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Living in the Here and Now: Interrelationships between Impulsivity, Mindfulness, and Alcohol Misuse

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Abstract

Rationale—Impulsivity and mindfulness both emphasize orientation to the present, and both have been linked to alcohol misuse, but the relationship between the two is not clearly understood.

Objectives—To examine the relationships between elements of impulsivity and mindfulness, and to examine both variables in relation to alcohol misuse.

Method—Young adults ($N = 116$) were assessed for alcohol use, mindfulness, and impulsivity using psychometrically validated measures.

Results—Numerous significant associations were present among the facets of impulsivity and mindfulness. The variable most substantially associated with alcohol misuse was Negative Urgency (NU; i.e., proneness to act out under conditions of negative affect). After controlling for other variables, Negative Urgency (NU), Positive Urgency (PU), and delay discounting (DD) were significantly related to alcohol consumption. When examining drinking related consequences, only Lack of Premeditation (LoP) and Negative Urgency (NU) were significant associated.

Conclusions—There was considerable overlap between some elements of impulsivity and mindfulness while the overlap was negligible for other facets. The associations between mindfulness and alcohol misuse were entirely a function of impulsivity. In particular, acting on impulses while experiencing negative affect was significantly associated with level of alcohol consumption and level of alcohol-related risk. Steep discounting of future rewards was associated with alcohol consumption while poor premeditation was associated with adverse drinking consequences. These findings illustrate the importance of jointly studying impulsivity when examining purported effects of mindfulness traits.

Keywords

Alcohol; Impulsivity; Mindfulness; Delay Discounting; Urgency

A strong association between impulsivity and addictive behavior has been clearly demonstrated in numerous studies using animal models and in human studies employing both questionnaire-based and performance-based approaches (for reviews, see de Wit 2009; Dick et al. 2010; MacKillop et al. 2011). Research has demonstrated a link between alcohol misuse and impulsivity showing that alcohol use predicts impulsivity (e.g., heavy alcohol use can trigger impulsive behavior; chronic heavy use can weaken self-regulation) and that impulsivity predicts alcohol use (e.g., prospective studies of individuals found to develop alcohol use disorders) (for review, see Dick et al. 2010). Most narrowly, impulsivity can be

defined as a person's propensity to act on an arising impulse, but it is increasingly clear that a simple definition is inadequate and that impulsivity is most validly understood as a multi-faceted construct, encompassing several domains of personality and behavior (de Wit 2009; Evenden 1999). For example, as a personality trait, there is evidence that impulsivity can be fractionated into different domains: lack of premeditation (i.e., limited forethought), lack of perseverance (i.e., willingness to give up on a task), sensation-seeking (i.e., preference for exciting and stimulating experiences), and urgency (i.e., proneness to react to an emotional state) (Whiteside and Lynam 2001; Whiteside et al. 2005). Further, urgency can be further divided into negative and positive domains, with negative urgency reflecting reactivity to negative mood states and positive urgency reflecting reactivity to positive mood states (Cyders et al. 2007). These domains can be characterized using the UPPS-P questionnaire (Cyders et al. 2007; Whiteside and Lynam 2001).

From a behavioral standpoint, there are several ways to measure impulsivity. These include response inhibition tasks (e.g., Go/no-go task), resistance to distractor interference tasks (e.g., Eriksen Flanker task), resistance to proactive interference tasks (e.g., Brown-Peterson task), and distortions in elapsed time tasks (e.g., TIME paradigm), and delay response tasks (Dick et al. 2010). Due to the survey methodology in the current study, a delay response task was chosen from the performance-based impulsivity tasks. A delay discounting task measures how much a person devalues a reward based on having to wait for it (i.e., discounting of delayed rewards) (Reynolds et al. 2006; MacKillop et al. 2010). These tasks typically use dichotomous choices between smaller immediate rewards and larger delayed rewards to calculate a temporal discounting function reflecting how steeply rewards lose their value based on a delay (e.g., Rachlin et al. 1991). In terms of relationships among these diverse indices of impulsivity, although they are conceptually related, significant correlations are typically only found among impulsive personality traits, with the behavioral indices independent of personality measures and each other (de Wit 2009). For this reason, both a personality-based questionnaire and a hypothetical delay response two choice impulsivity paradigm were chosen in the present study to measure potentially different subfacets of the impulsivity construct.

Common across these different domains and to impulsivity as a superordinate construct is the notion of impulsivity as a powerful orientation to the present, reflecting a person's emphasis (or overemphasis) on "living in the here and now." In this way, it is similar to the concept of mindfulness, which, too, relates to a person's perspective on and experience of the present. Originating from Buddhist meditation techniques, mindfulness refers to a person's attention and reactivity to the present moment (Kumar 2002). It putatively comprises jointly observing experiential stimuli as they arise and accepting those sensations, emotions, and thoughts without judging them (Baer 2003). Like impulsivity, in contrast to early studies that suggested unidimensionality (Brown and Ryan 2004; MacKillop and Anderson 2007), mindfulness has been determined to be multi-dimensional in nature. In a recent factor analysis of five mindfulness questionnaires, five different domains of trait mindfulness: observing, describing, acting with awareness, nonjudging of inner experience, and nonreactivity to inner experience, were found to be predominant (Baer et al. 2006). These domains are measured by the Five Facet Mindfulness Questionnaire (FFMQ; Baer et al. 2006). On this measure, observing refers to noticing internal and external experiences (e.g., sensations, thoughts, emotions, perception). Describing assesses the ability to label emotions. Acting with awareness measures the ability to focus attention to the current task rather than attending to other things. Nonreactivity refers to the tendency to let thoughts and emotions come and go without reflecting too heavily on them or reacting to them. Finally, nonjudging is the tendency to experience thoughts and feelings without judging them or being critical of oneself for feeling a certain way.

