PERSONALITY DIFFERENCES IN SUBJECTIVE EFFECTS OF ALCOHOL: A DYNAMIC EXAMINATION OF THE PATHWAYS EXPLAINING ALCOHOL-RELATED REWARD

by

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Through decades of research scientists have found personality traits such as extraversion and sensation-seeking to represent robust risk factors for Alcohol Use Disorder (AUD). Results of survey studies suggest that extraverted individuals gain greater mood enhancement from consuming alcohol than introverted individuals. However, alcohol administration studies to date have not found evidence of alcohol reward-sensitivity among extraverts. Of note, prior alcohol administration studies have examined these (highly social) individuals consuming alcohol alone. In the present study I examined whether extraverted individuals gained greater reward from consuming alcohol in a laboratory-based social drinking paradigm and, further, whether social processes explained alcohol reward sensitivity among extraverts. Social drinkers ($n = 720$) consumed a moderate dose of alcohol, placebo, or control beverage in groups of three over the course of 36 minutes. Their social interaction was video-recorded, and Duchenne smiling was coded using the Facial Action Coding System. Results suggested that extraverted individuals gained significantly more self-reported mood enhancement from alcohol than introverts. Further, findings of moderated mediation analyses indicated that social processes accounted for alcohol reward-sensitivity among extraverts. Alcohol significantly increased duration of smiles that were shared between group members (simultaneous smiles), and the association between simultaneous smiles and self-reported reward was strongest among extraverts. There was a non-significant trend ($p < .10$) suggesting sensation seeking moderated the impact of alcohol, but the processes underlying alcohol reward did

not differ according to sensation-seeking. Findings point to the importance of considering social processes in the study of individuals vulnerable to alcohol problems and further offer new directions for alcohol research that combines the study of individual differences with the study of mechanism.

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1.0 INTRODUCTION

A great deal of research has focused on identifying individuals who might be at risk for developing alcohol-related problems. Among many potential individual difference criteria hypothesized to denote addiction susceptibility, few have received as much consideration from behavioral researchers as has personality [85]. Through decades of research, scientists have identified a host of personality traits as potentially indicative of alcohol use disorder (AUD) susceptibility including all Five-Factor personality traits, with varying degrees of consistency, as well as traits associated with sensation-seeking/impulsivity [52, 57].

One potential explanation for links between personality and AUD susceptibility is that individuals with certain personality traits derive greater emotional reward from drinking alcohol [83]. In line with this prediction, survey research consistently finds that individuals high in impulsivity and extraversion report expecting to receive greater mood-enhancing effects from alcohol [2, 61, 62, 71] and are more likely to report that alcohol's mood enhancing properties motivate their drinking [14, 48, 91]. However, laboratory alcohol-administration studies have produced mixed findings concerning the relationship between "vulnerable" personality traits and alcohol-response [52, 83]. For example, some studies find that individuals high in traits associated with impulsivity and sociability receive a greater stress response dampening effect from a moderate dose of alcohol [49, 84, 81, 97], while a number of other studies find that impulsive and extraverted individuals experience no greater subjective response from alcohol than other individuals [65, 66, 74, 79, 82]. Thus, while survey findings suggest that a relationship between personality and alcohol-related mood enhancement does exist, experimental studies seem to suggest that this relationship is not direct. Instead, consistent with social-cognitive theories of alcohol-related reward [35, 76, 89], these findings might indicate that the relationship between personality vulnerability and alcohol-related

reward is indirect or mediated.

The current study aimed to integrate a consideration of mechanism into the study of personality differences in alcohol response, examining how the processes through which alcohol consumption is experienced as rewarding might differ across individuals. Using advanced over-time analyses and continuous real-time measures of affective[1] experience, I examined how dynamic social and affective processes differentially explain self-reported alcohol-related reward across individuals. In particular, I investigated the extent to which social and emotional processes explain alcohol's rewarding properties among individuals with differing levels of extraversion and sensation-seeking/impulsivity—two traits that have most consistently been shown to predict later onset of alcohol use disorder[2]. More broadly, this study sought to integrate personality research and social-cognitive theories of alcohol's effects, exploring how underlying processes impacted by alcohol consumption might be used to understand individual differences in the mechanisms supporting alcohol's rewarding properties.

1.1 EXTRAVERSION

Extraversion—defined by Jung [37] as the tendency to focus attention on external stimuli and later by Eysenck [22, p. 37] as the disposition to behave in a sociable manner—has been identified as a risk factor for AUD. Generally speaking, studies have not found alcoholics to be higher in extraversion than non-alcoholics [85]. However, studies examining alcohol use among non-alcoholic samples reveal that extraverts initiate alcohol use at an earlier age [34, 33] and show higher rates of heavy drinking when compared with introverted individuals [13, 27, 29, 60]. Further, a number of prospective studies have found that higher levels of extraversion predict later onset of problematic drinking [31, 40, 96]. Scholars have explained this pattern of findings by noting that, as alcohol-dependence progresses, drinkers who might

[1]For the purposes of the current research, the terms "affect" and "emotion" are used interchangeably to refer to an immediate emotional state reflecting an individual's appraisal of an internal or external stimulus on a moment-to-moment basis, whereas "mood" is used to refer to a more pervasive and long-lasting emotional state [7].

[2]A third personality trait that has historically been of interest to alcohol researchers is neuroticism. Prospective studies reveal, however, that the etiological significance of neuroticism in predicting later onset of alcohol problems is unclear [86].

have initially been highly social tend to become increasingly isolated and thus display lower levels of extraversion [85]. Thus, extraversion may have particular relevance for explaining the initial development, as opposed to the maintenance, of AUD [86].

Despite years of research examining individual difference criteria as moderators of alcohol response, it is noteworthy that research has yielded no known published reports of extraversion, as it has traditionally been defined, being linked to enhanced alcohol-related reward. While some studies have found links between general scales indexing both disinhibited and sociable personality traits and enhanced alcohol-response [81], studies using measures of extraversion defined within a standard three-factor or five-factor approach find no relationship between extraversion and alcohol-induced mood enhancement [e.g., 26], with one study finding extraverts to derive less reward from a moderate dose of alcohol [74].

Importantly, these laboratory studies have focused on alcohol response among participants drinking in isolation. Research suggests that, outside of the laboratory, the vast majority of alcohol consumption takes place in social settings [9, 19, 88]. The ability of these "asocial" laboratory studies to capture alcohol response as it might occur in more naturalistic settings is likely to be particularly limited with respect to examining alcohol response among individuals with strong social motivations. Extraverts not only spend more time in social settings than introverts [3], but are more strongly motivated by social goals [42, 41, 72], pay closer attention to social cues in affiliative social settings [10, 30, 50], and derive more reward from social settings than introverts [4, 22, 95].

The study of alcohol response among extraverted individuals seems to call for laboratory paradigms involving a social drinking setting, allowing participants to access alcohol-related social reward [77]. The examination of social processes within such interactions has been advanced by systems of behavioral measurement that enable precise capture of multiple streams of ongoing behavior [5] and statistical methods that permit an examination of the coordination of social behaviors across individuals within a social exchange [39]. Using social paradigms together with indexes of social coordination, studies might determine whether extraverts are especially sensitive to alcohol-related reward in social settings and also examine the extent to which social processes play a role in this increased sensitivity.

1.2 IMPULSIVITY/SENSATION-SEEKING

Another trait that appears to be highly relevant to AUD is the broad personality dimension of impulsivity. Traits associated with impulsivity have been identified as among the most powerful risk factors for AUD [86, 93]. Individuals with a family history of alcoholism show higher rates of sensation-seeking and impulsivity than controls [54, 69] and traits associated with impulsivity and disinhibition have been shown to prospectively predict onset of AUD [11, 31, 80, 91]. Recent work has partitioned the general trait of impulsivity into sub-facets [20], and the current research focuses on the facet of sensation-seeking. Impulsivity/sensation-seeking [101, 99] has been defined as a preference for change and uncertainty combined with a tendency to act without thinking or planning or, put differently, "the seeking of novel, varied, complex, and intense sensations and experiences, and the willingness to take physical, social, legal, and financial risks for the sake of such experience" [99, p. 27].

A popular explanation for links between impulsivity and maladaptive drinking is a deficit in behavioral inhibition processes among impulsive individuals [38, 45, 67, 94]. An alternative to this explanation has been proposed by Sher and colleagues, who suggest that differences between impulsive and non-impulsive individuals in susceptibility to AUD are attributable to increased sensitivity to the mood enhancing (generally stress-relieving) effects of alcohol among individuals high in impulsivity [83]. While some evidence has accrued to suggest that—in some circumstances—impulsive individuals may gain greater reward from alcohol, little is known about the mechanisms that might explain this effect [84].

A consideration of the predictions of personality theory regarding the characteristics and preferences of impulsive/sensation-seekers might inform the understanding of mechanisms underlying differential alcohol response among these individuals. Sensation-seeking individuals are theorized to derive particular reward from experiences that yield affective fluctuations or shifts in affect over time [99]. Sensation-seekers, compared to non-sensation-seekers, prefer music that is more complex and varied [51], exhibit greater discomfort in response to lack of sensory variation [100], and show increased cortical arousal in response to fluctuations in stimulus intensity [98]. Given research documenting a preference for emotional varia-

tion among sensation-seekers, it seems plausible that alcohol-related reward among these individuals is experienced as a dynamic affective process. An approach that examines alcohol's effects on emotional fluctuations over time might help reveal mechanisms underlying alcohol-related reward sensitivity among impulsive/sensation-seekers.

1.3 PHARMACOLOGICAL VULNERABILITY

While personality theory points to intriguing potential mediators of alcohol-related reward, these personality-specific pathways have not been considered within alcohol research to date. The "pharmacological vulnerability" explanation was among the first formal models proposed by researchers seeking to understand links between personality traits and AUD [81, 85]. This model contends that individuals with certain personality traits are more responsive to the rewarding or punishing effects of alcohol, and propose that it is this increased sensitivity that explains links between personality traits and the development of AUD. Consistent with contentions of the pharmacological vulnerability model, survey studies reliably reveal affect regulation as a powerful mediator of the relationship between personality and alcohol-related problems [14, 48, 53][3]. However, as reviewed earlier, experimental studies have produced mixed findings regarding the relationship between personality and alcohol-related reward, and interpretation of laboratory-based studies is further complicated by methodological limitations including small sample sizes, paradigms producing no overall effect of alcohol on mood, and a general scarcity of alcohol-administration research examining structured and empirically verified measures of personality [52, 85]. Taken together, this body of research provides only mixed support for the model's contention that a direct, pharmacologically-based susceptibility to alcohol-related reward explains links between personality traits and AUD.

[3] An alternative explanation for this pattern of findings is that individuals with different personality traits adopt different emotion regulation or coping strategies, making them more or less likely to decide on alcohol use as a means by which to change their mood. However, findings from alcohol expectancy studies mirror these drinking motive studies and find that beliefs about alcohol's ability to enhance mood mediate the relationship between personality and drinking outcomes [71], offering support for the notion that individuals with different personalities are differentially sensitive to alcohol's rewarding properties and thus are more likely to drink to regulate emotions.

Over the past three decades, considerable research has examined whether alcohol's effects on emotion might be considered direct vs. whether they are indirect or mediated by changes in cognition and subjective awareness. The answer, based on the results of dozens of alcohol administration studies, appears to be overwhelmingly in favor of cognitive mediation [e.g., 17, 18, 36, 79, 87]. This work suggests that alcohol has a consistent tendency to limit cognitive processing, and that these cognitive limitations might sometimes lead to mood-enhancement, dependent on elements of the drinking setting [35, 76, 89]. While cognitive theory has tended to focus on drinking setting, personality seems to represent a logical addition to these theories [e.g., 35]. The same internal subjective/cognitive experience may be perceived as rewarding or not depending on an individual's personality [22], and thus alcohol-related reward is likely moderated by both setting and personality traits. An expansion of personality research to incorporate a consideration of cognitive mediators might help cast seemingly inconsistent "pharmacological vulnerability" findings within a more coherent framework.

Arguably the most prominent cognitive theory of alcohol's effects is Alcohol Myopia (AM) [89]. In AM theory, Steele and colleagues propose that alcohol's impact on emotional experience is mediated by its tendency to limit attention to the immediate aspects of existence. AM suggests that alcohol constrains our ability to connect immediate experience with prior experience, limiting the extent to which the present is permeated by emotions derived from pre-existing thoughts and ideas. The authors argue that alcohol enhances mood by allowing us to leave the past behind, inducing a state of awareness in which the present moment has "broken away" [90, p. 196].

Steele and Josephs predict that alcohol will be associated with mood-enhancing properties to the extent to which immediate ongoing activities are experienced as pleasurable. Based on AM's proposition that alcohol decreases awareness of everything except the present moment, its authors predict that alcohol will act to intensify affective responsiveness to immediate cues. Since activities performed during alcohol consumption are frequently social in nature, Steele and Josephs propose that social processes often mediate alcohol-based reinforcement [36, 90]. Thus, in many drinking settings, AM predicts that alcohol consumption will increase affective responsiveness to social situations, and that drinking will be experienced as rewarding to the extent to which social interaction is perceived to be rewarding. As

discussed above, it stands to reason that not only the character of the social interaction itself (a factor mentioned by Steele and Josephs) but also the character-traits of the individuals involved might alter the extent to which alcohol's impact on social processes is associated with reward.

