency with sensation seeking at T1, T2, and T3.

Full and Simplified Models

Using the method described above (see Data Analyses), a two full models with all potential pathways were created, and then simplified by removing non-significant pathways. Standardized estimates and significance values for each of the pathways in full model A are listed in Tables 4, 5, and 6, and for simplified model A are listed in Table 7. Standardized estimates and significance values for full model B are listed in Tables 8, 9, and 10 and for simplified model B are listed in Table 11. See Table 12 for the total effects in both models of T1 alcohol use on T3 personality and of T1 personality on T3 alcohol use.

Personality Predicting Alcohol Use

The first aim of the study was to examine the impact of personality on later alcohol use, controlling for its relation with current use. Direct pathways from personality to alcohol use one year later were considered, as were the total effects of each of the T1 personality variables on T3 alcohol use. It was predicted that all three impulsive traits would predict higher levels of subsequent alcohol use.

T1 personality predicting T2 alcohol use. In model A, T1 sensation seeking was found to predict alcohol use at T2 (β = 0.06, p = .019) but negative urgency and lack of

premeditation were not. In model B none of the T1 variables were found to be significant predictors of T2 alcohol use.

T2 personality predicting T3 alcohol use. In model A, sensation seeking was the only T2 personality variables to predict T3 alcohol use (β = 0.12, p < .001). In model B, all three T2 personality variables predicted T3 alcohol use. Sensation seeking (β = 0.09, p = .002) and lack of premeditation (β = 0.10, p = .002) both predicted higher levels of use, while negative urgency demonstrated a significant negative relation (β = - 0.07, p = .013).

Total effects. In model A, only sensation seeking had a significant total effect on alcohol use at T3 (β = 0.14, p = .010). In model B, the total effects of T1 sensation seeking (β = 0.07, p = .010) and T1 lack of premeditation (β = 0.07, p = .018) on T3 alcohol use were both statistically significant but the effect of negative urgency was not.

Alcohol Use Predicting Personality

The second aim of the study was to examine the impact of alcohol use on later personality, controlling for its relation with current personality. Direct pathways from alcohol use to personality one year later were considered, as were the total effects of T1 alcohol use on each of the three personality variables at T3. Alcohol use was hypothesized to predict increases in sensation seeking and negative urgency.

T1 alcohol use predicting T2 personality. In model A, T1 alcohol use was a significant predictor of all three personality variables at T2 (negative urgency, β = 0.14, p < .001; sensation seeking, β = 0.11, p = .001; lack of premeditation, β = 0.11, p = .002). In model B, alcohol use at T1 predicted sensation seeking (β = 0.05, p = .041) and lack of premeditation β = 0.09, p = .005) but not negative urgency.

T2 alcohol use predicting T3 personality. In model A, T2 alcohol use predicted all three personality variables at T3 (negative urgency, $\beta = 0.14$, $p = .009$; sensation seeking, $\beta = 0.11$, $p < .001$; lack of premeditation, $\beta = 0.17$, $p < .001$). In model B, T2 alcohol use was a significant predictor of T3 lack of premeditation ($\beta = 0.17$, $p < .001$), but not of negative urgency or sensation seeking.

Total effects. T1 alcohol use had a significant total effect on each of the T3 personality variables in model A (negative urgency, $\beta = 0.20$, $p = .010$; sensation seeking, $\beta = 0.19$, $p = .010$; lack of premeditation, $\beta = 0.13$, $p = .010$) and in model B (negative urgency, $\beta = 0.07$, $p = .010$; sensation seeking, $\beta = 0.07$, $p = .010$; lack of premeditation, $\beta = 0.19$, $p = .010$).

Friend Norms as a Mediator

The third aim of the study was to examine whether friend norms for substance use mediated the relation between T1 alcohol use and T3 personality. It was hypothesized that friend norms would mediate the relation between T1 alcohol use and T3 sensation seeking. This prediction was to be tested in three steps: 1) examining the significance of the pathway from T1 alcohol use to T2 friend norms, 2) examining the significance of the pathways from T2 friend norms to T3 personality, and 3) testing the significance of the indirect effect.

Alcohol use predicting friend norms. In model A, alcohol use at T1 was found to be a significant predictor of friend norms for alcohol use at T2 ($\beta = .42$, $p < .001$). In model B, alcohol use at T1 was found to be a significant predictor of friend norms for drug use at T2 ($\beta = .33$, $p < .001$).

Friend norms predicting personality. In model A**,** T2 friend norms for alcohol use were found to significantly predict T3 negative urgency (β = -0.13, p = .002) and T3 sensation seeking (β = 0.10, p < .001) however these relations were in the opposite direction as what was predicted. The relation between T2 friend norms and T3 lack of premeditation was not significant. In model B, T2 friend norms for drug use were found to significantly predict T3 sensation seeking (β = 0.07, p = .002) but not T3 negative urgency or lack of premeditation.

Significance of the indirect pathway. Friend norms for alcohol use were ruled out as a potential mediator of the relation between T1 alcohol use and T3 personality based on the lack of positive relations with any of the three impulsive traits, but friend norms for drug use were considered to be a plausible mechanism based on the results of model B. Because software would not allow for the significance of individual indirect pathways to be tested (only the significance of the total indirect effect), one significant pathway was removed when testing the significance of the mediation: T2 sensation seeking to T3 sensation seeking. This allowed for testing the significance of the mediation, as the mediational pathway of interest was the only indirect pathway in the model (T1 alcohol use to T2 sensation seeking to T3 sensation seeking was no longer included), but means that this other relation was not controlled for. The indirect pathway (T1 alcohol use to T2 friend norms to T3 sensation seeking) was found to be significant (β = 0.06, p = .01). Providing further support for mediation, prior to including friend norms for drug use in the model (i.e., in step 3 of generating model B) T2 alcohol use was found to be predictive of T3 sensation seeking (β = 0.05, p = .034), however once friend norms were added this relation was no longer significant. This suggests that friend

norms for drug use accounted for the relation between alcohol use and subsequent sensation seeking.

Alcohol Problems as a Mediator

The fourth aim of the study was to examine whether alcohol problems mediated the relation between T1 alcohol use and T3 personality. Alcohol problems were hypothesized to mediate the relation between T1 alcohol use and T3 negative urgency. This prediction was to be tested in three steps: 1) examining the significance of the pathway from T1 alcohol use to T2 alcohol problems, 2) examining the significance of the pathways from T2 alcohol problems to T3 personality, and 3) testing the significance of the indirect effect.

Alcohol use predicting alcohol problems. T1 alcohol use was found to be a significant predictor of alcohol problems at T2 in both model A ($\beta = .42$, $p < .001$), and model B ($\beta = .42$, $p < .001$).