While impulsivity and mindfulness have a present-centered focus in common, how and why the present is emphasized is markedly different in each. In mindfulness, emphasis on the present moment stems from acknowledging the natural impermanence of all things (for a review, see Marlatt 2002). Value is placed on awareness of actions including noticing *that* (i.e., observe) and *what* (i.e., describe) is experienced without judging it or behaving reactively. This emanates from the presumption that everything changes and impulses and desires of the present will come and go, reflecting the Buddhist foundations of the concept. Impulsivity, on the other hand, reflects overemphasis on the present and the immediate, without adequate consideration of the future, potential consequences of action, and potential rewards and benefits from inaction. Thus, impulsivity and mindfulness are natural reciprocals. Both measure how prone a person is to act on an arising impulse, as opposed to objectively experiencing it and not acting, but they are opposites in that greater impulsivity putatively reflects a greater likelihood of acting on an impulse and greater mindfulness putatively reflects a decreased likelihood of doing so. Moreover, from a measurement perspective, specific facets of impulsivity and mindfulness appear to be opposites: negative and positive urgency as the inverse of nonjudging experience and nonreactivity, lack of premeditation as the inverse of acting with awareness and nonreactivity. However, this is not always the case. Sensation-seeking and observing sensations and feelings appear to tap parallel concepts, and there do not appear to be obvious opposites or parallels for lack of perseverance, impulsive discounting of delayed rewards, or capacity to describe experiences in words.

Furthermore, in the case of the seeming reciprocals between mindfulness and impulsivity, it would be expected that the relationship between mindfulness and addictive behavior would be the inverse of what is found between addictive behavior and impulsivity (i.e., mindfulness should be negatively associated with addictive behavior so that greater mindfulness predicts less substance misuse). This has been supported by recent studies. Specifically, Fernandez et al. (2010) found that alcohol use was significantly negatively associated with the describe and act with awareness facets of mindfulness. Based on this, Fernandez et al. (2010) suggested that increased awareness may interrupt the impulsive behavioral tendencies related to hazardous drinking and addictive behavior. However, another study found mindfulness may well moderate the relationship between alcohol use and other behaviors, yet found negligible direct associations between alcohol misuse and mindfulness (Gallagher et al. 2010).

A number of studies have explored how impulsivity and mindfulness may be related to dysregulated behaviors, such as disinhibition in eating behavior (Lattimore et al. 2011), and clinical disorders, such as Borderline Personality Disorder (Wupperman et al. 2009; Wupperman et al. 2008; Miller et al. 2000). Nonetheless, despite the clear conceptual linkages, there has been scant research simultaneously examining impulsivity and mindfulness in relation to addictive behavior. This is important because measures of impulsivity and mindfulness may be complements to each other, with each uniquely predicting alcohol misuse and both constructs warranting attention and consideration. Alternatively, impulsivity or mindfulness may actually be redundant with one another, which would be problematic as studies could conceivably measure parallel processes but attribute significant relationships to different psychological factors, not the shared dimension.

To address these issues, the current study directly examined the relationship between mindfulness and impulsivity, and also examined both in relation to alcohol misuse. For maximum resolution of different discrete indices of both domains, we used the UPPS-P and a temporal discounting measure of delay discounting to assess impulsivity and the FFMQ to

assess mindfulness. Based on conceptual linkages and previous studies, we made the following *a priori* predictions:

- A. Impulsivity-Mindfulness Hypotheses: Both types of urgency (Negative and Positive Urgency¹) will have significant negative relationships with Nonjudging of Experience and Nonreactivity to Inner Experience; Sensation Seeking will have a significant positive relationship with Observing Sensations/Feelings/Thoughts; Lack of Premeditation will have a significant inverse relationship with Acting with Awareness, and Lack of Premeditation will have a significant negative association with Nonreactivity to Inner experience. No *a priori* hypotheses were made for the impulsivity index of Lack of Perseverance, discounting of delayed rewards, or the mindfulness index of Describe with Words.
- B. Impulsivity-Alcohol Hypotheses: Alcohol consumption and consequences will have significant positive associations with Lack of Perseverance, Lack of Premeditation, Sensation Seeking, Negative and Positive Urgency, and Delay Discounting (Cyders et al. 2009; Lynam and Miller 2004; Magid and Colder 2007; Fischer and Smith 2008; MacKillop et al. 2011).
- C. Mindfulness-Alcohol Hypotheses: Alcohol misuse will have significant inverse relationships with Act with Awareness and Describing Experience (Fernandez et al. 2010).

Finally, given the anticipated overlap, we attempted to disentangle these relationships and determine the prepotent independent elements of both concepts in relation to alcohol misuse.