AM theory not only carries implications for social responsiveness across individuals within social interaction, but also holds implications for the dynamics of affective experience within the same individual over time. As alcohol increases responsiveness to stimuli in the immediate environment (e.g., social interaction), it is thought to decrease awareness of the past. Steele and Josephs suggest that alcohol disconnects present emotional experience from the past, and thereby induces a state of increased affective plasticity. As the authors note, alcohol induces a "roller-coaster ride" of affective experience [89, p. 923]. Again, as reviewed earlier, individuals vary in the extent to which they experience affective fluctuations as rewarding, and the "ride" described by Steele and Josephs might be considered differentially reinforcing depending on an individual's temperament.

1.4 EXAMINING PERSONALITY AND ALCOHOL RESPONSE DURING GROUP FORMATION

This study aimed to examine the influence of sensation-seeking and extraversion on the mechanisms underlying alcohol's mood enhancing properties. Specifically, I examined both social processes and affective plasticity as mediators of alcohol-related reward, and further examined how personality alters the manner in which alcohol's effects on social and emotional processes are experienced as reinforcing. The current study included several key methodological advantages relative to prior laboratory-based examinations of alcohol and personality including: 1) a sample of participants large enough to provide sufficient power to test moderating effects of personality; 2) structured, empirically verified measures of personality; 3) fine-grained observational measures that allow for examination of the real-time affective processes underlying alcohol-related mood enhancement; 4) a social drinking group formation paradigm that more closely approximates non-laboratory based drinking settings;

and 5) a paradigm that yielded powerful mood-enhancing effects of alcohol. More specifically, we examined response to alcohol among 720 social drinkers using a laboratory-based group formation drinking paradigm. Emotional responses were coded using Paul Ekman's Facial Action Coding System (FACS) for every frame (1/30th of a second) of a 36 minute social interaction yielding 66,000 points of observation for each subject (totaling 34.9 million frames of coded video). Importantly, initial analyses revealed comprehensive support for an overall mood-enhancing effect of alcohol among participants in our study [77].

We have used the group formation paradigm to examine the mechanisms underlying alcohol-based reinforcement. Consistent with predictions of AM, our research using the group formation paradigm has indicated an important role for social processes in alcohol-related reward. In initial analyses, we found that alcohol consumption increased the duration of simultaneous "group" smiles—termed "golden moments"—and that this effect emerged even in models controlling for individual-level smiling [43, 77]. In subsequent analyses, we employed sequential models to demonstrate that alcohol consumption increased the probability that a unilateral smile (an individual smiling "alone") would transition into a smile that was shared with another group member [25].

We have also used the group formation paradigm to test predictions of AM regarding the impact of alcohol on affective plasticity [23]. We measured emotional fluctuations using autocorrelation, a statistic borrowed from time-series analysis measuring the correlation between an individual's emotion at the present moment with his/her emotion during the preceding time interval [28]. In particular, we were interested in the correlation in duration of Duchenne-smiling from one ten second bin to the next during the 36-min interaction. Our use of unobtrusive, contemporaneous measurement of behavioral-affective display allowed for repeated assessment of emotional experience without directing the attention of participants to the content of their own emotions—a critical consideration when testing theories such as AM that place importance on the allocation of attention. In line with the predictions of AM, alcohol consumption significantly reduced autocorrelation of affective display. In other words, alcohol significantly reduced fluctuations in affect from one moment to the next. Autocorrelation of Duchenne smiling emerged as a robust predictor of self-reported positive mood, negative mood, and social bonding when compared with more commonly

used aggregate indexes including Duchenne-smiling mean, standard deviation, and linear trend. Finally, decreased autocorrelation mediated the link between alcohol consumption and positive mood, negative mood, and social bonding.

In summary, the group formation paradigm is well suited to an examination of both mechanisms underlying alcohol-related reward and also personality differences in alcohol response.

1.5 HYPOTHESES

In the present study I extended our prior work with the group formation paradigm by exploring whether personality altered the extent to which social coordination and autocorrelation mediated alcohol's reinforcing properties. I further examined whether personality differences in these underlying pathways might account for personality-related sensitivity to alcohol-related reward. I hypothesized a significant interaction between alcohol and personality in predicting self-reported mood and social bonding. Specifically, I predicted that the effect of alcohol in enhancing positive mood and social bonding and dampening negative mood would be greatest among participants high in extraversion and sensation-seeking. Of particular importance to the proposed study, I hypothesized that the mediational pathway explaining reported alcohol-related reward would vary depending on an individual's personality (a "moderated mediation" effect). Specifically, among extraverted individuals, who are attentive to social cues and enjoy social rewards, I predicted that social coordination of smiling would be experienced as especially rewarding. Thus, I predicted that alcohol's tendency to increase social coordination would mediate alcohol-related reward to a greater extent among extraverted individuals versus non extraverted individuals. In contrast, among sensation-seeking individuals, who value affective variation and novelty, I hypothesized that decreased autocorrelation would be experienced as especially rewarding [101]. I predicted that alcohol's tendency to decrease affective autocorrelation would mediate alcohol-related reward to a greater extent among sensation-seekers versus non sensation-seekers.

2.0 METHOD

2.1 PARTICIPANTS

Participants were 720 healthy social drinkers (360 female) aged 21-28, recruited via ads in local newspapers as reported in Sayette et al. [77]. Participants were required to have no medical conditions that contraindicated alcohol consumption (including pregnancy for females) and have no past alcohol abuse or dependence, as indexed by DSM-IV. Participants were further required to be within 15% of ideal weight for height, and to report they could comfortably drink at least 3 drinks in 30-min. Participants were 83% European-American, 11% African-American, 1% Hispanic, 2.5% Asian, and 2.5% other. Participants reported drinking 2-3 times/week and consuming 4.29 (SD= 1.89) drinks/occasion.

2.2 PROCEDURE

2.2.1 Questionnaire Session

Participants who answered advertisements were informed that the purpose of the study was to measure alcohol's impact on cognitive performance. Those who successfully completed an initial phone screening were invited to the Alcohol and Smoking Research Laboratory. Following informed consent, exclusion criteria were assessed, and participants who met criteria completed personality questionnaires including the NEO Five Factor Measure as well as the Impulsivity/Sensation-seeking Scale (see study measures).

2.2.2 Drink Session

Participants were randomly assigned to groups of three. Twenty groups representing each gender composition (0 females and 3 males, 1 female and 2 males, 2 females and 1 male, 3 females and 0 males) were assigned to each of three beverage conditions (alcohol, placebo, and control). Upon arriving in the lab, participants were casually and individually introduced to confirm that they were not previously acquainted [43]. Participants then provided a breath sample to assess blood alcohol content (BAC) and completed a variety of self-report subjective assessments (e.g., Biphasic Alcohol Effects Scale: [59]).

The three participants were then seated at equidistant intervals around a round table. Cameras were positioned in all four corners of the room, and a microphone recorded conversation. Participants were originally told that the cameras were used to monitor their drink consumption and were later informed (see below) that the cameras recorded facial expressions. Participants in the alcohol and placebo conditions were informed that they would be receiving alcohol and that the dose would be less than the legal driving limit. Drinks were mixed in front of all study groups [73]. The alcoholic beverage was 1 part 100 proof vodka and 3.5 parts cranberry juice. In the placebo group, the glass was smeared with vodka, and a few drops of vodka were "floated" on the top of the beverage to increase credibility. To adjust for gender effects, males in the alcohol condition were administered a .82g/kg dose of alcohol, while females were administered a .74g/kg dose [79]. Participants remained seated for a total of 36-min while beverages were administered in three equal parts at 0-min, 12-min, and 24-min. Participants were instructed to drink their beverages evenly over the 12-min intervals and refrain from discussing how intoxicated they felt. Participants were otherwise not given instructions on whether to speak during the interaction period or what to talk about—participants were ostensibly seated in the same room to facilitate drink administration and communication with the experimenter.

Immediately following drinking, participants' BACs were recorded and they completed measures of mood and social bonding, including an 8-item mood measure and Perceived Group Reinforcement Scale (see section on study measures). They then performed some additional cognitive tasks. (Because these cognitive tasks followed all relevant measures for

the present study they are discussed elsewhere [see 78]). After BAC was again assessed, placebo and control participants were debriefed, paid $50, and allowed to leave. Participants in the alcohol condition remained until their BACs dropped below .025%. Before leaving, participants were informed that their behavior had been videotaped, and their consent to analyze the data was solicited (all participants agreed).

Participants' facial expressions (e.g., Duchenne smiles) and speech during the drinking period were later coded by FACS-certified personnel using Observer Video-Pro software [92]. The Observer system allows coders to time-stamp the start (onset) and stop (offset) of each Action Unit (AU) to preserve the flow and synchrony of the interaction. Each frame (1/30th of a second) of the interaction was manually evaluated by coders for the presence or absence of relevant facial action units. Video from each participant was independently coded so that the facial expressions of only one group member were visible to the coder at one time. Coders were blind to experimental condition.

2.3 MEASURES

2.3.1 Extraversion

We assessed extraversion using the NEO Five-factor Inventory. The NEO reliably assesses five domains of adult personality (neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness) [15]. We used an abbreviated 60-item version of the revised NEO Personality Inventory, a reliable index of personality which remains the most popular measure of the "Big Five" [16, 85].

2.3.2 Sensation-seeking

We assessed sensation-seeking using the short form of the Impulsivity/Sensation-seeking Scale (ISSS: [99]). The ISSS is a 19-item scale assessing the tendency to act impulsively without thinking and the preference for varied and uncertain stimuli. Research has indicated that the ISSS has good psychometric properties and provides an adequate measure of

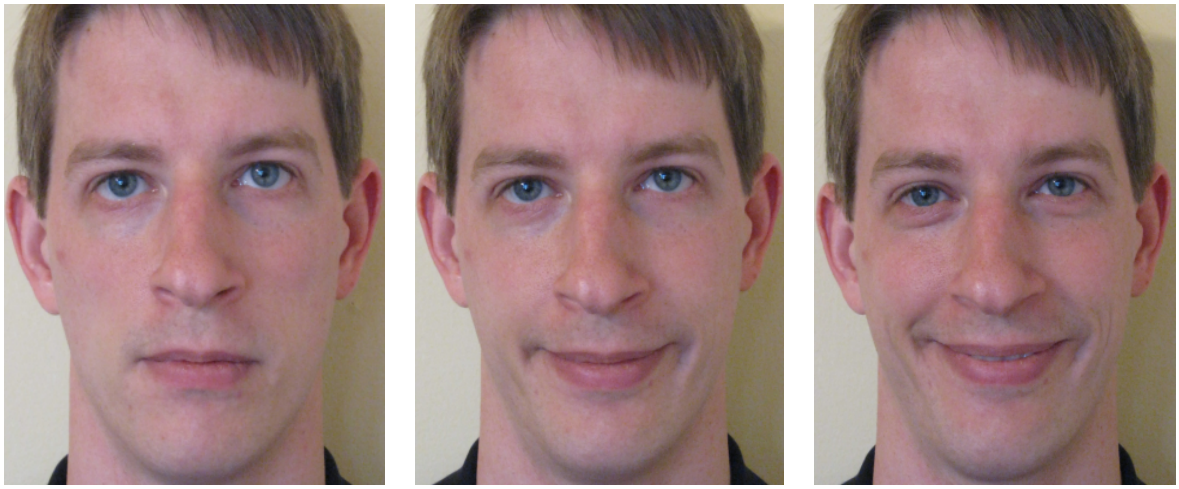

Figure 1: Image of a neutral face (left), social smile (middle), and Duchenne smile (right)

sensation-seeking [99].

2.3.3 Behavioral-Affective Display

We indexed affect during the social interaction by measuring duration of "Duchenne" smiling (Figure 1). The Duchenne smile, also known as the "true" smile or the smile of enjoyment, is the most widely researched facial expression within FACS [21, 32, 43]. Duchenne smiles include combined movement of the zygomaticus major (AU 12) and obicularis oculi muscles (AU 6) [1, 21]. Reliability of facial coding assessed on a random subset of 72 participants showed excellent inter-rater agreement for Duchenne smiling ($\kappa = .88$).

2.3.4 Self-Reported Mood

We assessed current positive and negative mood immediately after the interaction using an 8-item Mood Measure. The 8 item mood measure indexes four negative mood states (annoyed, sad, irritated, bored) and four positive mood states (cheerful, upbeat, happy, content) selected to represent all quadrants of the affective circumplex [75]. Participants reported the extent to which they felt each of these 8 mood states on a 6 point likert scale

from 0, "not at all," to 5, "extremely." Scores on the four positive items were averaged to create the positive mood subscale and scores on the four negative items created the negative subscale.

2.3.5 Self-Reported Social Bonding

The Perceived Group Reinforcement Scale (PGRS) included 12 Likert-type items, such as "I like this group" and "The members of this group are interested in what I have to say," which were aggregated as a composite score (α = .90). In the previous study, the PGRS correlated with non-verbal measures of social bonding [43, 77].

2.4 DATA ANALYSIS PLAN

Data analysis aimed to test the following hypothes: 1) Extraverted individuals are sensitive to alcohol-related reward; 2) Sensation-seeking individuals are sensitive to alcohol-related reward; 3) Social processes mediate alcohol-related reward to a greater extent among extraverted versus introverted individuals; and 4) Affective plasticity mediates alcohol-related reward to a greater extent among sensation-seeking versus non sensation-seeking individuals.