Alcohol problems predicting personality. T2 alcohol problems were found to be a significant predictor of T3 negative urgency in both model A ($\beta = .15$, $p = .002$), and model B ($\beta = .17$, $p < .001$). T3 sensation seeking and T3 lack of premeditation were not predicted by T2 alcohol problems in either model.

Significance of the indirect pathway. Because software would not allow for the significance of individual indirect pathways to be tested (only the significance of the total indirect effect), three significant pathways were removed from model A when testing the significance of the mediation: T2 negative urgency to T3 negative urgency, T2 alcohol use to T3 negative urgency, and T2 friend norms to T3 negative urgency. This allowed for testing the significance of the mediation, but means that these other relations were not

controlled for. The indirect pathway (T1 alcohol use to T2 alcohol problems to T3 negative urgency) was found to be significant (β = 0.16, p = .010) in model A. In model B, the pathway through alcohol problems was the only remaining indirect pathway from T1 alcohol use to T3 negative urgency, so no pathways were removed when testing the significance of the indirect effect. As was the case in model A, when model B was tested the indirect pathway (T1 alcohol use to T2 alcohol problems to T3 negative urgency) was found to be significant (β = 0.07, p = .010). Providing further support for mediation, prior to including alcohol problems in model B (i.e., in step 3 of generating the model) T1 alcohol use was found to be predictive of T2 negative urgency (β = 0.13, p < .001) and T2 alcohol use was predictive of T3 negative urgency (β = 0.14, p < .001). However, once alcohol problems were included in the model these relations were no longer significant. The pathways from T1 alcohol problems to T2 negative urgency and from T2 alcohol problems to T3 negative urgency were significant, suggesting that alcohol problems accounted for the relation between alcohol use and subsequent negative urgency.

Model Fit

In the full model A (including all specified pathways) model fit was as follows: CMIN/df = 5.38, CFI = 0.96, NFI = 0.95, RMSEA = 0.10. Model fit was somewhat improved in the simplified model (significant pathways only): CMIN/df = 4.23, CFI = 0.96, NFI = 0.95, RMSEA = 0.08. Three of the four indices (CFI, NFI, and RMSEA) indicated good model fit. Model fit for the full and simplified versions of model B were similar. In the full model, fit was as follows: CMIN/df = 5.40, CFI = 0.96, NFI = 0.95, RMSEA = 0.10. Again, model fit was somewhat improved in the simplified model

(significant pathways only): CMIN/df = 4.04, CFI = 0.96, NFI = 0.94, RMSEA = 0.08. Two of the four indices (CFI and RMSEA) were indicative of good model fit.

Table 1. Descriptive statistics at T1, T2, and T3

	T1 Mean (SD)	T2 Mean (SD)	T3 Mean (SD)
Negative urgency	2.25 (0.56)	2.27 (0.51)	2.32 (0.49)
Sensation seeking	3.03 (0.53)	3.06 (0.54)	3.04 (0.55)
Lack of premeditation	2.01 (0.46)	2.07 (0.43)	2.11 (0.41)
Alcohol use	6.37 (7.64)	6.74 (7.65)	7.10 (7.48)
Friend alcohol norms	2.88 (1.52)	3.11 (1.36)	3.07 (1.25)
Friend drug norms	1.16 (1.08)	1.33 (1.05)	1.29 (1.01)
Alcohol problems	4.75 (4.51)	4.85 (4.30)	4.68 (4.00)

Note: Alcohol use indicates average number of drinks consumed per week.

Table 2. Correlations among variables of interest at T1, T2, and T3

	1	2	3	4	5	6	7	8	9	10
1. T1 Alc	-									
2. T1 NU	.19*	-								
3. T1 SS	.28*	.06	-							
4. T1 LOP	.35*	.39*	.36*	-						
5. T1 FAN	.60*	.15*	.16*	.28*	-					
6. T1 FDN	.36*	.26*	.15*	.23*	.48*	-				
7. T1 AP	.57*	.36*	.21*	.34*	.54*	.41*	-			
8. T2 Alc	.74*	.19*	.26*	.27*	.54*	.29*	.49*	-		
9. T2 NU	.26*	.74*	.18*	.36*	.14*	.25*	.37*	.25*	-	
10. T2 SS	.28*	.00	.84*	.32*	.12*	.10*	.18*	.30*	.15*	-
11. T2 LOP	.36*	.38*	.31*	.74*	.25*	.17*	.32*	.25*	.51*	.29*
12. T2 FAN	.60*	.15*	15*	28*	.72*	.36*	.50*	.61*	.18*	.14*
13. T2 FDN	.48*	.25*	.20*	.29*	.46*	.59*	.44*	.43*	.26*	.13*
14. T2 AP	.66*	.28*	.23*	.25*	.51*	.31*	.72*	.71*	.36*	.24*
15. T3 Alc	.58*	.15*	.26*	.30*	.46*	.26*	.38*	.74*	.15*	.30*
16. T3 NU	.23*	.70*	$.10^{+}$	.39*	.16*	.27*	.29*	.30*	.70*	.14*
17. T3 SS	.27*	.08	.81*	.31*	.12*	.20*	.20*	.31*	.20*	.88*
18. T3 LOP	.36*	.30*	.31*	.66*	.26*	.22*	.29*	.34*	.41*	.33*
19. T3 FAN	.52*	$.10^{+}$	.12*	.19*	.64*	.34*	.44*	.57*	.14*	$.10^{+}$
20. T3 FDN	.38*	.20*	.20*	.24*	.47*	.50*	.41*	.40*	.22*	.14*
21. T3 AP	.60*	.26*	.24*	.24*	.48*	.32*	.63*	.69*	.30*	.28*

Note: Alc = alcohol use, NU = negative urgency, SS = sensation seeking, LOP = lack of premeditation, FAN = friend alcohol norms, FDN = friend drug norms, AP = alcohol problems.