Method

Participants

Participants were students at the University of Georgia ($N = 116$, Age $M = 20.3$ years, range: 18–23 years) who received research credit or extra credit for participating in research. Female participants (80.5%) reported consuming a mean of 7.6 ($SD = 6.8$) standard drinks per week and male participants reported consuming 14.1 ($SD = 11.1$) standard drinks per week. The sample is further characterized in Table 1.

Procedures

All study procedures were reviewed and approved by the Institutional Review Board. Participants attended group sessions during which they completed informed consent and paper and pencil format questionnaires. Questionnaires assessed demographics and other individual difference variables including impulsivity, alcohol use, and mindfulness.

Measures

Alcohol Use and Misuse—The primary measure of alcohol use and misuse was the Alcohol Use Disorders Identification Test (AUDIT; Babor et al. 2001), which has been extensively validated in diverse samples. The AUDIT is a 10-item measure and several studies have suggested that a 2-factor solution is most appropriate on the AUDIT with items 1–3 forming a consumption factor (AUDIT Consumption [AUDIT-C]) and items 4–10 forming a factor of adverse drinking consequences (AUDIT Adverse Drinking Consequences [AUDIT-ADC]) (Reinert and Allen 2007). Each response is given 0 to 4 points with higher overall scores indicating hazardous use. Level of alcohol *use* was defined

¹Note that we use lower case designations for discussion different conceptual aspects of impulsivity, but capitalized designations when referring to specific scales on the UPPS-P or FFMQ, which are proper nouns.

as AUDIT-C; level of alcohol *misuse* was defined as AUDIT-ADC. In addition, for an exact estimate of weekly drinking, the Drinking Days Questionnaire (DDQ; Collins et al. 1985), which assesses average alcohol consumption for each day of the week during the last year, was used.

UPPS-P Impulsivity Scale (Whiteside & Lynam, 2001; Cyders et al., 2007)—The UPPS-P is a 59-item measure which assesses five domains of impulsivity. The scales are 1) Negative Urgency; 2) Lack of Perseverance; 3) Lack of Premeditation; 4) Sensation Seeking, and 5) Positive Urgency. Each item is rated from 1 (*agree strongly*) to 4 (*disagree strongly*) with higher overall scores indicating greater impulsivity. The subscales of the UPPS-P were found to be highly reliable in this sample ($\alpha = .83$ to $.94$).

Monetary Choice Questionnaire (MCQ; Kirby et al. 1999)—The MCQ is a 27-item delay discounting measure that asks individuals to make hypothetical choices between smaller immediate rewards and larger delayed rewards. Delayed rewards fall into three magnitudes, but correlations among the magnitudes tend to be high (e.g., Kelly et al. in press), as was the case in this study ($r_s = .73-.82, p < .001$). Therefore, we used an overall delay discounting index of impulsive choice ratio (ICR)/percent of impulsive choices (e.g., Mitchell et al. 2005).

Five-Facet Mindfulness Questionnaire (FFMQ; Baer et al. 2006)—The FFMQ is a 39-question scale that looks at five facets of being mindful in daily life which was derived from five independent mindfulness questionnaires. The scales are 1) Non-reactivity to Inner Experience; 2) Observing Inner Experience; 3) Acting with Awareness; 4) Describing Experience; and 5) Nonjudging of Experience. Items are rated on a 5-point Likert-type scale from 1 (*never or very rarely true*) to 5 (*very often or always true*). Higher scores reflect higher levels of mindfulness. The subscales of the FFMQ were found to be highly reliable in this sample ($\alpha = .80$ to $.92$).

Data Analysis

For both *a priori* hypotheses and relationships in general, zero-order correlations (Pearson's r) were examined between impulsivity, as measured by the five UPPS-P impulsivity indices and the delay discounting index, and mindfulness, as measured by the five scales of the FFMQ. In addition, the relationships between these variables and the AUDIT-C and AUDIT-ADC subscales were assessed. A power analysis indicated the sample size was adequate to detect associations of $r = .26$ or higher (two-tailed $\alpha = .05, \beta = .80$), with 90% power for $r = .30$, 95% for $r = .35$, and 99% for $r = .40$. Seven *a priori* hypotheses were examined, each in relation to both alcohol use and misuse, and the remaining associations were examined for exploratory purposes. Given the relatively small number of measures used and paucity of previous work in this area, no family-wise error correction was made.

To clarify the interrelationships among variables, two exploratory strategies were employed. First, multiple regression was used to better understand how much variance mindfulness and impulsivity variables accounted for when predicting alcohol consumption and adverse consequences from drinking. Due to the highly intercorrelated nature of the variables, a hierarchical regression was deemed more appropriate than a model in which all variables were entered simultaneously. The order of the variables in each model was determined based on the magnitude of the zero-order associations. The variables were entered incrementally beginning with the mindfulness or impulsivity variable shown to have the strongest relationship with the alcohol variable of interest and ending with the smallest significant relationship. In the sequence, when a variable was found to contribute significantly to the model, that is account for a significant proportion of the variance after

controlling for the other relationships already in the model, it was retained in the model. If the variable did not significantly improve the model, it was removed and the next variable in the sequence was entered.