2.4.1 Exclusions

One participant did not comply with instructions and was excluded from analysis [see 77]. Data from four additional participants were excluded from extraversion analyses due to failure among these participants to adequately complete the NEO-FFI.

2.4.2 Data Processing

Data were coded continuously throughout the 36 minute interaction with the exception of two minutes during which the experimenter entered the room to refill drinks, yielding a total of 34.9 million frames of behavioral data. Consistent with our prior data analytic approach

[23, 77] analyses included only minutes 12–36 of the interaction—the period in which the effects of alcohol were hypothesized to be strongest. Binary frame data were aggregated into ten second bins for analyses [6].

2.4.3 Beverage Condition

Beverage Condition was represented as a complete orthogonal set of contrast codes, the first ("Alcohol") contrast comparing alcohol to both placebo and control conditions and the second ("Placebo vs. Control") contrast comparing placebo and control conditions [12]. Theories informing my hypotheses deal with the pharmacological (i.e., ethanol consumed vs. no ethanol consumed) effects of alcohol [89] and the parent study found no significant differences between placebo and control conditions in affective display [77]. After confirming that there is empirical justification for collapsing across placebo and control conditions in these analyses (significance of the Placebo vs. Control contrast), I represent alcohol condition as a single contrast comparing alcohol to no alcohol. For results of models examining independent comparisons of alcohol to placebo and alcohol to control conditions, see Appendix A.

2.4.4 Estimating Socio-Emotional Mediators

I examined two independent sets of mediators: 1) I explored autocorrelation and lagged-partner process components within the context of the cross-lagged Actor-Partner Interdependence Model (APIM) [39]. An individual's own Duchenne smiling duration at time $t-1$ (autocorrelation) as well as the summed smiling duration of his/her two fellow group members at time $t-1$ (lagged-partner) were entered as predictors of the individual's Duchenne smiling at time t. Thus, the APIM produced estimates of both affective plasticity—autocorrelation, relevant to hypothesis 4—as well as social processes—lagged partner, relevant to hypothesis 3; 2) Since the cross-lagged APIM considers social processes only in terms of the past behavior of fellow group members, I explored an additional social process variable examining the contemporaneous behaviors of fellow group members. I indexed the amount of time an individual smiled simultaneously with at least one fellow group member (i.e., group members smiled during the same 1/30th second interval). For the sake of clarity, simultaneous

smiling is represented in terms of seconds (average seconds/10 sec interval) in the results reported below. Consistent with procedures followed in our past research [23], all mediators were estimated and saved for each individual in the study to accommodate individual-level outcomes in mediation analyses described below.

2.4.5 Moderated Mediation and Mediated Moderation

Moderated mediation analyses were conducted according to procedures outlined by Muller et al. [64]. Gender, a factor that accounts for a large proportion of the between-person variance in mood outcomes, was entered as a covariate. The mediators of interest—APIM components and simultaneous smiling—as well as the two moderators—extraversion and sensation-seeking—were tested independently in separate models, although supplemental analyses examined whether significant moderated mediation effects reach significance when mediators are reversed. Consistent with recommendations put forward by Krull and MacKinnon [46, 47] for multilevel mediation analyses, all analyses described in this section were conducted within the framework of a two-level hierarchical model that accounts for the clustering of the individual-level self-report outcome variable within groups of three. Since the present research examines multiple outcome variables, all analyses begin with multivariate hierarchical linear models in which the overall significance of moderation and moderated mediation effects are examined across all three self-report outcome variables [70]. Where multivariate effects reached significance, I followed up with univariate models examining each outcome independently to explore where effects emerged as strongest. In reporting results of all analyses, I not only report regression coefficients in their original metrics (B) but also in standardized units (β) to facilitate comparison of the relative size of effects across analyses.

Moderated mediation analyses required examination of three separate models. Procedures began with a test of overall moderation (step 1), examining whether personality moderates the impact of alcohol on self-reported mood and social bonding (hypotheses 1 and 2). In the second step, I examined whether the pathway from the independent variable (Alcohol) to the mediator (APIM components or simultaneous smiling) was moderated by

Personality. In a third and final model, I examined whether the partial effect of the mediator on the outcome was moderated (hypotheses 3 and 4). That is, I examined whether personality moderated the effect of the mediator on the outcome after controlling for all direct effects of the independent variable on the outcome. Where analyses indicated a significant moderation effect, I examined simple contrasts by centering personality at one standard deviation above and below the mean. The strength of mediational pathways at different levels of the moderator variable was calculated [56, 64] and their significance was tested using the Sobel standard error [55, 68]. Consistent with terminology used by Muller and Colleagues, in the current research I use the umbrella term "moderated mediation" to refer to any effect in which the mediational pathway is shown to vary across levels of a moderating variable. However, where moderated mediation occurs in the presence of an overall moderation effect and the moderated mediational pathway is shown to account for this overall moderation effect, I refer to the effect as "mediated moderation" [64].

Table 1: Beverage Manipulation Check

	Alcohol		Placebo		Control		
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*F*
BAC after drinking	0.055^a	0.012	0.001^b	0.001	0.001^b	0.001	4825.72*
BAC 40-min after drinking†	0.062^a	0.011	0.001^b	0.001	—	—	7116.15*
SIS after drinking	38.50^a	17.31	14.90^b	10.44	0.20^c	1.49	647.70*
SIS 40-min after drinking†	35.12^a	16.90	8.90^b	10.80	—	—	410.12*
Highest Intoxication	43.53^a	18.71	16.15^b	11.11	0.61^c	3.19	698.07*
Vodka Estimate	7.11^a	9.85	4.64^b	5.44	0.05^c	0.43	70.80*

* $p < .001$

† Control participants were not asked to provide these data

Note: BAC = blood alcohol concentration; SIS = subjective intoxication scale; SIS and Highest Intoxication were scored on scaled ranging from 0 to 100; Groups with non-overlapping superscripts differed significantly ($p < .05$)

Table 2: Descriptive Statistics by Beverage Condition

	Alcohol		Placebo		Control	
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*
Personality and Baseline Mood						
Sensation-seeking	9.1958	4.1316	10.1333	4.0498	9.5336	4.3822
Extraversion	31.8410	6.7606	32.3096	6.8271	32.1737	5.9501
Positive Mood	26.0962	7.0844	25.7908	6.8757	25.0975	6.8680
Negative Mood	11.8109	2.5262	12.0125	2.5309	11.5232	2.3678
Duchenne Smiling During Drink and Post-Drink Mood Measures						
Duchenne Smile†	1.4790	0.8725	0.9366	0.7024	1.0197	0.7061
Positive Mood	3.5302	0.8270	3.2156	0.8054	3.3141	0.8199
Negative Mood	0.3333	0.4227	0.6750	0.6205	0.6008	0.5934
Social Bonding	7.2185	1.2489	6.7364	1.5213	7.0660	1.3007

† Duchenne Smiles were measured in number of seconds per 10 sec interval

Note: Groups with non-overlapping superscripts differed significantly ($p < .05$)

Table 3: Multivariate models exploring extraversion as moderator of the lagged-partner mediational pathway and sensation-seeking as moderator of the autocorrelation mediational pathway to self-reported alcohol reward

	Extraversion (lagged-partner)†			Sensation-seeking (autocorrelation)†		
	B	*t*-ratio	*p*-value	*B*	*t*-ratio	*p*-value
Step 1: Direct effect of independent variable on outcome						
Gender	0.231	4.19	.0001	0.263	4.60	.0001
Alcohol	0.312	5.66	.0001	0.298	5.11	.0001
Personality	0.032	8.94	.0001	0.001	0.03	.9787
Personality×Alcohol	0.017	2.32	.0202	0.022	1.65	.0984
Step 2: Pathway from independent variable to mediator						
Gender	–0.0002	–5.03	.0001	–0.0008	–5.95	.0001
Alcohol	–0.0003	–6.72	.0001	–0.001	–6.33	.0001
Personality	–0.00001	–1.54	.1246	–0.00003	–1.73	.0846
Personality×Alcohol	–0.00001	–0.30	.7680	–0.00006	–1.96	.0512
Step 3: Pathway from independent variable to mediator						
Gender	0.201	3.80	.0002	0.216	3.91	.0001
Personality	0.041	5.19	.0001	0.020	1.08	.2789
Mediator	–176.420	–2.57	.0103	–57.554	–3.69	.0002
Personality×Mediator	–9.006	–1.26	.2086	–3.954	–1.19	.2347
Alcohol	0.259	4.45	.0001	0.226	3.75	.0002
Personality×Alcohol	0.014	1.82	.0683	0.017	1.31	.1896

† Columns are labelled using the following format: Personality (Mediator)

Note: Personality, Alcohol, and Gender variables are centered; Gender is coded such that Male = −.5 and Female = .5; A more detailed description of the steps involved in the calculation of moderated mediation effects can be found on page 16 of this document.

Table 4: Univariate models exploring extraversion as moderator of the lagged-partner mediational pathway and sensation-seeking as moderator of the autocorrelation mediational pathway to self-reported alcohol-related social bonding

	Extraversion (lagged-partner)†			Sensation-seeking (autocorrelation)†		
	B	*t*-ratio	*p*-value	*B*	*t*-ratio	*p*-value
Step 1: Direct effect of independent variable on outcome						
Gender	0.320	2.90	.0039	0.369	3.15	.0018
Alcohol	0.340	3.23	.0013	0.318	2.84	.0049
Personality	0.055	7.86	.0001	0.001	0.01	.9939
Personality×Alcohol	0.026	1.84	.0659	0.032	1.27	.2040
Step 2: Pathway from independent variable to mediator (see multivariate model)						
Step 3: Partial effect of the mediator on the outcome						
Gender	0.284	2.69	.0073	0.332	2.86	.0044
Personality	0.068	4.34	.0001	0.058	1.52	.1280
Mediator	–221.880	–1.60	.1104	–60.631	–1.94	.0533
Personality×Mediator	–13.633	–0.91	.3635	–10.960	–1.59	.1116
Alcohol	0.273	2.45	.0148	0.239	2.06	.0409
Personality×Alcohol	0.021	1.44	.1510	0.021	0.84	.4009

† Columns are labeled using the following format: Personality (Mediator)

Note: Personality, Alcohol, and Gender variables are centered; Gender is coded such that Male = −.5 and Female = .5; A more detailed description of the steps involved in the calculation of moderated mediation effects can be found on page 16 of this document; Note that Step 2 does not change across these models as the mediators and IV's remain unchanged regardless of the self-report variable under examination.

Table 5: Univariate models exploring extraversion as moderator of the lagged-partner mediational pathway and sensation-seeking as moderator of the autocorrelation mediational pathway to self-reported alcohol-related positive mood

	Extraversion (lagged-partner)†			Sensation-seeking (autocorrelation)†		
	B	*t*-ratio	*p*-value	*B*	*t*-ratio	*p*-value
Step 1: Direct effect of independent variable on outcome						
Gender	0.182	2.96	.0030	0.237	3.73	.0002
Alcohol	0.285	4.35	.0001	0.276	4.15	.0001
Personality	0.035	8.84	.0001	0.012	1.39	.1657
Personality×Alcohol	0.018	2.18	.0296	0.025	1.55	.1214
Step 2: Pathway from independent variable to mediator (see multivariate model)						
Step 3: Partial effect of the mediator on the outcome						
Gender	–0.176	–4.33	.0001	–0.162	–3.91	.0001
Personality	–0.013	–1.81	.0705	–0.002	–0.19	.8525
Mediator	94.178	1.95	.0513	27.253	2.49	.0129
Personality×Mediator	6.827	0.86	.3915	2.417	0.96	.3351
Alcohol	–0.281	–6.80	.0001	–0.264	–6.17	.0001
Personality×Alcohol	–0.004	–0.60	.5468	–0.003	–0.39	.6984

† Columns are labeled using the following format: Personality (Mediator)

Note: Personality, Alcohol, and Gender variables are centered; Gender is coded such that Male = −.5 and Female = .5; A more detailed description of the steps involved in the calculation of moderated mediation effects can be found on page 16 of this document; Note that Step 2 does not change across these models as the mediators and IV's remain unchanged regardless of the self-report variable under examination.

Table 6: Univariate models exploring extraversion as moderator of the lagged-partner mediational pathway and sensation-seeking as moderator of the autocorrelation mediational pathway to self-reported alcohol-related negative mood

	Extraversion (lagged-partner)†			Sensation-seeking (autocorrelation)†		
	B	*t*-ratio	*p*-value	*B*	*t*-ratio	*p*-value
Step 1: Direct effect of independent variable on outcome						
Gender	–0.193	–4.60	.0001	–0.186	–4.44	.0001
Alcohol	–0.310	–7.64	.0001	–0.298	–7.21	.0001
Personality	–0.007	–2.08	.0377	0.010	2.19	.0287
Personality×Alcohol	–0.006	–0.99	.3225	–0.006	–0.69	.4905
Step 2: Pathway from independent variable to mediator (see multivariate model)						
Step 3: Partial effect of the mediator on the outcome						
Gender	0.145	2.36	.0190	0.157	2.52	.0120
Personality	0.041	4.42	.0001	–0.003	–0.16	.8726
Mediator	–218.27	–2.94	.0034	–82.567	–5.08	.0001
Personality×Mediator	–6.316	–0.74	.4613	2.318	0.62	.5346
Alcohol	0.219	3.21	.0014	0.173	2.54	.0117
Personality×Alcohol	0.015	1.75	.0807	0.024	1.56	.1205

† Columns are labeled using the following format: Personality (Mediator)

Note: Personality, Alcohol, and Gender variables are centered; Gender is coded such that Male = −.5 and Female = .5; A more detailed description of the steps involved in the calculation of moderated mediation effects can be found on page 16 of this document; Note that Step 2 does not change across these models as the mediators and IV's remain unchanged regardless of the self-report variable under examination.