$^{+}p < .05$, * $p < .0$

Table 2 (continued)

	11	12	13	14	15	16	17	18	19	20
1. T1 Alc										
2. T1 NU										
3. T1 SS										
4. T1 LOP										
5. T1 FAN										
6. T1 FDN										
7. T1 AP										
8. T2 Alc										
9. T2 NU										
10. T2 SS										
11. T2 LOP	-									
12. T2 FAN	.24*	-								
13. T2 FDN	.28*	.51*	-							
14. T2 AP	.33*	.56*	.42*	-						
15. T3 Alc	.25*	.52*	.36*	.51*	-					
16. T3 NU	.49*	.17*	.26*	.39*	.31*	-				
17. T3 SS	.29*	$.11^{+}$	.18*	.25*	.32*	.20*	-			
18. T3 LOP	.73*	.28*	.26*	.31*	.33*	.48*	.34*	-		
19. T3 FAN	.16*	.75*	.47*	.49*	.50*	.13*	.13*	.20*	-	
20. T3 FDN	.21*	.46*	.73*	.37*	.37*	.19*	.22*	.21*	.55*	-
21. T3 AP	.30*	.56*	.44*	.80*	.63*	.42*	.33*	.33*	.59*	.43*

Note: Alc = alcohol use, NU = negative urgency, SS = sensation seeking, LOP = lack of premeditation, FAN = friend alcohol norms, FDN = friend drug norms, AP = alcohol problems.

$^{+}p < .05$, * $p < .0$

Table 3. Standardized regression weights for primary relations of interest in full model A

	Standardized Effect	P Value
T1 personality predicting T2 alcohol use		
Negative urgency → alcohol use	0.08	$p = .013$
Sensation seeking → alcohol use	0.07	$p = .019$
Lack of premeditation → alcohol use	-0.05	$p = .148$
T2 personality predicting T3 alcohol use		
Negative urgency → alcohol use	-0.06	$p = .070$
Sensation seeking → alcohol use	0.10	$p < .001$
Lack of premeditation → alcohol use	0.08	$p = .012$
T1 alcohol use predicting T2 personality		
Alcohol use → negative urgency	0.14	$p = .002$
Alcohol use → sensation seeking	0.12	$p = .001$
Alcohol use → lack of premeditation	0.11	$p = .019$
T2 alcohol use predicting T3 personality		
Alcohol use → negative urgency	0.13	$p = .012$
Alcohol use → sensation seeking	0.10	$p = .008$
Alcohol use → lack of premeditation	0.22	$p < .001$
T1 alcohol use predicting T2 mediators		
Alcohol use → friend alcohol norms	0.36	$p < .001$
Alcohol use → alcohol problems	0.42	$p < .001$
T2 mediators predicting T3 personality		
Friend alcohol norms → negative urgency	-0.10	$p = .024$
Alcohol problems → negative urgency	0.12	$p = .015$
Friend alcohol norms → sensation seeking	-0.09	$p = .001$
Alcohol problems → sensation seeking	0.02	$p = .435$
Friend alcohol norms → lack of premeditation	0.02	$p = .726$
Alcohol problems → lack of premeditation	-0.08	$p = .073$

Table 4. Standardized regression weights for pathways from T1 to T2 in full model A

	Standardized Effect	P Value
T1 negative urgency predicting T2 variables		
Negative urgency → alcohol use	.08	$p = .013$
Negative urgency → friend alcohol norms	.00	$p = .984$
Negative urgency → alcohol problems	.05	$p = .095$
T1 sensation seeking predicting T2 variables		
Sensation seeking → alcohol use	.07	$p = .019$
Sensation seeking → friend alcohol norms	-.04	$p = .218$
Sensation seeking → alcohol problems	.02	$p = .427$
T1 lack of premeditation predicting T2 variables		
Lack of premeditation → alcohol use	-.05	$p = .148$
Lack of premeditation → friend alcohol norms	.03	$p = .368$
Lack of premeditation → alcohol problems	-.10	$p = .004$
T1 alcohol use predicting T2 variables		
Alcohol use → negative urgency	.14	$p = .002$
Alcohol use → sensation seeking	.12	$p = .001$
Alcohol use → lack of premeditation	.11	$p = .019$
Alcohol use → friend norms	.36	$p < .001$
Alcohol use → alcohol problems	.42	$p < .001$
T1 friend alcohol norms predicting T2 variables		
Friend alcohol norms → negative urgency	-.12	$p = .006$
Friend alcohol norms → sensation seeking	-.07	$p = .036$
Friend alcohol norms → lack of premeditation	-.03	$p = .469$
Friend alcohol norms → alcohol use	.14	$p < .001$
Friend alcohol norms → alcohol problems	-.01	$p = .786$
T1 alcohol problems predicting T2 variables		
Alcohol problems → negative urgency	.11	$p = .010$
Alcohol problems → sensation seeking	-.04	$p = .271$
Alcohol problems → lack of premeditation	.033	$p = .410$
Alcohol problems → alcohol use	.00	$p = .950$
Alcohol problems → friend alcohol norms	.02	$p = .600$

Table 5. Standardized regression weights for pathways from T2 to T3 in full model A

	Standardized Effect	P Value
T2 negative urgency predicting T3 variables		
Negative urgency → alcohol use	-0.06	$p = .070$
Negative urgency → friend alcohol norms	-0.01	$p = .703$
Negative urgency → alcohol problems	0.02	$p = .446$
T2 sensation seeking predicting T3 variables		
Sensation seeking → alcohol use	0.10	$p < .001$
Sensation seeking → friend alcohol norms	-0.05	$p = .108$
Sensation seeking → alcohol problems	0.70	$p = .010$
T2 lack of premeditation predicting T3 variables		
Lack of premeditation → alcohol use	0.08	$p = .012$
Lack of premeditation → friend alcohol norms	-0.03	$p = .417$
Lack of premeditation → alcohol problems	-0.03	$p = .345$
T2 alcohol use predicting T3 variables		
Alcohol use → negative urgency	0.13	$p = .012$
Alcohol use → sensation seeking	0.10	$p = .008$
Alcohol use → lack of premeditation	0.22	$p < .001$
Alcohol use → friend alcohol norms	0.23	$p < .001$
Alcohol use → alcohol problems	0.22	$p < .001$
T2 friend alcohol norms predicting T3 variables		
Friend alcohol norms → negative urgency	-0.10	$p = .024$
Friend alcohol norms → sensation seeking	-0.09	$p = .001$
Friend alcohol norms → lack of premeditation	0.02	$p = .726$
Friend alcohol norms → alcohol use	0.08	$p = .058$
Friend alcohol norms → alcohol problems	0.08	$p = .032$
T2 alcohol problems predicting T3 variables		
Alcohol problems → negative urgency	0.12	$p = .015$
Alcohol problems → sensation seeking	0.02	$p = .435$
Alcohol problems → lack of premeditation	-0.08	$p = .073$
Alcohol problems → alcohol use	-0.06	$p = .140$
Alcohol problems → friend alcohol norms	0.14	$p = .744$