Following the multiple regression analysis, a relative weights analysis (RWA; Johnson 2000) was conducted to determine the relative importance of variables retained in each model found to predicting alcohol consumption and drinking consequences. Relative importance is defined as the contribution each predictor makes to the coefficient of determination. It is calculated by transforming the predictor variables to be orthogonal then considering the contribution each predictor makes uniquely and when considered incrementally with other predictors (Johnson and LeBreton 2004). A relative weights analysis is particularly useful when predictors are correlated (Johnson and LeBreton 2004). All analyses were conducted using SPSS 18.0 with a Type I error rate (α) set at $p = .05$.

Results

Zero-order associations among alcohol use and misuse, mindfulness, and impulsivity variables are provided in Table 2. Several of the *a priori* hypotheses were supported, but several others were not supported. In general, as predicted, positive associations were present between impulsivity and alcohol involvement, and negative associations were present between mindfulness and alcohol involvement. All UPPS-P and discounting indices were significant, although this was the case for only three of the five mindfulness indices. In addition, a number of other significant relationships were present within and across the FFMQ and UPPS-P. Notable features of the zero-order associations were that the largest magnitude associate with alcohol use and misuse was Negative Urgency, which was also significantly associated with most other variables at varying levels of magnitude, and delay discounting was significantly associated with heaviness of alcohol use but not with any other indices of impulsivity or aspects of mindfulness.

The hierarchical regressions are presented in Table 3. For each alcohol variable, seven independent variables were used. In the case of alcohol consumption, only three were retained in the final model: Positive Urgency, Negative Urgency, and Delay Discounting. In the case of adverse consequences of drinking, only two were retained in the final model: Negative Urgency and Lack of Premeditation. The relative weights analyses (Table 3) revealed that, for alcohol consumption, negative and positive urgency accounted for similar proportions variance (~40%), while delay discounting accounted for about half as much. For adverse consequences, Negative Urgency accounted for the majority of variance, whereas Lack of Premeditation accounted for approximately one third.

Discussion

The goal of the current study was to concurrently examine elements of impulsivity and mindfulness in relation to each other and in relation to alcohol use and misuse. Based on clear conceptual linkages and a small number of previous studies, a number of *a priori* hypotheses were tested and the majority were supported. For example, as predicted, the negative and positive urgency indices of impulsivity were inversely associated with the nonreactivity and nonjudgment dimensions of mindfulness. Thus, individuals who tend to act rashly when experiencing positive and negative mood states, tended to be less behaviorally sensitive to their inner experiences and less evaluative of their thoughts and feelings. This relationship may be, in part, due to the affective component inherent in positive and negative urgency, which may blur one's ability to react in a calm and rational way. As predicted, Lack of Premeditation was also negatively associated with nonreactivity to inner experience and acting with awareness, meaning that those who don't tend to think

and reflect on the consequences of an act before acting tend to be more likely to act on “automatic pilot,” and more likely to get carried away with their thoughts and feelings. Similarly, sensation seeking was positively associated with the mindfulness index of observing, meaning that those who tend to like exciting and/or new experiences also being more experientially aware of sensations, thoughts, and feelings.

With regard to alcohol use and misuse, most of the indices of impulsivity were significantly positively associated, as predicted. Previous research has demonstrated similar associations between impulsivity and alcohol use and problems (Magid and Colder 2007; Ruiz et al. 2003). This study found a significant relationship between alcohol consumption and sensation seeking, replicating previous research (Lynam and Miller 2004; Magid and Colder 2007), although sensation seeking was not associated with adverse consequences of drinking. Though fewer in number, several associations were also found between indices of mindfulness and alcohol involvement. Tendencies not to judge subjective experiences, not to react to inner experiences, and to be experientially aware of experiences were inversely associated with alcohol involvement. However, contrary to our predictions, the mindfulness dimensions of describing experiences was not associated with alcohol use, as has been previously reported (Fernandez et al. 2010), suggesting that there is some level of sample specificity to the relationships among these characteristics and variables. Given the overlapping relationships between impulsivity and mindfulness variables, several strategies were used to disentangle which measures were most relevant in predicting alcohol use and misuse. When taking interrelationships into account, reactivity to unpleasant mood states (Negative Urgency) was still consistently associated with both alcohol consumption and problems that result from drinking. Furthermore, acting hastily in response to positive mood states (Positive Urgency) and delay discounting were associated with alcohol consumption, whereas low levels of premeditation were associated with adverse consequences from drinking.

Taken together, an integration of these results suggests a number of conclusions. This study found evidence of highly variable associations among aspects of impulsivity and mindfulness, supporting the notion these traits are highly similar in terms of some elements and distinct in terms of others. Broadly speaking, impulsivity and mindfulness do appear to be related to each other as reciprocals, but do not appear to be redundant with one another. This is illustrated by the fact that, when examined together, elements of impulsivity predicted alcohol consumption and resulting consequences whereas the elements of mindfulness did not. With regard to impulsivity, proneness to act rashly when experiencing strong affective states, both positive and negative, and steep discounting of delayed rewards were uniquely associated with alcohol consumption. Interestingly, while being reactive to positive mood states was associated with alcohol consumption that was not the case for problems from drinking. In that domain, the tendency to act thoughtlessly when experiencing strong negative emotions and a tendency not to consider the consequences of one's actions were uniquely associated with alcohol-related problems. Thus, different profiles were associated with general drinking levels compared to the level of problems associated with drinking.