Table 7: Multivariate models exploring extraversion as moderator of mediational pathways explaining self-reported alcohol reward that differ according to number of group members smiling

	Simultaneous Smiling			Unilateral Smiling			Dyadic Smiling			Golden Moments		
	B	*t*	*p*	*B*	*t*	*p*	*B*	*t*	*p*	*B*	*t*	*p*
Step 1: Direct effect of independent variable on outcome (see Table 3)												
Step 2: Pathway from independent variable to mediator												
Gender	0.082	3.39	.0008	0.131	4.53	.0001	0.083	3.66	.0003	0.139	3.37	.0010
Alcohol	0.443	6.07	.0001	0.184	6.98	.0001	0.245	6.25	.0001	0.194	5.97	.0001
Extraversion	0.004	2.15	.0318	0.003	1.12	.2639	0.003	1.91	.0566	-0.010	-2.23	.0260
Extraversion×Alcohol	0.001	0.26	.7983	0.002	0.35	.7247	0.001	0.23	.8192	-0.011	-1.25	.2140
Step 3: Partial effect of the mediator on the outcome												
Gender	0.205	3.80	.0002	0.218	4.05	.0001	0.207	3.83	.0001	0.216	3.98	.0001
Extraversion	0.032	8.68	.0001	0.032	8.88	.0001	0.031	8.75	.0001	0.032	8.69	.0001
Mediator	0.203	3.91	.0001	0.104	1.64	.1009	0.303	3.51	.0005	0.351	3.85	.0002
Extraversion×Mediator	0.015	2.41	.0160	0.003	0.29	.7730	0.021	1.97	.0495	0.031	2.54	.0111
Alcohol	0.227	3.81	.0002	0.293	5.35	.0001	0.240	4.16	.0001	0.249	4.20	.0001
Extraversion×Alcohol	0.010	1.30	.1938	0.016	2.28	.0230	0.015	1.53	.1251	0.011	1.32	.1864

Note: All variables are centered; Gender is coded such that Male = −.5 and Female = .5; Simultaneous smiling = target group member smiles simultaneously with either one or two other group members; Unilateral smiling = only target group member smiling; Dyadic smiling = target group member smiles simultaneously with one other group member; Golden moments = target group member smiles along with both other group members; A more detailed description of the steps involved in the calculation of moderated mediation effects can be found on page 16 of this document.

Table 8: Univariate models exploring extraversion as moderator of mediational pathways explaining self-reported alcohol-related social bonding that differ according to number of group members smiling

	Simultaneous Smiling			Unilateral Smiling			Dyadic Smiling			Golden Moments		
	B	*t*	*p*	*B*	*t*	*p*	*B*	*t*	*p*	*B*	*t*	*p*
Step 1: Direct effect of independent variable on outcome (see Table 3)												
Step 2: Pathway from independent variable to mediator (see Table 7)												
Step 3: Partial effect of the mediator on the outcome												
Gender	0.286	2.59	.0098	0.304	2.86	.0045	0.292	2.66	.0081	0.293	2.67	.0078
Extraversion	0.054	7.56	.0001	0.055	7.80	.0001	0.053	7.61	.0001	0.055	7.64	.0001
Mediator	0.283	2.84	.0047	0.111	0.94	.3476	0.375	2.31	.0213	0.059	3.27	.0011
Extraversion×Mediator	0.028	2.33	.0200	0.009	0.50	.6167	0.040	2.03	.0432	0.056	2.31	.0215
Alcohol	0.221	1.94	.0530	0.319	3.05	.0024	0.251	2.25	.0247	0.234	2.06	.0401
Extraversion×Alcohol	0.013	0.88	.3791	0.024	1.72	.0859	0.016	1.08	.2829	0.015	0.95	.3419

Note: All variables are centered; Gender is coded such that Male = −.5 and Female = .5; Simultaneous smiling = target group member smiles simultaneously with either one or two other group members; Unilateral smiling = only target group member smiling; Dyadic smiling = target group member smiles simultaneously with one other group member; Golden moments = target group member smiles along with both other group members; A more detailed description of the steps involved in the calculation of moderated mediation effects can be found on page 16 of this document.

Table 9: Univariate models exploring extraversion as moderator of mediational pathways explaining self-reported alcohol-related positive mood that differ according to number of group members smiling

	Simultaneous Smiling			Unilateral Smiling			Dyadic Smiling			Golden Moments		
	B	*t*	*p*	*B*	*t*	*p*	*B*	*t*	*p*	*B*	*t*	*p*
Step 1: Direct effect of independent variable on outcome (see Table 3)												
Step 2: Pathway from independent variable to mediator (see Table 7)												
Step 3: Partial effect of the mediator on the outcome												
Gender	0.155	2.53	.0118	0.160	2.58	.0101	0.152	2.47	.0137	0.171	2.82	.0050
Extraversion	0.035	8.55	.0001	0.035	8.81	.0001	0.035	8.63	.0001	0.035	8.54	.0001
Mediator	0.206	3.07	.0023	0.179	2.44	.0151	0.351	3.34	.0009	0.270	2.12	.0348
Extraversion×Mediator	0.014	1.76	.0793	-0.001	-0.04	.9671	0.019	1.36	.1758	0.028	2.04	.0421
Alcohol	0.198	2.77	.0057	0.252	3.82	.0002	0.201	2.90	.0039	0.237	3.38	.0008
Extraversion×Alcohol	0.012	1.27	.2035	0.018	2.14	.0329	0.013	1.46	.1456	0.012	1.33	.1850

Note: All variables are centered; Gender is coded such that Male = −.5 and Female = .5; Simultaneous smiling = target group member smiles simultaneously with either one or two other group members; Unilateral smiling = only target group member smiling; Dyadic smiling = target group member smiles simultaneously with one other group member; Golden moments = target group member smiles along with both other group members; A more detailed description of the steps involved in the calculation of moderated mediation effects can be found on page 16 of this document.

Table 10: Univariate models exploring extraversion as moderator of mediational pathways explaining self-reported alcohol-related negative mood that differ according to number of group members smiling

	Simultaneous Smiling			Unilateral Smiling			Dyadic Smiling			Golden Moments		
	B	*t*	*p*	*B*	*t*	*p*	*B*	*t*	*p*	*B*	*t*	*p*
Step 1: Direct effect of independent variable on outcome (see Table 3)												
Step 2: Pathway from independent variable to mediator (see Table 7)												
Step 3: Partial effect of the mediator on the outcome												
Gender	-0.173	-4.20	.0001	-0.190	-4.58	.0001	-0.175	-4.23	.0001	-0.180	-4.33	.0001
Extraversion	-0.007	-2.02	.0444	-0.006	-2.05	.0410	-0.006	-1.96	.0503	-0.007	-2.07	.0388
Mediator	-0.117	-3.51	.0005	-0.026	-0.55	.5796	-0.180	-3.43	.0007	-0.197	-2.78	.0056
Extraversion×Mediator	-0.003	-0.56	.5745	0.001	0.08	.9357	-0.003	-0.35	.7234	-0.009	-0.91	.3657
Alcohol	-0.259	-6.04	.0001	-0.305	-7.49	.0001	-0.266	-6.33	.0001	-0.273	-6.35	.0001
Extraversion×Alcohol	-0.005	-0.74	.4577	-0.006	-1.01	.3122	-0.005	-0.84	.3987	-0.005	-0.66	.5083

Note: All variables are centered; Gender is coded such that Male = −.5 and Female = .5; Simultaneous smiling = target group member smiles simultaneously with either one or two other group members; Unilateral smiling = only target group member smiling; Dyadic smiling = target group member smiles simultaneously with one other group member; Golden moments = target group member smiles along with both other group members; A more detailed description of the steps involved in the calculation of moderated mediation effects can be found on page 16 of this document.

3.0 RESULTS

3.1 BEVERAGE MANIPULATION CHECK

BACs and measures of subjective intoxication appear in Table 1. Participants administered alcohol were on the ascending limb of the BAC curve with a BAC rising to about .06% immediately following the interaction period. All placebo and alcohol participants estimated that they had consumed at least 1 oz. of vodka. Consistent with prior studies [e.g., 79], placebo participants reported experiencing some level of intoxication, more than control participants and less than alcohol participants.

3.2 BASELINE INDIVIDUAL DIFFERENCES AND DESCRIPTIVE STATISTICS

Age, marital status, income, smoking status, ethnicity, and baseline positive and negative mood were equivalent across Beverage conditions, as were responses to questions about drinking history and current drinking patterns. Although individuals in the placebo condition appear to report slightly higher sensation-seeking scores than did those in the alcohol condition, analyses suggested that those in the alcohol group did not show significantly lower extraversion or sensation-seeking scores when compared with individuals in both placebo and control conditions, $p > .05$ (the comparison of interest here). Descriptive statistics concerning personality, baseline mood, self-report ratings, and Duchenne smiling behavior are presented in Table 2.

Relationships between the three post-interaction mood and social bonding variables

were significant: social bonding and negative mood, $B = -.149$, $\beta = -0.36$, $t = -8.48$, $p < 0.0001$, positive mood and social bonding, $B = .626$, $\beta = 0.38$, $t = 9.77$, $p < 0.0001$, and negative mood and positive mood, $B = -0.490$, $\beta = -0.34$, $t = -9.03$, $p < 0.0001$[1]. Positive mood and social bonding self-report measures followed a normal distribution. The distribution of scores on the negative mood inventory tended towards a positive skew (Skewness = 1.695). Consistent with our past research [23], I used linear modeling procedures in primary analyses reported below. However, follow-up generalized linear analyses were conducted with respect to the negative mood measure, and results confirmed those produced by linear procedures.

3.3 PERSONALITY MEASURES

The personality traits of sensation-seeking and extraversion were weakly correlated, $r = .08$, $p < .05$ (a standard Pearson correlation index was used here since observations were not clustered). Participants in the current study reported a mean extraversion score of 32.11 ($SD = 6.52$) and a mean sensation-seeking score of 9.64 ($SD = 4.21$). These means and standard deviations generally correspond to average extraversion ($M = 30.58$, $SD = 6.67$; [63]) and sensation-seeking ($M = 10.11$, $SD = 4.07$; [101]) scores reported by participants in standardization samples. Inter-item reliability was acceptable for both measures of extraversion (.797) and sensation-seeking (.823). Of the 19 items on Zuckerman's impulsivity/sensation seeking scale, 11 specifically targeted sensation-seeking tendencies. Reliability for this sensation-seeking subscale did not reach the Cronbach's alpha minimum value of .7 ($\alpha = .693$).

[1]Correlation analyses were conducted within the framework of hierarchical regression models, to account for clustering. Regression coefficients reported here represent the effect of the first self-report variable listed as a predictor of the second self-report variable.

3.4 MODERATION ANALYSES

Findings revealed a significant multivariate main effect of extraversion on self-reported mood and social bonding, $B = 0.030$, $\beta = 0.19$, $t = 8.36$, $p < 0.0001$. Tests examining this effect for each of the three self-report variables independently indicated that individuals high in extraversion reported significantly higher positive mood, $B = 0.033$, $\beta = 0.26$, $t = 8.28$, $p < 0.0001$, more social bonding, $B = 0.052$, $\beta = 0.24$, $t = 7.51$, $p < 0.0001$, and marginally lower negative mood, $B = -0.005$, $\beta = -0.06$, $t = -1.74$, $p = 0.0825$, compared with individuals low in extraversion. Findings revealed no significant multivariate main effect of sensation-seeking on self-reported mood and social bonding, $B = -0.003$, $\beta = -0.02$, $t = -0.54$, $p = 0.5889$. As noted elsewhere [23], analyses also revealed a significant main effect of alcohol in enhancing self-reported mood and social bonding, $B = 0.310$, $\beta = 0.18$, $t = 5.60$, $p < 0.0001$ (positive mood, $B = 0.276$, $\beta = 0.16$, $t = 4.15$, $p < 0.0001$; negative mood, $B = -0.299$, $\beta = -0.26$, $t = -7.22$, $p < 0.0001$; social bonding, $B = 0.320$, $\beta = 0.12$, $t = 2.86$, $p = 0.005$). With the exception of social bonding, there were no significant differences between placebo and control groups in predicting self-reported mood and social bonding [see 77].