Table 6. Standardized regression weights for pathways in simplified model A

	Standardized Effect	P Value
T1 → T2 Pathways		
Sensation seeking → alcohol use	0.06	$p = .019$
Lack of premeditation → alcohol problems	-0.06	$p = .020$
Alcohol use → negative urgency	0.14	$p < .001$
Alcohol use → sensation seeking	0.11	$p = .002$
Alcohol use → lack of premeditation	0.11	$p < .001$
Alcohol use → friend alcohol norms	0.36	$p < .001$
Alcohol use → alcohol problems	0.42	$p < .001$
Friend alcohol norms → negative urgency	-0.10	$p = .008$
Friend alcohol norms → sensation seeking	-0.08	$p = .018$
Friend alcohol norms → alcohol use	0.14	$p < .001$
Alcohol problems → negative urgency	0.09	$p = .002$
T2 → T3 Pathways		
Sensation seeking → alcohol use	0.12	$p < .001$
Sensation seeking → alcohol problems	0.08	$p = .003$
Alcohol use → negative urgency	0.14	$p = .009$
Alcohol use → sensation seeking	0.11	$p < .001$
Alcohol use → lack of premeditation	0.17	$p < .001$
Alcohol use → friend alcohol norms	0.24	$p < .001$
Alcohol use → alcohol problems	0.26	$p < .001$
Friend alcohol norms → negative urgency	-0.13	$p = .002$
Friend alcohol norms → sensation seeking	-0.10	$p < .001$
Alcohol problems → negative urgency	0.15	$p = .002$

Table 7. Standardized regression weights for primary relations of interest in full model B

	Standardized Effect	P Value
T1 personality predicting T2 alcohol use		
Negative urgency → alcohol use	0.07	$p = .024$
Sensation seeking → alcohol use	0.06	$p = .043$
Lack of premeditation → alcohol use	-0.04	$p = .249$
T2 personality predicting T3 alcohol use		
Negative urgency → alcohol use	-0.07	$p = .040$
Sensation seeking → alcohol use	0.09	$p = .002$
Lack of premeditation → alcohol use	0.09	$p = .006$
T1 alcohol use predicting T2 personality		
Alcohol use → negative urgency	0.08	$p = .054$
Alcohol use → sensation seeking	0.09	$p = .006$
Alcohol use → lack of premeditation	0.10	$p = .012$
T2 alcohol use predicting T3 personality		
Alcohol use → negative urgency	0.07	$p = .177$
Alcohol use → sensation seeking	0.02	$p = .543$
Alcohol use → lack of premeditation	0.23	$p < .001$
T1 alcohol use predicting T2 mediators		
Alcohol use → friend drug norms	0.27	$p < .001$
Alcohol use → alcohol problems	0.42	$p < .001$
T2 mediators predicting T3 personality		
Friend drug norms → negative urgency	0.03	$p = .460$
Alcohol problems → negative urgency	0.10	$p = .037$
Friend drug norms → sensation seeking	0.06	$p = .016$
Alcohol problems → sensation seeking	0.00	$p = .968$
Friend drug norms → lack of premeditation	-0.01	$p = .798$
Alcohol problems → lack of premeditation	-0.08	$p = .080$

Table 8. Standardized regression weights for pathways from T1 to T2 in full model B

	Standardized Effect	P Value
T1 negative urgency predicting T2 variables		
Negative urgency → alcohol use	0.07	$p = .024$
Negative urgency → friend drug norms	0.03	$p = .467$
Negative urgency → alcohol problems	0.06	$p = .059$
T1 sensation seeking predicting T2 variables		
Sensation seeking → alcohol use	0.06	$p = .043$
Sensation seeking → friend drug norms	0.02	$p = .521$
Sensation seeking → alcohol problems	0.02	$p = .432$
T1 lack of premeditation predicting T2 variables		
Lack of premeditation → alcohol use	-0.04	$p = .249$
Lack of premeditation → friend drug norms	0.05	$p = .180$
Lack of premeditation → alcohol problems	-0.09	$p = .004$
T1 alcohol use predicting T2 variables		
Alcohol use → negative urgency	0.08	$p = .054$
Alcohol use → sensation seeking	0.09	$p = .006$
Alcohol use → lack of premeditation	0.10	$p = .012$
Alcohol use → friend drug norms	0.27	$p < .001$
Alcohol use → alcohol problems	0.42	$p < .001$
T1 friend norms predicting T2 variables		
Friend drug norms → negative urgency	0.01	$p = .683$
Friend drug norms → sensation seeking	-0.04	$p = .189$
Friend drug norms → lack of premeditation	-0.05	$p = .166$
Friend drug norms → alcohol use	-0.02	$p = .443$
Friend drug norms → alcohol problems	-0.06	$p = .079$
T1 alcohol problems predicting T2 variables		
Alcohol problems → negative urgency	0.08	$p = .052$
Alcohol problems → sensation seeking	-0.04	$p = .218$
Alcohol problems → lack of premeditation	0.04	$p = .333$
Alcohol problems → alcohol use	0.03	$p = .387$
Alcohol problems → friend drug norms	0.06	$p = .238$

Table 9. Standardized regression weights for pathways from T2 to T3 in full model B

	Standardized Effect	P Value
T2 negative urgency predicting T3 variables		
Negative urgency → alcohol use	-0.07	$p = .040$
Negative urgency → friend drug norms	0.02	$p = .539$
Negative urgency → alcohol problems	0.01	$p = .718$
T2 sensation seeking predicting T3 variables		
Sensation seeking → alcohol use	0.09	$p = .002$
Sensation seeking → friend drug norms	0.02	$p = .481$
Sensation seeking → alcohol problems	0.06	$p = .021$
T2 lack of premeditation predicting T3 variables		
Lack of premeditation → alcohol use	0.09	$p = .006$
Lack of premeditation → friend drug norms	-0.03	$p = .343$
Lack of premeditation → alcohol problems	-0.02	$p = .469$
T2 alcohol use predicting T3 variables		
Alcohol use → negative urgency	0.07	$p = .177$
Alcohol use → sensation seeking	0.02	$p = .543$
Alcohol use → lack of premeditation	0.23	$p < .001$
Alcohol use → friend drug norms	0.12	$p < .001$
Alcohol use → alcohol problems	0.24	$p < .001$
T2 friend norms predicting T3 variables		
Friend drug norms → negative urgency	0.03	$p = .460$
Friend drug norms → sensation seeking	0.06	$p = .016$
Friend drug norms → lack of premeditation	-0.01	$p = .798$
Friend drug norms → alcohol use	0.03	$p = .353$
Friend drug norms → alcohol problems	0.08	$p = .006$
T2 alcohol problems predicting T3 variables		
Alcohol problems → negative urgency	0.10	$p = .037$
Alcohol problems → sensation seeking	0.00	$p = .968$
Alcohol problems → lack of premeditation	-0.08	$p = .080$
Alcohol problems → alcohol use	-0.06	$p = .175$
Alcohol problems → friend drug norms	0.01	$p = .892$