An interesting collateral finding is that this study did not find a relationship between personality-based impulsivity measures and delayed reward discounting. This is consistent with previous research demonstrating that these domains are not associated with one another and are independent characteristics of impulsivity (e.g., MacKillop et al. 2007). In other words, a person may be high on these personality traits, but not overvalue immediate rewards, or vice versa. This further supports the notion that the impulsivity construct may be better understood as heterogeneous, comprising a number of distinct facets (de Wit 2009).

Importantly, this suggests that conclusions based on aspect of impulsivity variables may not apply to others and the need for terminological precision in studies on impulsivity is high.

A second methodological implication comes from the findings is that, although elements of mindfulness were significantly correlated with alcohol use and misuse, these associations were fully accounted for by their relationship with aspects of impulsivity. This suggests that a potential risk in studies on mindfulness and alcohol use is to attribute relationships to mindfulness when they may in fact be better accounted for by aspects of impulsivity. This is a classic 'third variable' confound, in which a significant relationship between two variables is in fact spurious because it is actually a function of a unmeasured third variable. Thus, in future studies on mindfulness and alcohol use, it will be important to concurrently measure impulsivity to accurately capture the proximal antecedents. More generally, to understand these traits more clearly, further study of the intersection of impulsivity, mindfulness, and addictive behavior is warranted.

These conclusions are accompanied by a number of considerations. First, the study sample was of young adult drinkers from a college campus and was disproportionately female, meaning the generalizability of these findings to all drinkers or other addictive behaviors is by no means definitive. Second, the study was cross-sectional, meaning that although the natural inclination is to presume these putatively longstanding personality traits are responsible for alcohol misuse, the opposite is equally possible. For these reasons, caution should be exercised with regard to imputations of causality and longitudinal studies will be essential to definitively determine whether elements of impulsivity or mindfulness predate alcohol misuse. Third, several measurement issues warrant consideration. A methodological limitation was that, behavioral inhibition, a motor-based index of impulsivity (e.g., Go/NoGo; Marciszewski and Fillmore 2003) was not included in the present study, meaning that we cannot address its role in relation to mindfulness or the other variables. Related, the use of a hypothetical delay discounting measure may be considered a limitation, although research has supported a close association between discounting of hypothetical and actual monetary rewards (e.g., Madden et al. 2003). Finally, while the internal reliability of personality traits of mindfulness (FFMQ) and impulsivity (UPPS-P) have been demonstrated, few studies have focused on temporal stability. This is an important consideration given research showing that changes in impulsivity across time correspond to changes in problematic alcohol involvement (Littlefield et al. 2009).

Also of note was that although the current study was powered to detect significant associations for modest effect sizes, several findings were statistical trends that warrant discussion. One example is the overlap between Positive and Negative Urgency. Negative Urgency was highly correlated with Positive Urgency ($r = .74$), and only exhibited a trend-level impact on when predicting quantity and frequency of drinking, nonetheless, the relative weights analysis revealed that when disentangling their associations both predicted alcohol consumption nearly equally well, accounting for 39% and 37% of the total alcohol consumption variance accounted for by the model. Thus, although the two are highly correlated, these analyses suggest both shared variance and independent variance were associated with alcohol-involvement. However, the marginal levels of statistical significance make these conclusions far from definitive and a larger sample would have been necessary to unravel these relationships fully. Indeed, more generally, it is probable that a larger sample would even more clearly elucidate the prepotent elements of impulsivity and mindfulness, which is an important prospect for future studies.

Finally, even though mindfulness traits did not predict alcohol use and misuse when accounting for impulsivity traits, linkages between mindfulness and impulsivity were indeed present. As such, intervention designed to increase mindfulness may subsequently reduce

the forms of impulsivity that predict alcohol use and misuse. Successful mindfulness-based interventions (e.g., mindfulness-based stress reduction; Kabat-Zinn 1982, 1990) may be viable for reducing impulsivity when treating addictive behavior (e.g., Mindfulness-Based Relapse Prevention; Witkiewitz et al. 2005). Using mindfulness techniques, individuals may learn to observe their thoughts and feelings and react to them as dispassionate observers (Bishop et al., 2004). One mindfulness-based technique, known as urge surfing, may be useful for individuals who tend to experience strong impulses (high in urgency). The goal of urge surfing is for clients to visualize an urge as a wave and to “surf the urge by allowing it to pass without being wiped out by giving into it” (Marlatt, 2002, p. 47). In particular, using mindfulness-based approaches to improve coping with powerful affective states or cravings, improve premeditation, and decrease steep discounting of future rewards would seem to have promise. Moreover, it is highly plausible that individuals who are high in terms of impulsivity might disproportionately benefit from mindfulness interventions, suggesting impulsivity might be a treatment matching variable in this domain. In light of the current findings, each of these prospects reflects a promising future direction.