Of particular relevance, analyses also indicated a significant multivariate interaction between extraversion and alcohol in predicting self-reported mood and social bonding, $B = .017$, $\beta = 0.05$, $t = 2.32$, $p = 0.0202$ (see Figure 2). Individuals high in extraversion reported deriving over two times more social-emotional enhancement from alcohol, $B = .41$, $\beta = 0.23$, $t = 6.24$, $p < 0.0001$, compared with individuals low in extraversion, $B = 0.20$, $\beta = 0.12$, $t = 2.61$, $p = 0.009$. Tests examining the interaction for each self-report variable independently suggested that this multivariate effect was primarily driven by positive mood, $B = 0.018$, $\beta = 0.07$, $t = 2.18$, $p = 0.0296$, with a trend towards significance emerging with respect to perceived social bonding, $B = .026$, $\beta = 0.06$, $t = 1.84$, $p = 0.0659$, and a non-significant effect in the expected direction for negative mood, $B = -0.006$, $\beta = 0.03$, $t = -0.99$, $p = 0.3225$ (see "step 1" portion of Table 3, Table 4, Table 5, and Table 6). The distinction between placebo and control conditions did not interact with extraversion in predicting self-reported mood and social bonding, $p = 0.3451$.

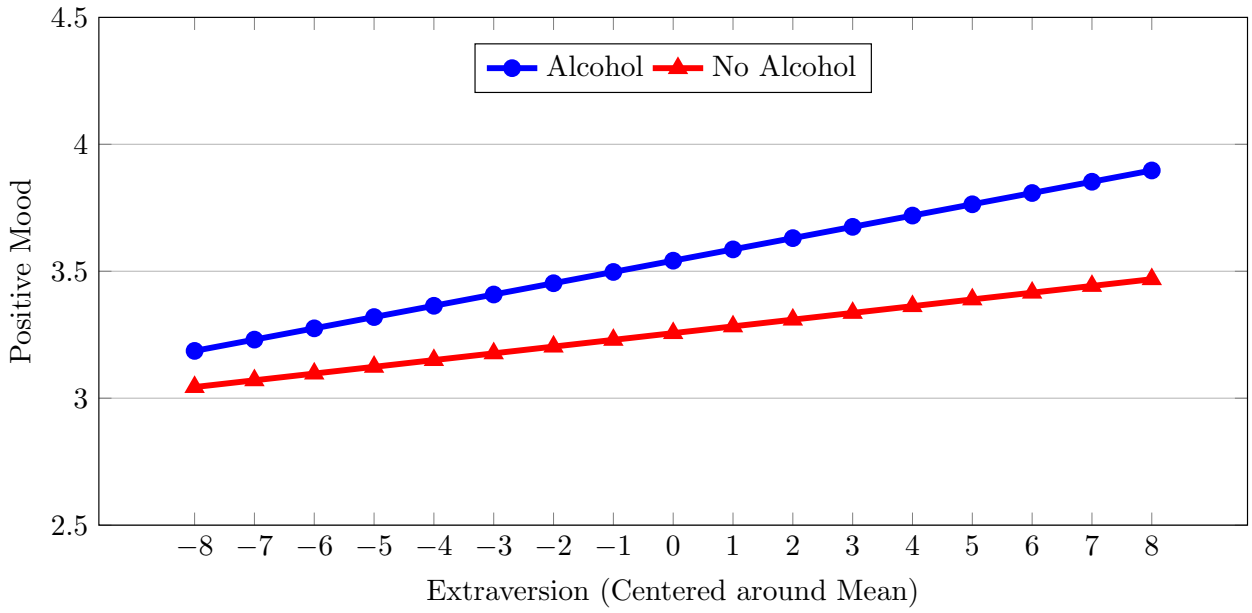

Figure 2: Extraversion as a moderator of alcohol's impact on self-reported positive mood

There was a trend towards a significant multivariate interaction between sensation-seeking and alcohol in predicting self-reported mood and social bonding, $B = 0.022$, $\beta = 0.04$, $t = 1.65$, $p = 0.0984$. Individuals high in sensation-seeking reported deriving just under twice as much social-emotional enhancement from alcohol, $B = .39$, $\beta = 0.21$, $t = 4.70$, $p < 0.0001$, as individuals low in sensation-seeking, $B = 0.21$, $\beta = 0.13$, $t = 2.68$, $p = 0.007$. Tests examining this interaction across each self-report variable independently did not reach significance, $p > .121$, although all tended in the expected direction. The distinction between placebo and control conditions also did not interact with sensation-seeking in predicting self-reported outcomes, $p = 0.2465$.

In sum, individuals high in extraversion appear to experience significantly more social and mood enhancement from consuming alcohol than those low in extraversion. Individuals high in sensation-seeking may experience somewhat more social and mood enhancement from consuming alcohol than those low in sensation-seeking, although this trend did not quite reach significance with alpha set at .05.

3.5 MEDIATED MODERATION AND MODERATED MEDIATION

3.5.1 APIM Components—Autocorrelation and Lagged-Partner

Analyses did not produce evidence that mediational pathways created within the framework of the cross-lagged APIM are moderated by personality. Specifically, I did not find evidence that personality moderated the extent to which autocorrelation or lagged-partner effects were associated with self-reported mood and social bonding. Although there was a significant main effect of alcohol on both autocorrelation, $B = -0.001$, $\beta = -0.31$, $t = -6.33$, $p < 0.0001$, and lagged-partner, $B = -0.0003$, $\beta = -0.30$, $t = -6.72$, $p < 0.0001$ (Step 2 of moderated mediation analyses), the partial effect of autocorrelation was not moderated by sensation-seeking, $B = -3.954$, $\beta = -.03$, $t = -1.19$, $p = 0.2347$, and the partial effect of the lagged-partner variable was not moderated by extraversion, $B = -9.066$, $\beta = -0.03$, $t = -1.26$, $p = 0.2086$, in models predicting self-reported outcomes (Step 3 of moderated-mediation analyses). See Table 3, Table 4, Table 5, and Table 6 for results of all univariate and multivariate models examining moderated mediation effects for APIM components.

3.5.2 Simultaneous Smiling

Mediators produced within the APIM framework represent only lagged social effects—the behavior of fellow group members is considered during the previous 10 second interval and not in the current moment. Thus, results reported to this point may not capture the coordination of social behaviors between group members as it occurs on a momentary basis. In the next section I further consider social processes as mediators of alcohol-related mood and social enhancement—an examination that seems especially warranted in light of moderation analyses reported above indicating that individuals high in extraversion gain particular mood and social enhancement from alcohol in our social drinking paradigm. Here, I examine duration of coordinated "simultaneous smiling" as a mediator of alcohol-related reward, and personality as a moderator of this mediational pathway. Results suggested that the extent to which simultaneous smiling mediated alcohol-related mood and social enhancement was significantly moderated by extraversion. Step 1 of moderated mediation analyses revealed

a significant main effect of alcohol on simultaneous smiling that was un-moderated by extraversion, $B = .437$, $\beta = 0.37$, $t = 6.20$, $p < 0.0001$. Alcohol increased the total amount of time individuals spent smiling simultaneously with another group member by about .5 seconds during each 10 second interval of the social interaction.

After confirming that a significant pathway existed from the independent variable to the mediator, I next examined pathways from the mediator to the outcomes. In line with criteria for moderated mediation, analyses revealed that the partial effects of simultaneous smiling were significantly moderated by extraversion in multivariate models examining effects across all three self-report outcomes, $B = 0.015$, $\beta = 0.05$, $t = 2.41$, $p = .0160$. Among individuals high in extraversion, a 1 second increase in simultaneous smiling was associated with a .29 unit increase in self-reported mood and social bonding, after accounting for all moderated and unmoderated direct effects of alcohol, $B = 0.290$, $\beta = 0.17$, $t = 4.91$, $p < .0001$. In contrast, among individuals low in extraversion, higher levels of simultaneous smiling did not appear to be associated with enhanced self-reported mood and social bonding, $B = 0.105$, $\beta = 0.07$, $t = 1.50$, $p = 0.1340$. An examination of calculated indirect effects confirmed that simultaneous smiles explained alcohol-related mood and social enhancement to a greater extent among individuals high in extraversion, $B = 0.130$, $z = 3.665$, $p = 0.0002$, compared with individuals low in extraversion, $B = 0.046$, $z = 1.445$, $p = 0.1490$. Importantly, once the (moderated) indirect effects of simultaneous smiling were accounted for, the significant overall moderating influence of extraversion on alcohol mood and social enhancement no longer reached significance, $p = 0.194$. Thus, effects here moved beyond moderated mediation to classify as an effect referred to by Muller and colleagues as "mediated moderation." Tests examining the interaction across each self-report variable independently suggested that this multivariate effect was primarily driven by social bonding, $B = 0.028$, $\beta = 0.07$, $t = 2.33$, $p = 0.0200$, with a trend towards significance emerging with respect to positive mood, $B = 0.014$, $= 0.06$, $t = 1.76$, $p = 0.0793$, and a non-significant effect in the expected direction with respect to negative mood, $B = -.003$, $\beta = -0.02$, $t = -.56$, $p = .5745$. (When only "golden moments"—smiles involving all three group members—were considered in simultaneous smiling analyses, models predicting positive mood also reached significance. See Table 7, Table 8, Table 9, and Table 10 for all results of mediated moderation models

as subdivided by number of group members engaged in simultaneous smiling.)

Next I explored whether the specific pairing of personality trait with mediational pathway was necessary to produce significant findings reported above. First, I examined whether extraverted individuals derived more mood and social enhancement from alcohol's tendency to increase smiling in general, regardless of whether it was simultaneous smiling. More specifically, I examined the effects of "smiling alone," or a smile displayed in the absence of any other group member's simultaneous smile. There was a main effect of alcohol on "smiling alone," with alcohol increasing the duration of smiling alone by approximately .18 seconds for each 10 seconds of the interaction, $B = 0.184$, $\beta = 0.21$, $t = 6.98$, $p < 0.0001$. However, extraversion did not moderate the relationship between "smiling alone" and self-reported mood and social bonding—there was not a stronger relationship between "smiling alone" and self-reported mood and social bonding among extraverted individuals than among introverted individuals, $B = 0.003$, $\beta = 0.004$, $t = 0.29$, $p = 0.7730$. Thus, extraverted individuals do not appear to derive greater mood or social enhancement from all smiles, but instead selectively gain particular reinforcement from smiles that are simultaneous with other group members. I next examined the generalizability of the effects described above across personality traits. I examined whether sensation-seeking moderated the "simultaneous smiling" pathway to alcohol-related mood and social enhancement. This model also produced a null effect, $B = -0.008$, $\beta = -0.01$, $t = -0.58$, $p = 0.5646$. Unlike extraverted individuals, sensation-seekers did not appear to derive particular reward from alcohol's tendency to increase simultaneous smiling between group members.

In sum, individuals high in extraversion experienced more alcohol-related mood and social enhancement during the social interaction than did those low in extraversion, and this moderating effect of extraversion was explained by increased sensitivity to social factors among extraverts. Specifically, individuals high in extraversion derived more self-reported mood and social enhancement from alcohol's tendency to increase simultaneous smiling. Alcohol's effects on simultaneous smiling explained alcohol's tendency to promote positive mood, relieve negative mood, and enhance social bonding selectively among individuals high in extraversion and not among those low in extraversion. There also was a trend suggesting that sensation-seeking moderated the impact of alcohol on reported mood and social bonding,

though the mechanisms underlying this potential association remain unclear.

4.0 DISCUSSION

Research examining social/cognitive mediators of alcohol's effects and research examining individual differences in AUD susceptibility each represent dominant subfields within alcohol studies. Notably, these two major research areas have proceeded independently to this point, with little evidence of conversation or mutual influence. Research examining individual difference criteria has generally not considered indirect effects of alcohol on mood, while cognitive theories such as AM have tended to ignore individual differences in alcohol response, leading scholars to observe that the study of moderators has been largely "divorced" from studies of mechanism underlying alcohol response [87, p. 362]. The current project represents an initial effort to integrate the study of personality with the study of underlying mechanisms impacted by alcohol consumption.

Results of this effort point to the importance of considering social processes in the examination of alcohol response. This research represents what is, to my knowledge, the first laboratory-based study to produce evidence that extraverted individuals derive more alcohol-related reward than introverted individuals. As reviewed earlier, while extraverted individuals report greater mood-enhancing effects from alcohol in survey studies, laboratory-based studies have produced no evidence that extraverts gain greater alcohol-related reward than introverts. Importantly, none of these alcohol-administration studies have examined extraverted individuals—individuals who self-identify as being highly social—consuming alcohol in a social context. It is possible that the social drinking environment featured in the present research accounts for the pronounced mood-enhancing effects of alcohol experienced by extraverted individuals in this study. In support of such a proposition, analyses suggested that the overall moderating influence of extraversion on alcohol-related reward is accounted for by alcohol's effects on social processes.

More specifically, I examined two social process variables as potential mechanisms underlying differential sensitivity to alcohol reward among extraverted individuals. First, I examined the lagged-partner variable created within the context of the APIM, a variable that represents the correlation of an individual's current smiling with the (recent) past smiling of fellow group members. This lagged variable did not emerge as a significant mechanism underlying alcohol reward sensitivity among extraverted individuals. Instead, a significant moderated mediation effect emerged through a consideration of the contemporaneous behavior of fellow group members. Extraverted individuals appeared to gain particular reward from instances when their own smiles coincided (i.e., were simultaneous) with the smiles of their interaction partners. Alcohol consumption increased incidence of these simultaneous smiles, and extraverts' tendency to derive greater reward from simultaneous smiles fully explained their sensitivity to alcohol's effects. Importantly, the relationship between "smiling alone" and subjective reward did not differ according to extraversion, and thus the mediated moderation effect described here appears to be specific to coordinated social behavior. Of note, while efforts were made to establish the specificity of these findings to the moderator and mediator of interest, analyses conducted within this paper cannot establish that simultaneous smiling is the only or, even, the best mechanism for understanding alcohol reward sensitivity among extraverts. Nonetheless, findings of this study appear to indicate an intriguing and intuitive role for social processes in alcohol reward sensitivity among extraverts.