Table 10. Standardized regression weights for pathways in simplified model B

	Standardized Effect	P Value
T1 → T2 Pathways		
Lack of premeditation → alcohol problems	-0.07	$p = .012$
Alcohol use → sensation seeking	0.05	$p = .041$
Alcohol use → lack of premeditation	0.09	$p = .005$
Alcohol use → friend drug norms	0.33	$p < .001$
Alcohol use → alcohol problems	0.42	$p < .001$
Alcohol problems → negative urgency	0.13	$p < .001$
T2 → T3 Pathways		
Negative urgency → alcohol use	-0.07	$p = .013$
Lack of premeditation → alcohol use	0.10	$p = .002$
Sensation seeking → alcohol use	0.09	$p = .002$
Alcohol use → lack of premeditation	0.17	$p < .001$
Alcohol use → friend drug norms	0.13	$p < .001$
Alcohol use → alcohol problems	0.23	$p < .001$
Friend drug norms → sensation seeking	0.07	$p = .002$
Friend drug norms → alcohol problems	0.07	$p = .011$
Alcohol problems → negative urgency	0.17	$p < .001$

Table 11. Standardized total effects in simplified models

	Model A	Model B
T1 negative urgency → T3 alcohol use	--	--
T1 sensation seeking → T3 alcohol use	0.14*	.07*
T1 lack of premeditation → T3 alcohol use	--	.07*
T1 alcohol use → T3 negative urgency	0.20*	.07*
T1 alcohol use → T3 sensation seeking	0.19*	.07*
T1 alcohol use → T3 lack of premeditation	0.13*	.19*

* $p < 0.01$

Chapter Four: Discussion

Previous research provides robust support for the role of impulsive personality as a risk factor for substance use and abuse (e.g., Corbin et al., 2011; Horvath et al., 2004; Settles et al., 2010). In addition to increasing an individual's risk, impulsive personality also appears to be impacted by substance use, and longitudinal studies have demonstrated that substance use predicts increases in impulsive personality over time (Horvath et al., 2004; Quinn et al., 2011), though it is unclear what mechanism(s) account for this relation. The present study sought to examine the bidirectional relations of alcohol use with impulsive personality in a longitudinal sample of college students with a focus on clarifying the mechanism(s) that might account for the impact of alcohol use on later impulsivity. Based on a review of the literature it was predicted that the three UPPS personality traits examined—negative urgency, sensation seeking, and lack of premeditation—would all predict higher levels of alcohol use. Next, it was predicted that alcohol use would result in higher scores on negative urgency and sensation seeking but not lack of premeditation at subsequent time points. Alcohol-related problems and friend group norms were examined as mediators of the relation between alcohol use and later impulsive personality, and were hypothesized to operate differently in relation to the different impulsive traits. Friend group norms for substance use were hypothesized to mediate the relation between alcohol use and later sensation seeking, while alcohol-related problems were hypothesized to mediate the alcohol-negative urgency relation. Support was found for each of the hypotheses. Notable findings of the present research include 1) the longitudinal impact of alcohol use on all three of the impulsive traits, 2) the mediating role of friend norms for drug use in the relation between alcohol use and

subsequent sensation seeking, and 3) the mediating role of alcohol-related problems in the relation between alcohol use and subsequent negative urgency.

Sensation Seeking and Lack of Premeditation Predict Later Alcohol Use

All three impulsive traits were hypothesized to predict later alcohol use, and findings indicate that when considered separately (i.e., by examining the correlations of each of the UPPS variables with later alcohol use) they each did. However, when all three personality variables were considered together, only sensation seeking and lack of premeditation predicted later alcohol use. One likely reason for negative urgency's unexpected lack of significant relations with later alcohol use is the inclusion of lack of premeditation and sensation seeking in the model, as examining all three impulsive traits together represents a stringent test for the role of each in predicting later alcohol use. Negative urgency has been found to predict later drinking among college students in a prior study, however this model did not include sensation seeking and lack of premeditation (Settles et al., 2010). The current results are consistent with prior findings, where lack of premeditation and sensation seeking have been found to contribute uniquely to participation in risky behaviors (Fischer & Smith, 2004), and these two traits but not negative urgency have been found to relate substance use when four UPPS facets (the three traits of interest plus lack of perseverance) are considered together (Lynam & Miller 2004; Miller et al 2003). Similarly Cyders and colleagues (2009) found that negative urgency predicted later alcohol use when considered alone but not when the other UPPS impulsive traits were included in the model. Results suggest that, while urgency does relate to later alcohol use, it does not have the same unique predictive power as the other impulsive traits examined.

Another possible reason for negative urgency's lack of significant relations is the type of alcohol variable examined—average weekly alcohol use. Studies examining sensation seeking and negative urgency's relations with alcohol outcomes suggest that each of the personality variables is uniquely associated with specific types of alcohol outcomes. Sensation seeking has been found to be more related to frequency/amount of alcohol use, while negative urgency is more related to problems (Curcio & George, 2011; Fischer & Smith, 2008; LaBrie, Kenney, Napper, & Miller, 2014). This pattern was partially supported in our sample: negative urgency's cross-sectional correlations with alcohol problems (ranging from r = .36 to r = .42) were higher than those of sensation seeking (ranging from r = .21 to r = .33), though correlations of both traits with concurrent alcohol use were relatively similar. There is substantial overlap between alcohol use and problems (in the present study correlations within time points ranged from r = .57 to r = .71) and including both variables in the final model likely allowed for better parsing out of the unique relations of the impulsive personality traits with each alcohol variable.

Past research suggests that different impulsive personality traits may predispose individuals to different types of drinking behaviors and experiences, which may have also contributed to differential relations of the personality variables with later alcohol use in the full model. In one study, negative urgency but not sensation seeking was found to relate to unplanned drinking, which the authors hypothesized makes it more likely that a person will experience negative consequences related to alcohol consumption (e.g., driving home because they did not plan to have a designated driver; Pearson & Henson, 2013). Because many of the participants in the present study were underage at multiple

time points (mean = 18.95 years at T1) unplanned drinking may not have been as relevant to their total consumption, as alcohol use may have required some planning (e.g., asking an older friend to purchase alcohol). Thus negative urgency may not have increased individuals' total amount of use, even if it led to more problematic patterns of consumption (i.e., unplanned use).