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References

- Babor, TF.; Higgins-Biddle, JC.; Saunders, JB.; Monteiro, MG. The Alcohol Use Disorders Identification Test: Guidelines for Use in Primary Health Care (WHO Publication No 016a). World Health Organization; Geneva, Switzerland: 2001.
- Baer RA. Mindfulness training as a clinical intervention: A conceptual and empirical review. *Clin Psychol-Science Pr.* 2003; 10(2):125–143.
- Baer RA, Smith GT, Hopkins J, Krietemeyer J, Toney L. Using self-report assessment methods to explore facets of mindfulness. *Assessment.* 2006; 13(1):27–45. [PubMed: 16443717]
- Baer RA, Smith GT, Lykins E, Button D, Krietemeyer J, Sauer S, et al. Construct validity of the five facet mindfulness questionnaire in meditating and nonmeditating samples. *Assessment.* 2008; 15(3): 329–342. [PubMed: 18310597]
- Bishop SR, Lau M, Shapiro S, Carlson L, Anderson ND, Carmody J, et al. Mindfulness: A proposed operational definition. *Clin Psychol-Science Pr.* 2004; 11(3):230–241.
- Breslin FC, Zack M, McMain S. An information-processing analysis of mindfulness: Implications for relapse prevention in the treatment of substance abuse. *Clin Psychol-Science Pr.* 2002; 9(3):275–299.
- Brown KW, Ryan RM. Perils and promise in defining and measuring mindfulness: Observations from experience. *Clin Psychol-Science Pr.* 2004; 11:242–248.
- Collins LR, Parks GA, Marlatt GA. Social determinants of alcohol consumption: The effects of social interaction and model status on the self administration of alcohol. *J Consult Clin Psych.* 1985; 53:189–200.
- Cyders MA, Smith GT, Spillane NS, Fischer S, Annus AM, Peterson C. Integration of impulsivity and positive mood to predict risky behavior: Development and validation of a measure of positive urgency. *Psychol Assessment.* 2007; 19:107–118.
- Cyders MA, Flory K, Rainer S, Smith GT. The role of personality dispositions to risky behavior in predicting first-year college drinking. *Addiction.* 2009; 104:193–202. [PubMed: 19149813]
- de Wit H. Impulsivity as a determinant and consequence of drug use: a review of underlying processes. *Addict Biol.* 2009; 14:22–31. [PubMed: 18855805]

- Dick DM, Smith G, Olausson P, Mitchell SH, Leeman RF, O'Malley SS, Sher K. Understanding the construct of impulsivity and its relationship to alcohol use disorders. *Addict Biol.* 2010; 15(2): 217–226. [PubMed: 20148781]
- Evenden JL. Varieties of impulsivity. *Psychopharmacology (Berl)*. 1999; 146:348–61. [PubMed: 10550486]
- Fernandez AC, Wood MD, Stein LAR, Rossi JS. Measuring mindfulness and examining its relationship with alcohol use and negative consequences. *Psychol Addict Behav.* 2010; 24(4):608–616. [PubMed: 21198223]
- Fischer S, Smith GT. Binge eating, problem drinking, and pathological gambling: Linking behavior to shared traits and social learning. *Pers Indiv Differ.* 2008; 44:789–800.
- Johnson JW. A heuristic method for estimating the relative weights of predictor variables in multiple regression. *Multi Behav Res.* 2000; 35:1–19.
- Johnson JW, LeBreton JM. History and use of relative importance indices in organizational research. *Organ Res Methods.* 2004; 7:238–257.
- Kabat-Zinn J. An outpatient program in behavioral medicine for chronic pain patients based on the practice of mindfulness meditation: Theoretical considerations and preliminary results. *Gen Hosp Psychiat.* 1982; 4:33–4.
- Kabat-Zinn, J. *Full catastrophe living: Using the wisdom of your body and mind to face stress, pain, and illness.* New York: Delacorte; 1990.
- Kirby KN, Petry NM, Bickel WK. Heroin addicts have higher discount rates for delayed rewards than non-drug-using controls. *J Exp Psychol.* 1999; 128:78–87.
- Kivlahan DR, Marlatt GA, Fromme K, Coppel DB, Williams E. Secondary prevention with college drinkers: Evaluation of an alcohol skills training program. *J Consult Clin Psychol.* 1990; 58:805–810. [PubMed: 2292630]
- Kumar SM. An introduction to Buddhism for the cognitive-behavioral therapist. *Cogn Behav Pract.* 2002; 9(1):40–43.
- Lattimore P, Fisher N, Malinowski P. A cross-sectional investigation of trait disinhibition and its association with mindfulness and impulsivity. *Appetite.* 2011; 56(2):241–248. [PubMed: 21146571]
- Littlefield A, Sher K, Wood P. Is “maturing out” of problematic alcohol involvement related to personality change? *J Abnorm Psychol.* 2009; 118(2):360–374. [PubMed: 19413410]
- Logan, GD. On the ability to inhibit thought and action: A user's guide to the stop-signal paradigm. In: Dagenbach, D.; Carr, TH., editors. *Inhibitory Processes in Attention, Memory, and Language.* Academic Press; San Diego: 1994. p. 189–239.
- Lynam DR, Miller JD. Personality pathways to impulsive behavior and their relations to deviance: Results from three samples. *J Quant Criminol.* 2004; 20:319–341.
- Lynam, DR.; Smith, GT.; Whiteside, SP.; Cyders, MA. Technical Report. West Lafayette: Purdue University; 2006. The UPPS-P: Assessing five personality pathways to impulsive behavior.
- MacKillop J, Amlung MT, Few LR, Ray LA, Sweet LH, Munafò MR. Delayed reward discounting and addictive behavior: a meta-analysis. *Psychopharmacology (Berl)*. in press.
- MacKillop J, Anderson EJ. Further psychometric validation of the Mindful Attention and Awareness Scale. *J Psychopathol Behav.* 2007; 29:289–293.
- MacKillop J, Mattson RE, Anderson EJ, Castelda BA, Donovan PJ. Multidimensional assessment of impulsivity in undergraduate hazardous drinkers and controls. *J Stud Alcohol Drugs.* 2007; 68:785–788. [PubMed: 17960295]
- MacKillop J, Miranda R, Monti PM, Ray LA, Tidey JW, Rohsenow DJ, Gwaltney GJ, McGeary JE, Swift RM. Alcohol demand, delayed reward discounting, and craving in relation to drinking and alcohol use disorders. *J Abnorm Psychol.* 2010; 119:106–114. [PubMed: 20141247]
- Magid V, Colder CR. The UPPS Impulsive Behavior Scale: Factor structure and associations with college drinking. *Pers Indiv Differ.* 2007; 43:1927–1937.
- Marlatt GA. Buddhist philosophy and the treatment of addictive behavior. *Cogn Behav Pract.* 2002; 9(1):44–49.