4.1 SENSATION-SEEKING

While extraverted individuals in the current study demonstrated sensitivity to alcohol-related reward, results for sensation-seekers were more equivocal. Results suggested that individuals high in sensation-seeking reported somewhat more reward from alcohol, but this interaction was only a statistical trend. Results did not support the hypothesis, however, that autocorrelation mediated alcohol reward to a greater extent among individuals high versus low in sensation-seeking.

Failure to detect a significant moderating effect of sensation-seeking on alcohol-related

reward and the mechanisms underlying this reward could have been attributable to various factors. First, while the sample of participants in the present study was much larger than that examined in many previous laboratory-based alcohol studies, statistical power may have limited my ability to detect significant effects. Mediation analyses pose notorious challenges in terms of statistical power [56]—requiring upwards of 1,000 participants to achieve adequate power to detect smaller effect sizes—and such challenges are exacerbated within the framework of moderated mediation [64]. Thus, some non-significant sensation-seeking effects observed within the present study could potentially be explained by insufficient statistical power. Future research might increase power to detect a moderating effect of personality by selectively sampling participants according to their level of sensation-seeking. As noted above, individuals in the present research showed a similar range of scores to those examined in prior studies along both sensation-seeking and also extraversion. However, individuals vulnerable to AUD may evidence more extreme personality characteristics, and future studies could specifically select participants with high and low sensation-seeking scores.

Second, non-significant findings could have been attributable to the personality measure used within the current study. Prior studies that have demonstrated significant alcohol reward sensitivity according to personality have tended to use measures targeting other subfacets of impulsivity, such as disinhibition and antisociality [49, 81, 97]. Where Zuckerman's sensation-seeking scale was included together with these other measures as a predictor of alcohol response, factor loadings for sensation-seeking items were notably low [84]. In the current research, which was designed prior to more recent conceptualizations of impulsivity as a multi-faceted construct [e.g., 20], the sensation-seeking subscale of the impulsivity/sensation-seeking index showed suboptimal reliability. Results of overall moderation as well as moderated mediation analyses might have reached significance given a measure of sensation-seeking with more favorable psychometric properties.

A further possibility is that nonsignificant results observed in the present study were attributable to the nature of the drinking paradigm we employed. Our laboratory social drinking paradigm represents a relatively controlled, predictable and "sterile" drinking environment when compared with some naturalistic drinking settings—for example, a bar—and did not tend to induce strong feelings of elation or anxiety. In contrast, paradigms used in

prior studies that did produce evidence of alcohol reward sensitivity among sensation-seekers exposed subjects to unusual conditions intended to induce strong emotional responses (e.g., threat of electric shock or potential for public embarrassment [81]). Research suggests that dynamic affective shifts are most pronounced during laboratory manipulations intended to induce strong emotional reactions (e.g., anxiety [44]). Our social drinking paradigm might not have offered sufficient opportunity for the dramatic shifts in emotion that sensation-seekers enjoy and, assuming affective plasticity does underlie differential alcohol response among sensation-seekers, could drive a more pronounced moderating effect of sensation-seeking on alcohol-related reward. Future studies might observe dynamic emotional fluctuations evinced within the context of social interaction paradigms intended to induce strong emotional responses.

4.2 METHODOLOGICAL IMPLICATIONS

The present study not only has theoretical implications concerning mechanisms underlying alcohol response sensitivity, but also carries implications for study design and represents a methodological advance. In their study of alcohol's impact on stress, Sher et al. [87] note the dearth of research combining the study of individual differences with the study of mechanism. These authors present findings intended to form a bridge between these areas. Sher and colleagues show that cognitive factors mediate alcohol's mood-enhancing effects, and, within a separate analysis, that baseline differences in this cognitive variable are associated with differences in alcohol's impact on mood. While the authors point to the conceptual connection between the cognitive mediator and moderator, this connection is not demonstrated analytically. More specifically, analyses fail to combine mediation and moderation analyses and to demonstrate that alcohol's impact on underlying cognitive processes truly accounts for differential alcohol reward sensitivity according to cognition. By implementing Muller et al. [64] moderated mediation analyses, the present study builds on work by Sher and colleagues and introduces a new method well suited to the study of mechanisms underlying individual differences in alcohol response.

In addition to carrying statistical implications, the present study has implications for social drinking paradigms. As noted earlier, social drinking paradigms are rarely implemented within alcohol administration studies. When social paradigms have been employed, participants often have not interacted with other participants but instead engage with confederates. More specifically—in an effort to standardize experimental conditions across participants and, in some cases, create an aversive social environment—alcohol-administration researchers have often employed confederate interactions in which confederates follow strict behavioral scripts and are largely facially and verbally unresponsive to participants. Indeed, in a recent meta-analysis, we found that the majority of alcohol-administration studies examining social interaction have featured interactions with unresponsive confederates [24]. Results produced by the present study seem to confirm that the natural behavioral coordination and responsiveness that occurs within the context of most everyday social discourse is essential to understanding alcohol's mood enhancing properties. Extraverted individuals in our study did not gain particular reward from smiling alone—the only possible type of smile during an interaction with a facially unresponsive confederate—but instead selectively gained heightened reinforcement from the smiles they shared with other group members. Thus, results of this study suggest that natural social discourse holds important implications to the understanding of alcohol reward sensitivity and addiction susceptibility.

4.3 LIMITATIONS AND FUTURE DIRECTIONS

In the present research, I studied social and emotional processes through an examination of the Duchenne smile. I chose to focus on the Duchenne smile for several reasons. Importantly, negative facial expressions in our study did not arise with sufficient frequency to enable a rigorous examination of momentary shifts in these expressions [23]. Nonetheless, research targeting a variety of facial expressions would be valuable, and future studies should expand on the present research to include a range of behavioral expressive measures.

Second, the current study employed a single moderate dose of alcohol and tested the responses of individuals while on the ascending limb of the BAC curve. The BACs of partic-

ipants in our study were likely to be relatively low, since we examined affective responding of participants soon after drinking began. However, as in most alcohol administration studies, our participants drank quite rapidly and reported clear effects from the alcohol. Research suggests that, independent of absolute intoxication level, it is important to consider "rate of change" of intoxication when examining pharmacological effects of alcohol on subjective experience [8, 58]. Nevertheless, future studies should test the generalizability of these results to higher and lower doses of alcohol and to individuals whose BACs are descending.

Third, the mediation analyses presented here do not establish temporal precedence in the relationship between mediator and dependent variable. In other words, I was unable to conclusively determine that simultaneous smiling caused improvements in mood or completely rule out the inverse causal pathway. Establishing the order of this relationship experimentally represents an important challenge for future research.

Finally, as in the parent study [77], a powerful main effect of gender emerged in the present research with respect to both behavioral and self-reported outcomes. Women reported significantly enhanced mood and social outcomes compared to men, and also exhibited greater affective plasticity and higher levels of simultaneous smiling. Future research might further examine the effects of gender and alcohol on social and emotional outcomes.

4.4 SUMMARY AND CONCLUSIONS

Outside the laboratory, the vast majority of alcohol is consumed in the company of others. Within laboratory studies, in contrast, participants have almost always consumed alcoholic beverages in isolation. Perhaps unsurprisingly, past alcohol-administration studies testing subjects in isolation have not produced evidence that extraverted individuals are more susceptible to alcohol reward than other individuals. Using continual behavioral-affective measurement and dynamic, individual-level process variables, I found that highly social individuals gained greater reward from alcohol consumption, and that social processes explain their enhanced alcohol reward sensitivity. Results of the current study provide evidence that social paradigms can offer novel information relevant to identification of those at risk for al-

cohol use disorders and suggest that such paradigms deserve a place within laboratory-based alcohol research.

APPENDIX A

SUPPLEMENTAL TABLES

Table 11: Results of multivariate models examining alcohol as compared to placebo and control conditions separately

	Sensation-seeking (autocorrelation)†			Extraversion (lagged-partner)†			Extraversion (simultaneous smiling)†		
	B	*t*-ratio	*p*-value	*B*	*t*-ratio	*p*-value	*B*	*t*-ratio	*p*-value
Step 1: Direct effect of independent variable on outcome									
Gender	0.268	4.68	.0001	0.233	4.27	.0001	0.233	4.27	.0001
Placebo	–0.384	–5.70	.0001	–0.396	–6.25	.0001	–0.396	–6.25	.0001
Personality	0.011	1.07	.2850	0.041	7.09	.0001	0.041	7.09	.0001
Personality×Placebo	–0.011	–0.71	.4749	–0.013	–1.61	.1069	–0.013	–1.61	.1069
Control	–0.218	–3.17	.0017	–0.227	–3.45	.0007	–0.227	–3.45	.0007
Personality×Control	–0.029	–1.87	.0611	–0.021	–2.36	.0182	–0.021	–2.36	.0182
Step 2: Pathway from independent variable to mediator									
Gender	–0.00080	–5.79	.0001	–0.00002	–5.10	.0001	0.08200	3.40	.0007
Placebo	0.00100	6.01	.0001	0.00030	6.31	.0001	–0.45400	–5.74	.0001
Personality	–0.00002	–1.19	.2356	–0.00000	–1.09	.2774	0.00400	1.40	.1626
Personality×Placebo	0.00000	0.08	.9343	0.00000	0.03	.9738	–0.00100	–0.32	.7501
Control	0.00100	4.85	.0001	0.00030	5.45	.0001	–0.40600	–5.45	.0001
Personality×Control	0.00003	1.08	.2818	0.00000	0.58	.5635	–0.00100	–0.25	.8052
Step 3: Partial effect of the mediator on the outcome									
Gender	0.222	4.02	.0001	0.206	3.90	.0001	0.208	3.87	.0001
Personality	0.031	1.54	.1230	0.048	5.77	.0001	0.037	5.91	.0001
Mediator	–55.151	–3.62	.0003	–167.600	–2.48	.0130	0.198	3.92	.0001
Personality×Mediator	–4.361	–1.30	.1923	–9.832	–1.33	.1841	0.015	2.35	.0189
Placebo	–0.306	–4.50	.0001	–0.341	–5.31	.0001	–0.308	–4.72	.0001
Personality×Placebo	–0.005	–0.37	.7105	–0.010	–1.14	.2560	–0.007	–0.74	.4607
Control	–0.158	–2.25	.0256	–0.182	–2.63	.0092	–0.147	–2.11	.0358
Personality×Control	–0.024	–1.60	.1091	–0.018	–2.01	.0442	–0.015	–1.60	.1090

† Columns are labeled using the following format: Personality (Mediator)

Note: Placebo and Control conditions are entered as dummy codes; Personality, Simultaneous Smiling, and Gender variables are centered; Gender is coded such that Male = –.5 and Female = .5.

APPENDIX B

BIBLIOGRAPHY

[1] Z. Ambadar, J. Cohn, and L. Reed. All smiles are not created equal: Morphology and timing of smiles perceived as amused, polite, and embarrassed/nervous. *Journal of Nonverbal Behavior*, 33:17–34, 2009. doi: 10.1007/s10919-008-0059-5.

[2] K. G. Anderson, A. Schweinsburg, M. P. Paulus, S. A. Brown, and S. Tapert. Examining personality and alcohol expectancies using functional magnetic resonance imaging (fMRI) with adolescents. *Journal of Studies on Alcohol*, 66:323–331, 2005. URL http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2270701/.

[3] M. Argyle and L. Lu. The happiness of extraverts. *Personality and Individual Differences*, 11:1011–1017, 1990. doi: 10.1016/0191-8869(90)90128-E. URL http://www.sciencedirect.com/science/article/pii/019188699090128E.

[4] M. C. Ashton, K. Lee, and S. V. Paunonen. What is the central feature of extraversion?: Social attention versus reward sensitivity. *Journal of Personality and Social Psychology*, 83:245–252, 2002. doi: 10.1037/0022-3514.83.1.245. URL http://psycnet.apa.org/journals/psp/83/1/245/.

[5] R. Bakeman. Behavioral observation and coding. In H. T. Reis and C. M. Judd, editors, *Handbook of research methods in social and personality psychology*, pages 138–149. Cambridge University Press, New York, 1999.

[6] R. Bakeman and J. M. Gottman. *Observing interaction: An introduction to sequential analysis*. Cambridge University Press, New York, 2 edition, 1997.

[7] C. D. Batson, L. L. Shaw, and K. C. Oleson. Differentiating affect, mood, and emotion: Toward functionally based conceptual distinctions. In M. Clark, editor, *Emotion: Review of personality and social psychology*, volume 13, pages 294–326. Sage Publications, Newbury Park, CA, 1992.

[8] F. C. Breslin, M. Mayward, and A. Baum. Effect of stress on perceived intoxication and the blood alcohol curve in men and women. *Health Psychology*, 13:479–487, 1994. doi: 10.1037/0278-6133.13.6.479. URL http://psycnet.apa.org/journals/hea/13/6/479/.