Personality also appears to shape individuals experiences of alcohol use, as sensation seeking but not negative urgency predicts positive drinking experiences, such as feeling more sociable, which in turn leads to higher levels of consumptions (Lang et al., 2012; Park, Kim, Gellis, Zaso, & Maisto, 2014). In contrast to sensation seeking, negative urgency is predictive of negative consequences of alcohol use, which do not predict increases in consumption (Park et al., 2014). Sensation seeking may have emerged as the better predictor of alcohol use in the current study because it better predicts the types of experiences that make individuals more likely to drink. No known studies have examined the impact of lack of premeditation on unplanned alcohol use or positive drinking experiences, but based on the findings of the present study it seems plausible that it's effects more closely resemble those of sensation seeking rather than negative urgency.

Alcohol Use Predicts Changes in Impulsive Personality

Alcohol use was found to be a consistent predictor of later impulsive personality, demonstrating significant total effects on all three impulsive personality traits at T3. The effect of alcohol use on lack of premeditation and sensation seeking is consistent with the findings of Quinn and colleagues (2011), where heavy drinking was found to predict increases in both traits among college students. The current study further clarified the

impact of alcohol use on impulsive personality by demonstrating that alcohol consumptions also impacts negative urgency longitudinally. Findings are consistent with the Corresponsive Principle, which suggests that personality traits that predispose individuals to certain life experiences are in turn reinforced and increased by these experiences (Caspi et al., 2005). The results of the present study highlight the usefulness of examining the relations between personality traits and risky behavior using a longitudinal design. All three personality traits correlate with alcohol use cross-sectionally, but examining the relations over time reveals a more nuanced picture. While both sensation seeking and lack of premeditation evidenced bidirectional relations with alcohol use, negative urgency's relation appears to be better understood as reflecting the impact of alcohol use on personality, as negative urgency did not predict alcohol use but was predicted by it.

Mediating Effects of Friend Norms and Alcohol Problems

Results supported the hypothesis that alcohol use would predict later impulsive personality, so the next step was to examine whether the predicted mechanisms would account for these relations. Friend group norms for substance use (both alcohol and drug use) were hypothesized to mediate the relation between alcohol use and later sensation seeking, as heavy alcohol use would lead individuals to select into friend groups with a similar propensity toward risk-taking, who would in turn reinforce and increase the individual's level of sensation seeking. Results varied depending on the substance use norm considered. In the first model, friend norms for alcohol use were examined. Alcohol use at T1 predicted friend norms for alcohol use at T2, however T2 friend norms for alcohol use did not predict higher levels of any of the impulsive traits at T3,

indicating that the variable does not account for the alcohol-personality relation. This counterintuitive finding will be discussed in more detail below.

In the second model, where friend norms for drug use were used instead of alcohol norms, T1 alcohol use once again was a significant predictor of T2 friend norms. T2 friend norms for drug use in turn significantly predicted T3 sensation seeking, in contrast to the findings for friend alcohol norms. The indirect effect of alcohol use on sensation seeking via friend norms for drug use was found to be statistically significant. Providing further support for the mediating role of friend norms for drug use, T2 alcohol use was found to directly predict T3 sensation seeking in an earlier version of the model, but was no longer significant once friend norms for drug use were included. Although all three personality variables were correlated with friend norms for drug use cross-sectionally, this mediational relation was unique to sensation seeking. T2 friend norms for drug use were not predictive of either negative urgency or lack of premeditation at T3.

Consistent with Quinn and colleagues (2011), friend norms for alcohol use did not account for the relation between alcohol use and personality. However, substituting drug use norms for alcohol norms into the model resulted in strikingly different results, as friend norms for drug use were found to mediate the relation between alcohol use and sensation seeking. Drug use may have emerged as a better predictor of later personality for a number of reasons. First, the high overlap between an individual's friends' alcohol use and their own (cross-sectional correlations ranged from $r = .50$ to $r = .60$) means that friends' use may not have contributed much unique information to the model. Friend norms for drug use were also significantly correlated with individuals' alcohol use, but not to the same extent as alcohol use norms (cross-sectional correlations ranged from $r =$

.36 to r = .43). This interpretation is consistent with the unusual finding that T2 friend norms for alcohol use predicted lower levels of sensation seeking and negative urgency at T3. The high degree of overlap between friend alcohol norms and an individual's own use may have resulted in the remaining portion of the variance attributed to friend alcohol norms (i.e., the portion which did not overlap with other variables in the model) representing something different from what it was intended to. Another potential explanation for the disparate findings is that friend norms for drug use are a better indicator of peer-group riskiness than friend norms for alcohol use. This seems likely given the fact that binge drinking is much more common among college students than drug use (Cranford et al., 2009). The high prevalence of binge drinking relative to drug use means that knowing that an individual's friends drink heavily likely provides comparatively less information regarding the likelihood that that individual will be exposed to opportunities for high risk behavior. In particular, drug-using friend groups likely enable increased experimentation with substances in ways that friend groups who drink alcohol but refrain from drug use may not.

Findings regarding the influence of friends' substance use on later sensation seeking add to the existing literature on the interplay between peer norms for substance use and the personality trait. The results also provide support for the Corresponsive Principle, with sensation seeking both predicting and being predicted by a particular life experience; in this case that life experience seems to be membership in a high-risk friend group. Previous research has found that individuals who are high in sensation seeking tend to select into peer groups with other high sensation seekers (Yanovitsky, 2005; Yanovitsky, 2006) and higher rates of substance use (Romer & Hennessy, 2007), and

results of the present study indicate that membership in these kinds of peer groups in turn predicts increases in sensation seeking. Individuals who select into these kinds of groups likely have more opportunities and incentives for substance use and other types of risky behavior, which could lead to an increase in both high-risk behavior and subsequent ratings of sensation seeking over time.

Alcohol-related problems were also examined as a potential mediator of the relation between alcohol use and later impulsive personality. It was predicted that alcohol-related problems would mediate the relation between alcohol use and later negative urgency, as individuals engaging in heavy alcohol use would be at increased risk for the development of alcohol problems, and the onset of alcohol problems would make individuals more likely to engage in impulsive behaviors (i.e., consuming alcohol) when experiencing distress. Results supported this hypothesis. Alcohol use at T1 positively predicted levels of alcohol-related problems at T2, alcohol problems at T2 in turn positively predicted negative urgency at T3, and the indirect effect was found to be statistically significant. This suggests that alcohol problems accounted for the relation between alcohol use and changes in negative urgency over time. T3 sensation seeking and lack of premeditation were not significantly predicted by T2 alcohol problems in either model, suggesting that this mediating mechanism is unique to negative urgency.