- Madden GJ, Begotka AM, Raiff BR, Kastern LL. Delay discounting of real and hypothetical rewards. *Exp Clin Psychopharmacol.* 2003; 11(2):139–145. [PubMed: 12755458]
- Marczinski CA, Fillmore MT. Preresponse cues reduce the impairing effects of alcohol on the execution and suppression of responses. *Exp Clin Psychopharmacol.* 2003; 11:110–117. [PubMed: 12622349]
- Miller AL, Wyman SE, Huppert JD, Glassman SL, Rathus JH. Analysis of behavioral skills utilized by suicidal adolescents receiving dialectical behavior therapy. *Cogn Behav Pract.* 2000; 7(2):183–187.
- Miller J, Schaffer R, Hackley SA. Effects of preliminary information in a Go versus No-go task. *Acta Psychol (Amst).* 1991; 76:241–92. [PubMed: 1927576]
- Mitchell JM, Fields HL, D’Esposito M, Boettiger CA. Impulsive responding in alcoholics. *Alcohol Clin Exp Res.* 2005; 29:2158–69. [PubMed: 16385186]
- Ostafin BD, Marlatt GA. Surfing the urge: Experiential acceptance moderates the relation between automatic alcohol motivation and hazardous drinking. *J Soc Clin Psychol.* 2008; 27(4):404–418.
- Petry NM. Delay discounting of money and alcohol in actively using alcoholics, currently abstinent alcoholics, and controls. *Psychopharmacology.* 2001; 154(3):243–250. [PubMed: 11351931]
- Preacher KJ, Hayes AF. SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behav Res Meth Ins C.* 2004; 36:717–731.
- Rachlin H, Raineri A, Cross D. Subjective probability and delay. *J Exp Anal Behav.* 1991; 55:233–44. [PubMed: 2037827]
- Reinert DF, Allen JP. The alcohol use disorders identification test: An update of research findings. *Alcohol Clin Exp Res.* 2007; 31:185–199. [PubMed: 17250609]
- Reynolds B, Ortengren A, Richards JB, de Wit H. Dimensions of impulsive behavior: Personality and behavioral measures. *Pers Indiv Differ.* 2006; 40(2):305–315.
- Ruiz MA, Pincus AL, Dickinson KA. NEO PI-R predictors of alcohol use and alcohol-related problems. *J Pers Assess.* 2003; 81:226–236. [PubMed: 14638447]
- Whiteside SP, Lynam DR. The Five Factor Model and impulsivity: Using a structural model of personality to understand impulsivity. *Pers Indiv Differ.* 2001; 30:669–689.
- Whiteside SP, Lynam DR. Understanding the role of impulsivity and externalizing psychopathology in alcohol abuse: application of the UPPS impulsive behavior scale. *Exp Clin Psychopharmacol.* 2003; 11:210–7. [PubMed: 12940500]
- Whiteside SP, Lynam DR, Miller JD, Reynolds SK. Validation of the UPPS impulsive behaviour scale: A four-factor model of impulsivity. *European Journal of Personality.* 2005; 19:559–574.
- Witkiewitz K, Marlatt GA, Walker D. Mindfulness-based relapse prevention for alcohol and substance use disorders. *J Cog Psychotherapy.* 2005; 19:211–228.
- Wupperman P, Neumann CS, Axelrod SR. Do deficits in mindfulness underlie borderline personality features and core difficulties? *J Pers Disord.* 2008; 22(5):466–482. [PubMed: 18834295]
- Wupperman P, Neumann CS, Whitman JB, Axelrod SR. The role of mindfulness in borderline personality disorder features. *J Nerv Mental Dis.* 2009; 197(10):766–771.