[9] D. Cahalan, I. H. Cisin, and H. M. Crossley. *American drinking practices: A national study of drinking behavior and attitudes.* Rutgers Center of Alcohol Studies, New Brunswick, NJ, 1969.

[10] T. Canli, H. Sivers, S. L. Whitfield, I. H. Gotlib, and J. D. Gabrieli. Amygdala response to happy faces as a function of extraversion. *Science*, 296:2191–2191, 2002. doi: 10.1126/science.1068749. URL http://www.sciencemag.org/content/296/5576/2191.short.

[11] D. B. Clark, M. Vanyukov, and J. Cornelius. Childhood antisocial behavior and adolescent alcohol use disorders. *Alcohol Research and Health*, 26:109–115, 2002. URL http://pubs.niaaa.nih.gov/publications/arh26-2/109-115.htm?lad_zip=&lad_spec=0.

[12] J. Cohen, P. Cohen, S. G. West, and L. S. Aiken. *Applied multiple regression/correlation analysis for the behavioral sciences*. Routledge Academic, Hillsdale, NJ, 3 edition, 2003. ISBN 0805822232.

[13] M. Cook, A. Young, D. Taylor, and A. P. Bedford. Personality correlates of alcohol consumption. *Personality and Individual Differences*, 24:641–647, 1998. doi: 10.1016/S0191-8869(97)00214-6. URL http://www.sciencedirect.com/science/article/pii/S0191886997002146.

[14] M. L. Cooper, M. R. Frone, M. Russell, and P. Mudar. Drinking to regulate positive and negative emotions: A motivational model of alcohol use. *Journal of Personality and Social Psychology*, 69:990–1005, 1995. doi: 10.1037/0022-3514.69.5.990.

[15] P. T. Costa and R. R. McCrae. Four ways five factors are basic. *Personality and Individual Differences*, 13:653–665, 1992. doi: 10.1016/0191-8869(92)90236-I. URL http://www.sciencedirect.com/science/article/pii/019188699290236I.

[16] P. T. Costa and R. R. McRae. *Revised NEO-Personality Inventory and NEO-Five Factor Inventory*. Psychological Assessment Resources, Lutz, FL, 2003.

[17] J. J. Curtin, A. R. Lang, C. J. Patrick, and W. G. K. Stritzke. Alcohol and fear-potentiated startle: The role of competing cognitive demands in the stress-reducing effects of intoxication. *Journal of Abnormal Psychology*, 107:547–557, 1998. URL http://psycnet.apa.org/journals/abn/107/4/547/.

[18] J. J. Curtin, C. J. Patrick, A. R. Lang, J. T. Cacioppo, and N. Birbaumer. Alcohol affects emotion through cognition. *Psychological Science*, 12:527–531, 2001. doi: 10.1111/1467-9280.00397. URL http://pss.sagepub.com/content/12/6/527.short.

[19] A. Demers, S. Kairouz, E. Adlaf, L. Gliksman, B. Newton-Taylor, and A. Marchand. Multilevel analysis of situational drinking among Canadian undergraduates. *Social Science & Medicine*, 55:415–424, 2002. doi: 10.1016/S0277-9536(01)00258-1. URL http://www.sciencedirect.com/science/article/pii/S0277953601002581.

[20] D. M. Dick, G. Smith, P. Olausson, S. H. Mitchell, R. F. Leeman, S. S. O'Malley, and K. Sher. Review: Understanding the construct of impulsivity and its relationship to alcohol use disorders. *Addiction Biology*, 15:217–226, 2010. URL http://onlinelibrary.wiley.com/doi/10.1111/j.1369-1600.2009.00190.x/full.

[21] P. Ekman, R. Davidson, and W. Friesen. The Duchenne smile: Emotional expression and brain physiology: II. *Journal of Personality and Social Psychology*, 58:342–353, 1990. doi: 10.1037/0022-3514.58.2.342.

[22] H. J. Eysenck. *The biological basis of personality.* Charles C. Thomas., Springfield, IL, 1967.

[23] C. Fairbairn and M. A. Sayette. The effect of alcohol on emotional inertia: A test of alcohol myopia. *Journal of Abnormal Psychology*, 122:770–781, 2013. doi: 10.1037/a0032980.

[24] C. E. Fairbairn and M. A. Sayette. A social-attributional analysis of alcohol response. *Psychological Bulletin*, 140:1361–1382, 2014.

[25] C. E. Fairbairn, M. A. Sayette, O. O. Aalen, and A. Frigessi. Alcohol and emotional contagion: An examination of the spreading of smiles in male and female drinking groups. *Clinical Psychological Science*.

[26] P. R. Finn and R. O. Pihl. Men at high risk for alcoholism: The effect of alcohol on cardiovascular response to unavoidable shock. *Journal of Abnormal Psychology*, 96:230–236, 1987. doi: 10.1037/0021-843X.96.3.230. URL http://psycnet.apa.org/journals/abn/96/3/230/.

[27] K. Flory, D. Lynam, R. Milich, C. Leukefeld, and R. Clayton. The relations among personality, symptoms of alcohol and marijuana abuse, and symptoms of comorbid psychopathology: Results from a community sample. *Experimental and Clinical Psychopharmacology*, 10:425–434, 2002. doi: 10.1037/1064-1297.10.4.425. URL http://psycnet.apa.org/journals/pha/10/4/425/.

[28] J. M. Gottman. *Time-series analysis: A comprehensive introduction for social scientists.* Cambridge University Press, Cambridge, 1981.

[29] E. Grau and G. Ortet. Personality traits and alcohol consumption in a sample of non-alcoholic women. *Personality and Individual Differences*, 27:1057–1066, 1999. doi: 10.1016/S0191-8869(99)00047-1. URL http://www.sciencedirect.com/science/article/pii/S0191886999000471.

[30] W. G. Graziano, A. B. Feldesman, and D. F. Rahe. Extraversion, social cognition, and the salience of aversiveness in social encounters. *Journal of Personality and Social Psychology*, 49:971–980, 1985. doi: 10.1037/0022-3514.49.4.971. URL http://psycnet.apa.org/journals/psp/49/4/971/.

[31] E. R. Grekin, K. J. Sher, and P. K. Wood. Personality and substance dependence symptoms: Modeling substance-specific traits. *Psychology of Addictive Behaviors*, 20:415–424, 2006. doi: 10.1037/0893-164X.20.4.415. URL http://psycnet.apa.org/journals/adb/20/4/415/.

[32] U. Hess, R. Banse, and A. Kappas. The intensity of facial expression is determined by underlying affective state and social situation. *Journal of Personality and Social Psychology*, 69:280–288, 1995. doi: 10.1037/0022-3514.69.2.280. URL http://psycnet.apa.org/journals/psp/69/2/280/.

[33] S. Y. Hill and H. Yuan. Familial density of alcoholism and onset of adolescent drinking. *Journal of Studies on Alcohol and Drugs*, 60:7–17, 1999. URL http://www.jsad.com/jsad/article/Familial_Density_of_Alcoholism_and_Onset_of_Adolescent_Drinking/575.html.

[34] S. Y. Hill, S. Shen, L. Lowers, and J. Locke. Factors predicting the onset of adolescent drinking in families at high risk for developing alcoholism. *Biological Psychiatry*, 48:265–275, 2000. URL http://www.sciencedirect.com/science/article/pii/S0006322300008416.

[35] J. Hull. A self-awareness model of the causes and effects of alcohol consumption. *Journal of Abnormal Psychology*, 90:586–600, 1981. doi: 10.1037/0021-843X.90.6.586.

[36] R. A. Josephs and C. M. Steele. The two faces of alcohol myopia: Attentional mediation of psychological stress. *Journal of Abnormal Psychology*, 99:115–126, 1990. doi: 10.1037/0021-843X.99.2.115.

[37] C. Jung. *Psychological Types: Collected Works*. Princeton University Press, Princeton, NJ, 1921.

[38] K. S. Kendler, C. A. Prescott, J. Myers, and M. C. Neale. The structure of genetic and environmental risk factors for common psychiatric and substance use disorders in men and women. *Archives of General Psychiatry*, 60:929–937, 2003. URL http://archpsyc.ama-assn.org/cgi/reprint/60/9/929.pdf.

[39] D. Kenny, D. Kashy, and W. Cook. *Dyadic data analysis*. The Guilford Press, New York, NY, 2006.

[40] M. M. Kilbey, K. Downey, and N. Breslau. Predicting the emergence and persistence of alcohol dependence in young adults: The role of expectancy and other risk factors. *Experimental and Clinical Psychopharmacology*, 6:149–156, 1998. doi: 10.1037/1064-1297.6.2.149. URL http://psycnet.apa.org/journals/pha/6/2/149/.

[41] L. A. King. Wishes, motives, goals, and personal memories: Relations of measures of human motivation. *Journal of Personality*, 63:985–1007, 1995. doi: 10.1111/j.1467-6494.1995.tb00323.x. URL http://onlinelibrary.wiley.com/doi/10.1111/j.1467-6494.1995.tb00323.x/abstract.

[42] L. A. King and S. J. Broyles. Wishes, gender, personality, and well-being. *Journal of Personality*, 65:49–76, 1997. doi: 10.1111/j.1467-6494.1997.tb00529.x. URL http://onlinelibrary.wiley.com/doi/10.1111/j.1467-6494.1997.tb00529.x/abstract.

[43] T. R. Kirchner, M. A. Sayette, J. F. Cohn, R. L. Moreland, and J. M. Levine. Effects of alcohol on group formation among male social drinkers. *Journal of Studies on Alcohol*, 67:785–793, 2006.

[44] P. Koval and P. Kuppens. Changing emotion dynamics: Individual differences in the effect of anticipatory social stress on emotional inertia. *Emotion*, 12:256–267, 2011.

[45] R. F. Krueger, B. M. Hicks, C. J. Patrick, S. R. Carlson, W. G. Iacono, and M. McGue. Etiologic connections among substance dependence, antisocial behavior and personality:

Modeling the externalizing spectrum. *Journal of Abnormal Psychology*, 111:411–424, 2002. URL http://psycnet.apa.org/psycinfo/2002-17277-001.

[46] J. L. Krull and D. P. MacKinnon. Multilevel mediation modeling in group-based intervention studies. *Evaluation Review*, 23:418–444, 1999. doi: 10.1177/0193841X9902300404. URL http://erx.sagepub.com/content/23/4/418.short.

[47] J. L. Krull and D. P. MacKinnon. Multilevel modeling of individual and group level mediated effects. *Multivariate Behavioral Research*, 36:249–277, 2001. doi: 10.1207/S15327906MBR3602_06. URL http://www.tandfonline.com/doi/abs/10.1207/S15327906MBR3602_06.

[48] E. Kuntsche, R. Knibbe, G. Gmel, and R. Engels. Who drinks and why? A review of socio-demographic, personality, and contextual issues behind the drinking motives in young people. *Addictive Behaviors*, 31:1844–1857, 2006. doi: 10.1016/j.addbeh.2005.12.028. URL http://www.sciencedirect.com/science/article/pii/S0306460305003217.

[49] R. W. Levenson, O. N. Oyama, and P. S. Meek. Greater reinforcement from alcohol for those at risk: Parental risk, personality risk, and sex. *Journal of Abnormal Psychology*, 96:242–253, 1987. doi: 10.1037/0021-843X.96.3.242. URL http://psycnet.apa.org/journals/abn/96/3/242/.

[50] M. D. Lieberman and R. Rosenthal. Why introverts can't always tell who likes them: Multitasking and nonverbal decoding. *Journal of Personality and Social Psychology*, 80:294–310, 2001. doi: 10.1037/0022-3514.80.2.294. URL http://psycnet.apa.org/journals/psp/80/2/294/.

[51] P. Litle and M. Zuckerman. Sensation seeking and music preferences. *Personality and Individual Differences*, 7:575–578, 1986. URL http://www.sciencedirect.com/science/article/pii/0191886986901364.

[52] A. K. Littlefield and K. J. Sher. The multiple, distinct ways that personality contributes

to alcohol use disorders. *Social and Personality Psychology Compass*, 4:767–782, 2010. doi: 10.1111/j.1751-9004.2010.00296.x. URL http://onlinelibrary.wiley.com/doi/10.1111/j.1751-9004.2010.00296.x/full.

[53] A. K. Littlefield, K. J. Sher, and P. K. Wood. Do changes in drinking motives mediate the relation between personality change and maturing out of problem drinking? *Journal of Abnormal Psychology*, 119:93–105, 2010. URL http://psycnet.apa.org/journals/abn/119/1/93/.

[54] A. Loukas, H. E. Fitzgerald, R. A. Zucker, and A. v. Eye. Parental alcoholism and co-occurring antisocial behavior: Prospective relationships to externalizing behavior problems in their young sons. *Journal of Abnormal Child Psychology*, 29:91–106, 2001. URL http://www.springerlink.com/index/t586qn285047n474.pdf.

[55] D. P. MacKinnon, G. Warsi, and J. H. Dwyer. A simulation study of mediated effect measures. *Multivariate Behavioral Research*, 30:41–62, 1995. doi: 10.1207/s15327906mbr3001_3. URL http://www.tandfonline.com/doi/abs/10.1207/s15327906mbr3001_3.