Previous research indicates that the onset of an alcohol use disorder is associated with changes in personality, including increases in impulsiveness, and the findings of the current study are consistent with these results (Östlund et al., 2007). The referenced study used a single, general impulsive personality variable (i.e., the tendency to act without thinking), and inclusion of three distinct impulsive personality traits in the present model

allowed for clarification of these prior findings. Impulsivity is indeed impacted by alcohol problems; however the current results suggest that alcohol-related problems have a unique impact on negative urgency rather than impacting all impulsive traits similarly. This makes intuitive sense, as it is easy to imagine how alcohol-related pathology could predispose an individual to engage in rash action (e.g., consuming large quantities of alcohol) when feeling upset. In contrast, the idea of an individual seeking out new or exciting experiences as a result of alcohol-related problems makes less sense.

Cross-sectional studies have found strong relations between negative urgency and alcohol and drug problems (Fischer & Smith, 2008; Settles et al., 2012; Verdejo-García et al., 2007), and the results were consistent with these findings, with cross sectional correlations of negative urgency with alcohol problems ranging from $r = .36$ to $r = .42$. Examination of a longitudinal model allowed for further clarification of the relations between negative urgency and alcohol problems, and results suggest that cross-sectional associations in our sample were reflective of the impact of alcohol problems on negative urgency rather than negative urgency's role in predicting alcohol problems. Though negative urgency was correlated with later alcohol problems ($r = .28$ for T1 negative urgency with T2 alcohol problems; $r = .30$ for T2 negative urgency with T3 alcohol problems), its effects in the full model did not reach statistical significance. These findings suggest that, when considering the association between negative urgency and substance related problems, the direction of the relation should be examined rather than assumed.

Alcohol use was a significant predictor of a later lack of premeditation, however neither friend norms nor alcohol problems accounted for this relation. It may be the case

that, rather than being accounted for by social factors or psychopathology, alcohol's impact on lack of premeditation can be explained by an increase in rash behavior occurring while individuals are intoxicated. This would be consistent with the findings of previous studies where, when administered alcohol, social drinkers tended to behave impulsively on subsequent laboratory tasks (Dougherty, Marsh, Moeller, Chokshi, & Rosen, 2000; Dougherty, Marsh-Richard, Hatzis, Nouvion, & Mathias, 2008), and research indicating that not only are heavy drinkers more impulsive than light drinkers on self-report and laboratory tasks, but they also demonstrate an increase in impulsive behavior following a high dose of alcohol that light drinkers do not (Reed, Levin, & Evans, 2012).

Clinical Implications

Findings are consistent with a bidirectional relation between alcohol use and impulsive personality, but highlight the importance of differentiating between distinct impulsive personality traits. The three impulsive traits examined all showed associations with alcohol use, but differed in terms of how they impacted and were impacted by alcohol use longitudinally. These differences have useful implications for clinical intervention. Sensation seeking emerged as the best predictor of later alcohol use, demonstrating significant direct and total effects in both models. This and other studies linking the trait with subsequent alcohol use (e.g., Horvath et al., 2004) build a strong case for the potential usefulness of targeting intervention approaches to individuals who are high in sensation seeking. Indeed, prevention interventions tailored to specific personality traits, including sensation seeking, have shown promising results (Conrod, Castellanos-Ryan, & Mackie, 2011; Conrod, Stewart, Comeau, & Maclean, 2006).

Whereas some life experiences have been found to impact personality in favorable ways (e.g., occupational attainment predicting reduced negative emotionality; Roberts, Caspi, & Moffitt., 2003), alcohol's effect on personality appears to be maladaptive, as increased impulsivity increases risk for further substance use and quite possibly for other types of negative experiences. For this reason it may be useful to target these personality traits in treatment for individuals with alcohol-related problems or hazardous levels of alcohol use. For both sensation seeking and negative urgency, psychoeducation on the link between personality and alcohol-use may be helpful, particularly if that information is targeted to whichever trait is more relevant. The personality-targeted prevention programs developed by Conrod and colleagues (e.g., Conrod et al., 2006) include a psychoeducational component on the unique risk pathways associated with specific personality traits, and this type of personality-targeted information may be a useful component of treatment for individuals with alcohol-related problems or high levels of use who also demonstrate high levels of impulsive personality traits.

The distinct pathways from alcohol use to sensation seeking versus negative urgency suggest that the most useful approach to addressing maladaptive personality change will vary depending on the personality trait being considered. For an individual who is displaying high levels of sensation seeking in conjunction with high levels of alcohol use, it may be helpful to target the social network and focus on building relationships with individuals who are moderate in their substance use or express high sensation seeking in healthier ways (e.g., rock climbing). Peer substance use has been shown to have a significant influence on an individual's own substance use (Andrews et

al., 2002; Fergusson et al., 2001) and helping an individual to seek out relationships that do not encourage high-risk behavior could help to prevent or reduce alcohol use and problematic effects on personality. The present findings suggest that it is selection into high-risk peer groups by college drinkers that leads to increases in sensation seeking, and the social component may make individuals less interested in reducing drinking than those who are experiencing personality change as a result of alcohol-related problems. For these people, strategies that seek to reduce risk rather than drinking itself may be helpful, and the use of protective behavioral strategies (e.g., planning to have a designated driver) has been found to relate to lower levels of alcohol-related negative consequences among college drinkers (Kenney & LaBrie, 2013).

On the other hand, high negative urgency might be better targeted using mindfulness-based treatments which seek to increase awareness of emotions and impulses, and which have been found to be effective at reducing binge drinking among college students (Mermelstein & Garske, 2015) in the treatment of substance use disorders (Bowen et al., 2014). Another treatment well-suited to addressing high negative urgency as a result of alcohol problems is Dialectical Behavior Therapy (DBT), an empirically-validated treatment for Borderline Personality (BPD), a disorder which is characterized by high levels of negative urgency (Peters et al., 2013). It includes strategies for regulating emotions and tolerating distress, and has been found to be helpful in treating substance use disorders among women with comorbid BPD (Linehan et al., 2002; van den Bosch, Verheul, Schippers, & van den Brink, 2002). The relation between alcohol problems and changes in negative urgency suggest that individuals with alcohol-related problems would benefit from DBT even if they do not have comorbid BPD.

Previous research indicates that treatment of BPD with DBT can lead to positive changes in personality, for example increases in self-control and agreeableness (Davenport et al., 2010). It is very plausible that the use of a well-matched treatment for alcohol-problems might similarly lead to adaptive changes in personality, including a reduction in negative urgency.