Table 1

Participant characteristics.

Variable	<i>M (SD)</i>	Percent
Gender		
Male		19.5%
Female		80.5%
Race		
White		86.2%
Black		2.6%
Asian		3.4%
Mixed		3.4%
Other		3.4%
Age	20.3 (1.3)	
Drinks Per Week	8.8 (8.2)	
AUDIT Score	7.4 (5.3)	

Note. AUDIT = Alcohol Use Disorder Identification Task

Table 2

Associations among indices of alcohol misuse, mindfulness, and impulsivity.

Alcohol Misuse			Mindfulness				Impulsivity					
AUDIT			FFMQ				UPPS-P				MCQ	
C	ADC	Observe	Describe	Aware	Non Judge	Non React	Pos Urge	Neg Urge	Sens Seek	Premed	Persev	Delay Dis
AUDITC	1.00	.60***	0.15	-0.06 ^b	-.23*	-.012	.40*** ^a	.40*** ^a	.18* ^a	.31*** ^a	.21* ^a	.26*** ^a
AUDITADC	1.00	1.00	0.06	-0.14 ^b	-.21*	-.31***	.47*** ^a	.55*** ^a	0.12 ^b	.41*** ^a	.35*** ^a	0.12 ^b
Observe		1.00	0.14	0.14	-.42***	.23*	0.14	0.16 [†]	.20*	-.017 [†]	0.06	0.07
Describe			1.00	.29**	.18*	.30**	-.27**	-.25**	-.003	-.21*	-.32***	0.09
Aware				1.00	.54***	.24**	-.32***	-.45***	-.018 [†]	-.016 [†]	-.33***	0.06
NonJudge					1.00	.27**	-.29**	-.46***	-.006	0.08	-.21*	-.009
NonReact						1.00	-.24**	-.39***	0.05	-.22*	-.23*	-.003
Pos Urge							1.00	.74***	0.15	.43***	.51***	0.15
Neg Urge								1.00	0.16 [†]	.50***	.49***	0.10
Sens Seek									1.00	0.18 [†]	-.007	-.001
Premed										1.00	.48***	0.17 [†]
Persev											1.00	-.001
Delay Dis												1.00

Notes: Zero order correlations are presented. AUDIT = Alcohol Use Disorder Identification Task; Quant/Freq = AUDIT Quantity/Frequency; Conseq = AUDIT Adverse Consequences of Drinking; FFMQ = Five-Facet Mindfulness Questionnaire; Observe = FFMQ Observing Inner Experience; Describe = FFMQ Describing Experience; Aware = FFMQ Acting with Awareness; NonJudge = FFMQ Nonjudging of Experience; NonReact = FFMQ Non-reactivity to Inner Experience; Pos Urge = UPPS-P Positive Urgency; Neg Urge = UPPS-P Negative Urgency; Sens Seek = UPPS-P Sensation Seeking; Premed = UPPS-P Lack of Premeditation; Persev = UPPS-P Lack of Perseverance; MCQ = Monetary Choice Questionnaire; Delay Dis = Delay Discounting Impulsive Choice Ratio;

[†] $p < .10$,

* $p < .05$,

** $p < .01$,

*** $p < .001$;

a priori hypothesis supported,
b priori hypothesis not supported.

Table 3

Hierarchical regression and relative weights analysis of the relationships between indices of mindfulness and impulsivity in relation to alcohol consumption (AUDIT-C) and adverse consequences (AUDIT-ADC). Order of entry was determined by the magnitude of the associations in zero-order correlations. Variables that did not significantly increase the coefficient of determination were not retained in subsequent models. Relative weights analysis characterized the relative contribution of a variable to the final model.

AUDIT Consumption				AUDIT Adverse Consequences of Drinking			
R ²	R ² /ΔR ²	p	RW of R ²	R ²	R ² /ΔR ²	p	RW of R ²
1. PU	.40	.16	<.001	1. NU	.55	.29	<.001
2. NU	.40	.02	.08	2. PU	.47	--	.22
3. PM	.31	--	.18	3. PM	.41	.03	.04
4. DD	.26	.04	.01	4. PS	.35	--	.56
5. NJ	-.23	--	.48	5. Aware	-.33	--	.17
6. PS	.21	--	.98	6. NR	-.31	--	.19
7. SS	.18	--	.15	7. NJ	-.21	--	.73
Total = .22				Total = .32			

Note. AUDIT= Alcohol Use Disorder Identification Test; RW = Relative Weight; PU = UPPS-P Positive Urgency; NU = UPPS-P Negative Urgency; PM = UPPS-P (lack of) Premeditation; DD = Delay Discounting Monetary Choice Questionnaire Impulsive Choice Ratio; NJ = Five-Facet Mindfulness Questionnaire Nonjudging of Experience; PS = UPPS-P Perseverance; Sens Seek = UPPS-P Sensation Seeking; Aware = Five-Facet Mindfulness Questionnaire Acting with Awareness; NR = Five-Facet Mindfulness Questionnaire Non-reactivity to Inner Experience. As entry was determined by zero-order correlations, PU was entered before NU for AUDIT Consumption due to a slightly larger zero-order correlation not detectable here due to rounding of digits.