[56] D. P. MacKinnon, C. M. Lockwood, J. M. Hoffman, S. G. West, and V. Sheets. A comparison of methods to test mediation and other intervening variable effects. *Psychological Methods*, 7:83–104, 2002. doi: 10.1037/1082-989X.7.1.83. URL http://psycnet.apa.org/psycinfo/2002-00925-005.

[57] J. M. Malouff, E. B. Thorsteinsson, S. E. Rooke, and N. S. Schutte. Alcohol involvement and the five-factor model of personality: A meta-analysis. *Journal of Drug Education*, 37:277–294, 2007. URL http://baywood.metapress.com/index/91613594G5855882.pdf.

[58] C. S. Martin and M. Earleywine. Ascending and descending rates of change in blood alcohol concentrations and subjective intoxication ratings. *Journal of Substance Abuse*, 2:345–352, 1990. URL http://www.sciencedirect.com/science/article/pii/S0899328910800069.

[59] C. S. Martin, M. Earleywine, R. E. Musty, M. W. Perrine, and R. M. Swift. Development and validation of the biphasic alcohol effects scale. *Alcoholism: Clinical and Experimental Research*, 17:140–146, 1993. doi: 10.1111/j.1530-0277.1993.tb00739.x. URL http://onlinelibrary.wiley.com/doi/10.1111/j.1530-0277.1993.tb00739.x/abstract.

[60] C. T. Martsh and W. R. Miller. Extraversion predicts heavy drinking in college students. *Personality and Individual Differences*, 23:153–155, 1997. doi: 10.1016/S0191-8869(97)00015-9. URL http://www.sciencedirect.com/science/article/pii/S0191886997000159.

[61] D. M. McCarthy, L. S. Kroll, and G. T. Smith. Integrating disinhibition and learning risk for alcohol use. *Experimental and Clinical Psychopharmacology*, 9:389–398, 2001. URL http://psycnet.apa.org/journals/pha/9/4/389/.

[62] D. M. McCarthy, T. L. Miller, G. T. Smith, and J. A. Smith. Disinhibition and expectancy in risk for alcohol use: Comparing Black and White college samples. *Journal of Studies on Alcohol*, 62:313–321, 2001. URL http://psycnet.apa.org/psycinfo/2001-01129-006.

[63] R. R. McCrae and P. T. Costa. A contemplated revision of the NEO Five-Factor Inventory. *Personality and Individual Differences*, 36:587–596, 2004. doi: 10.1016/S0191-8869(03)00118-1. URL http://www.sciencedirect.com/science/article/pii/S0191886903001181.

[64] D. Muller, C. M. Judd, and V. Y. Yzerbyt. When moderation is mediated and mediation is moderated. *Journal of Personality and Social Psychology*, 89:852–863, 2005. doi: 10.1037/0022-3514.89.6.852.

[65] C. T. Nagoshi, J. R. Wilson, and L. A. Rodriguez. Impulsivity, sensation seeking, and behavioral and emotional responses to alcohol. *Alcoholism: Clinical and Experimental Research*, 15:661–667, 2006. URL http://onlinelibrary.wiley.com/doi/10.1111/j.1530-0277.1991.tb00575.x/abstract.

[66] R. Niaura, G. T. Wilson, and E. Westrick. Self-awareness, alcohol consumption, and reduced cardiovascular reactivity. *Psychosomatic Medicine*, 50:360–380, 1988. URL http://www.psychosomaticmedicine.org/content/50/4/360.short.

[67] C. X. Poulos, A. D. Le, and J. L. Parker. Impulsivity predicts individual susceptibility to high levels of alcohol self-administration. *Behavioural Pharmacology*, 6:810–814, 1995. URL http://psycnet.apa.org/psycinfo/1996-22444-001.

[68] K. J. Preacher and A. F. Hayes. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, 40:879–891, 2008. doi: 10.3758/BRM.40.3.879. URL http://www.springerlink.com/index/6XP1676N382P53K1.pdf.

[69] L. I. Puttler, R. A. Zucker, H. E. Fitzgerald, and C. R. Bingham. Behavioral outcomes among children of alcoholics during the early and middle childhood years: Familial subtype variations. *Alcoholism: Clinical and Experimental Research*, 22:1962–1972, 1998. URL http://onlinelibrary.wiley.com/doi/10.1111/j.1530-0277.1998.tb05904.x/abstract.

[70] S. W. Raudenbush, R. T. Brennan, and R. C. Barnett. A multivariate hierarchical model for studying psychological change within married couples. *Journal of Family Psychology*, 9:161–161, 1995. doi: 10.1037/0893-3200.9.2.161. URL http://www.psych.umass.edu/uploads/people/79/RaudenbushBrennanBarnett_1995.pdf.

[71] J. P. Read and R. M. O'Connor. High-and low-dose expectancies as mediators of personality dimensions and alcohol involvement. *Journal of Studies on Alcohol and Drugs*, 67:204–214, 2006. URL http://www.jsad.com/jsad/authdownload/High_and_LowDose_Expectancies_as_Mediators_of_Personality_Dimensions_and_/891.html.

[72] B. W. Roberts and R. W. Robins. Broad dispositions, broad aspirations: The intersection of personality traits and major life goals. *Personality and Social Psychology Bulletin*, 26:1284–1296, 2000. doi: 10.1177/0146167200262009. URL http://psp.sagepub.com/content/26/10/1284.short.

[73] D. Rohsenow and G. Marlatt. The balanced placebo design: Methodological considerations. *Addictive Behaviors*, 6:107–122, 1981. doi: 10.1016/0306-4603(78)90034-5.

[74] W. Ruch. Extraversion, alcohol, and enjoyment. *Personality and Individual Differences*, 16:89–102, 1994. doi: 10.1016/0191-8869(94)90113-9. URL http://www.sciencedirect.com/science/article/pii/0191886994901139.

[75] J. A. Russell. Core affect and the psychological construction of emotion. *Psychological Review*, 110:145–172, 2003. doi: 10.1037/0033-295X.110.1.145. URL http://psycnet.apa.org/?fa=main.doiLanding&doi=10.1037/0033-295X.110.1.145.

[76] M. Sayette. An appraisal-disruption model of alcohol's effects on stress responses in social drinkers. *Psychological Bulletin*, 114:459–476, 1993. doi: 10.1037/0033-2909.114.3.459.

[77] M. Sayette, K. Creswell, J. Dimoff, C. Fairbairn, J. Cohn, B. Heckman, T. Kirchner, J. Levine, and R. Moreland. Alcohol and group formation: A multimodal investigation of the effects of alcohol on emotion and social bonding. *Psychological Science*, 23:869–878, 2012. doi: 10.1177/0956797611435134.

[78] M. Sayette, J. Dimoff, J. Levine, R. Moreland, and E. Votruba-Drzal. The effects of alcohol and dosage-set on risk-seeking behavior in groups and individuals. *Psychology of Addictive Behaviors*, 26:194–200, 2012. doi: 10.1037/a0023903.

[79] M. A. Sayette, C. S. Martin, M. A. Perrott, J. M. Wertz, and M. R. Hufford. A test of the appraisal-disruption model of alcohol and stress. *Journal of Studies on Alcohol*, 62:247–256, 2001.

[80] M. A. Schuckit. Biological, psychological and environmental predictors of the alcoholism risk: a longitudinal study. *Journal of Studies on Alcohol and Drugs*, 59:485–494, 1998. URL http://www.jsad.com/jsad/article/Biological_Psychological_and_Environmental_Predictors_of_the_Alcoholism_Ri/540.html.

[81] K. J. Sher and R. W. Levenson. Risk for alcoholism and individual differences in the stress-response-dampening effect of alcohol. *Journal of Abnormal Psychology*, 91:350–367, 1982. doi: 10.1037/0021-843X.91.5.350.

[82] K. J. Sher and K. S. Walitzer. Individual differences in the stress-response-dampening effect of alcohol: A dose-response study. *Journal of Abnormal Psychology*, 95:159–167, 1986. doi: 10.1037/0021-843X.95.2.159.

[83] K. J. Sher and M. D. Wood. Subjective effects of alcohol II: Individual differences. In M. Earleywine, editor, *Mind Altering Drugs: Scientific Evidence for Subjective Experience*, pages 86–134. Oxford, New York, 2005.

[84] K. J. Sher, D. B. Bylund, K. S. Walitzer, J. Hartmann, and C. Ray-Prenger. Platelet monoamine oxidase (MAO) activity: Personality, substance use, and the stress-response-dampening effect of alcohol. *Experimental and Clinical Psychopharmacology*, 2:53–81, 1994. doi: 10.1037/1064-1297.2.1.53. URL http://psycnet.apa.org/journals/pha/2/1/53/.

[85] K. J. Sher, T. Trull, B. Bartholow, and A. Vieth. Personality and alcoholism: Issues. methods, and etiological processes. In K. E. Leonard and H. T. Blane, editors, *Psychological theories of drinking and alcoholism*, pages 54–105. Plenum, New York, 1999.

[86] K. J. Sher, E. R. Grekin, and N. A. Williams. The development of alcohol use disorders. *Annual Review of Clinical Psychology*, 1:493–523, 2005. doi: 10.1146/annurev.clinpsy.1.102803.144107. URL http://www.annualreviews.org/doi/abs/10.1146/annurev.clinpsy.1.102803.144107.

[87] K. J. Sher, B. D. Bartholow, K. Peuser, D. J. Erickson, and M. D. Wood. Stress-response-dampening effects of alcohol: Attention as a mediator and moderator. *Journal of Abnormal Psychology*, 116:362–377, 2007. doi: 10.1037/0021-843X.116.2.362. URL http://psycnet.apa.org/psycinfo/2007-06673-013.

[88] E. Single and S. Wortley. Drinking in various settings as it relates

to demographic variables and level of consumption: Findings from a national survey in Canada. *Journal of Studies on Alcohol and Drugs*, 54:590–599, 1993. URL http://www.jsad.com/jsad/authdownload/Drinking_in_Various_Settings_As_It_Relates_to_Demographic_Variables_and_Lev/1949.html.

[89] C. Steele and R. Josephs. Alcohol myopia: Its prized and dangerous effects. *American Psychologist*, 45:921–933, 1990. doi: 10.1037/0003-066X.45.8.921.

[90] C. M. Steele and R. A. Josephs. Drinking your troubles away II: An attention-allocation model of alcohol's effect on psychological stress. *Journal of Abnormal Psychology*, 97:196–205, 1988. doi: 10.1037/0021-843X.97.2.196. URL http://psycnet.apa.org/journals/abn/97/2/196/.

[91] S. H. Stewart and H. Devine. Relations between personality and drinking motives in young adults. *Personality and Individual Differences*, 29:495–511, 2000. doi: 10.1016/S0191-8869(99)00210-X. URL http://www.sciencedirect.com/science/article/pii/S019188699900210X.

[92] N. I. Technology. The Observer: Professional System for Collection, Analysis, and Presentation of Observational Data, 2010.

[93] A. Verdejo-Garca, A. J. Lawrence, and L. Clark. Impulsivity as a vulnerability marker for substance-use disorders: Review of findings from high-risk research, problem gamblers and genetic association studies. *Neuroscience and Biobehavioral Reviews*, 32:777–810, 2008. URL http://psycnet.apa.org/psycinfo/2008-03013-008.

[94] R. E. Vuchinich and C. A. Simpson. Hyperbolic temporal discounting in social drinkers and problem drinkers. *Experimental and Clinical Psychopharmacology*, 6:292–305, 1998. doi: 10.1037/1064-1297.6.3.292. URL http://psycnet.apa.org/journals/pha/6/3/292/.

[95] D. Watson, L. A. Clark, C. W. McIntyre, and S. Hamaker. Affect, personality, and social

activity. *Journal of Personality and Social Psychology*, 63:1011–1025, 1992. doi: 10.1037/0022-3514.63.6.1011. URL http://psycnet.apa.org/psycinfo/1993-13450-001.

[96] P. Wennberg. The development of alcohol habits in a Swedish male birth cohort. In S. Shohov, editor, *Advances in Psychology Research*. Nova Sci, Hauppauge, NY, 2002.

[97] A. Zeichner, P. R. Giancola, and J. D. Allen. Effects of hostility on alcohol stress-response-dampening. *Alcoholism: Clinical and Experimental Research*, 19:977–983, 1995. URL http://onlinelibrary.wiley.com/doi/10.1111/j.1530-0277.1995.tb00977.x/abstract.

[98] M. Zuckerman. The psychophysiology of sensation seeking. *Journal of Personality*, 58: 313–345, 1990. URL http://onlinelibrary.wiley.com/doi/10.1111/j.1467-6494.1990.tb00918.x/abstract.

[99] M. Zuckerman. *Behavioral expressions and biosocial bases of sensation seeking*. Cambridge Univ Press, 1994.

[100] M. Zuckerman, H. Persky, T. R. Hopkins, T. Murtaugh, G. K. Basu, and M. Schilling. Comparison of stress effects of perceptual and social isolation. *Archives of General Psychiatry*, 14:356–365, 1966. URL http://archpsyc.ama-assn.org/cgi/reprint/14/4/356.pdf.

[101] M. Zuckerman, D. M. Kuhlman, J. Joireman, P. Teta, and M. Kraft. A comparison of three structural models for personality: The Big Three, the Big Five, and the Alternative Five. *Journal of Personality and Social Psychology*, 65:757–768, 1993. URL http://psycnet.apa.org/journals/psp/65/4/757/.