Limitations and Future Directions

The present study has several limitations that could be addressed in future research. The sample lacked racial and ethnic diversity, and it would be worthwhile to examine relations in a more diverse sample. Next, because participants were reporting on behaviors that are illegal for their age group, even though they were reassured that there would not be any legal ramifications for reporting illegal substance use, it is possible that some participants may have underreported or otherwise distorted their substance use history. It is possible that the assessment of substance use in a one-on-one interview with an experimenter (versus the administration of a questionnaire in a group setting or online) could impact the degree to which participants disclosed substance use honestly. Although a college student sample seemed well-suited to the research questions of interest, it should be noted that participants were not randomly selected from the entire population of young adults and thus constitute a convenience sample.

Additionally, it will also be essential to examine these relations in other samples, as differences in age (e.g., young adulthood versus adolescence), context (e.g., attending college versus working fulltime), or length of time between assessments could impact relations. Previous research indicates that, when compared to later adulthood, personality during early adulthood demonstrates less stability (Hopwood et al., 2011; Roberts et al.,

2006). It may be the case that the results of the present study were influenced by the amenability of personality during this time period to change as a result of substance use. The unique nature of the context experienced by college students may also have contributed to the observed changes in personality. College students may experience different consequences of substance use than individuals in other contexts, which could encourage a wider range of substance use behaviors. For example, staying out late drinking with friends on a weeknight would likely not have the same negative consequences for a college student as it would for an individual working a full time job if the student did not have class until later in the day, or chose to skip a class where attendance was not monitored. The substantial changes individuals experience as they transition from living in their family homes to living in dorms or off-campus housing may also contribute to changes in personality. It has been suggested that "individual differences are most likely to be accentuated during transitions into new situations that are characterized by unpredictability, when there is a press to behave but no information about how to behave adaptively" (Caspi & Moffitt, 1993, p. 248), and the impact of the transition to college life may have contributed the bidirectional effects observed in the present study.

It will be important to examine the observed effects in a longer time span, as the length of time between assessments may have impacted the results. A recent study of the transactional relations of alcohol use and personality found that heavy alcohol use predicted changes in novelty seeking (an impulsivity-related trait) over a shorter time span—from the fall of the first year of college to spring of the second year—but not when examined from age 18 to age 25 (Littlefield, Vergés, Wood, & Sher, 2012). The authors

suggest that their "findings are consistent with the extant literature that suggests proximal, but not necessarily distal, alcohol use influences subsequent changes in personality" (p. 781). Findings regarding the mediating role of friend norms and alcohol problems could help explain why alcohol's impact on personality may not extend over long periods of time, as both alcohol problems and peer group membership likely change over time. Individuals who experience alcohol problems may choose to get treatment, which could in turn lead to self-reported negative urgency returning to baseline levels. Similarly, observed increases in sensation seeking may not be maintained if individuals experience changes in the norms of their peer groups following college graduation, when many people may be reducing substance use as a result of transitioning into new roles and responsibilities (e.g., fulltime employment).

Summary

The present study sought to further clarify the relation between impulsive personality and alcohol use by examining bidirectional relations over two years, and by considering the potential mediating roles of friend norms for substance use and the development of alcohol-related problems. Previous research indicates that alcohol use leads to increases in sensation seeking and lack of premeditation over time (Horvath et al., 2004; Quinn et al., 2011) and the present study built upon these findings by demonstrating that alcohol use also predicts changes in negative urgency. Support was found for the mediating roles of friend norms and alcohol problems, though results varied depending on the impulsive trait under consideration. Friend norms for drug use were found to mediate the relation between alcohol use and later sensation seeking, while alcohol-related problems were found to mediate the relation between alcohol use and

later negative urgency. Results support the utility of multidimensional model of impulsive personality, and suggest that the UPPS traits impact and are impacted by alcohol use in different ways.

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Zuckerman, M. (1994). *Behavioral expressions and biosocial bases of sensation seeking*. New York: Cambridge University Press.

Curriculum Vitae

Alison J. Kaiser

EDUCATION

M.S. in Clinical Psychology 2010

University of Kentucky, Lexington KY

Thesis: "Negative Urgency and Problematic Alcohol Use: Does Distress Tolerance Moderate the Relation?"

Advisor: Richard Milich, Ph.D.

B.A. in Psychology- *Summa Cum Laude* 2008

Miami University, Oxford OH

Senior Thesis for Departmental Honors: "Does Emotion Dysregulation Predict Sexual Victimization? An Investigation of Emotion Regulation, Coping, Risky Sex, and Rape"

Mentor: Terri Messman-Moore, Ph.D.

CLINICAL POSITIONS

Psychology Intern 2013 –2015

University of Kentucky Internship Consortium, Lexington KY

Rotations: Cardinal Hill Rehabilitation Hospital, Orofacial Pain Clinic, University of Kentucky Counseling Center, Eastern State Hospital

Assistant Director 2012 –2013

Jesse G. Harris Psychological Services Center, University of Kentucky, Lexington KY

Clinic Assistant Coordinator 2011 –2012

Jesse G. Harris Psychological Services Center, University of Kentucky, Lexington KY

Practicum Therapist 2009 – 2013

Jesse G. Harris Psychological Services Center, University of Kentucky, Lexington KY

Practicum Clinician 2010 – 2011

UK Healthcare Psychiatry Outpatient Clinic, Lexington KY

Practicum Therapist 2009 –2010

University of Kentucky Counseling Center, Lexington KY

RESEARCH POSITIONS

Research Assistant 2013 – Present
Department of Psychology, University of Kentucky, Lexington KY

Narrative Comprehension Grant

Research Assistant 2008 – 2012
Department of Psychology, University of Kentucky, Lexington KY

Center for Drug Abuse Research Translation (CDART)

Undergraduate Research Assistant 2005 – 2008
Department of Psychology, Miami University, Oxford OH

PUBLICATIONS

Kaiser, A. J., Milich, R., Lynam, D. R., & Charnigo, R. J. (2012). Negative urgency, distress tolerance, and substance use among college students. *Addictive Behaviors, 37*(10), 1075-1083

Adams, Z. W., Kaiser, A. J., Lynam, D. R., Charnigo, R. J., & Milich, R. (2012). Drinking motives as mediators of the impulsivity-substance use relation: Pathways for negative urgency, lack of premeditation, and sensation seeking. *Addictive Behaviors, 37*(7), 848-855

Kaiser, A. J., Bonsu, J. A., Charnigo, R. J., Milich, R., & Lynam, D. R. (2014). *Impulsive personality and alcohol use: Bidirectional relations over one year.* Manuscript submitted for publication.

HONORS AND AWARDS

Scientist Practitioner Award 2013
Department of Psychology, University of Kentucky, Lexington KY

Excellence in Clinical Performance 2012
Department of Psychology, University of Kentucky, Lexington KY

Undergraduate Summer Scholar 2007
Miami University, Oxford OH

Oxford Scholar 2004 – 2008
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National Merit Finalist 2004