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The “What” and the “How” of Dispositional Mindfulness: Using Interactions Among Subscales of the Five-Facet Mindfulness Questionnaire to Understand Its Relation To Substance Use

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Abstract

Although self-report measures of dispositional mindfulness have good psychometric properties, a few studies have shown unexpected positive correlations between substance use and mindfulness scales measuring observation of present-moment experience. The current study tested the hypothesis that the relationship between present-moment observation and substance use is moderated by the tendency to be nonjudgmental and nonreactive toward the observed stimuli. Two hundred and ninety-six undergraduates completed the Five-Facet Mindfulness Questionnaire (FFMQ), a calendar measuring periods of substance use, and a measure of the Five-Factor Model of personality. Controlling for FFMQ and personality subscales, significant interactions between the *observing* and *nonreactivity* subscales indicated that the *observing* subscale was negatively associated with substance use at higher levels of nonreactivity but positively associated with periods of substance use at lower levels of nonreactivity. Results support the use of statistical interactions among FFMQ subscales to test for the presence of interactive effects of different aspects of mindfulness.

Keywords

mindfulness; construct validity; substance use; alcohol use; tobacco use; Five-Facet Mindfulness Questionnaire

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Self-Report Assessment of Mindfulness and the Five-Facet Mindfulness Questionnaire

Mindfulness refers to nonjudgmental present-moment awareness of internal and external stimuli. It can be cultivated through meditation and behavioral skills training, and a large treatment literature shows that these procedures have beneficial effects on a range of disorders, including substance use disorders (Keng, Smoski, & Robins, 2011; Zgierska et al.,

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2009). Mindfulness has also been conceptualized as a dispositional characteristic that varies in the general population, and several self-report measures of mindfulness have been developed. A growing body of literature suggests that such measures are psychometrically sound, and that higher levels of self-reported dispositional mindfulness are associated with adaptive functioning (Baer, 2011).

Of these self-report measures, the Five-Facet Mindfulness Questionnaire (FFMQ; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006) is among the most widely used and may provide the most comprehensive coverage of the general tendency to be mindful in daily life. The 39-item scale is composed of five unidimensional subscales that were derived through factor analysis of preexisting scales; therefore, each facet is intended to measure one of five aspects of mindfulness: *observing* (noticing internal and external experiences), *describing* (labeling experiences with words), *acting with awareness* (attending to one's present activities and avoiding automatic pilot), *nonjudging of inner experience* (taking a nonevaluative stance toward internal phenomena), and *nonreactivity to inner experience* (allowing thoughts and feelings to come and go, without getting carried away by them). Mindfulness as measured by the FFMQ is conceptualized as a relatively stable dispositional characteristic that is not expected to change greatly unless an individual engages in mindfulness training. Scores on the FFMQ are correlated in the expected directions with numerous variables, including psychological symptoms and well-being, thought suppression, experiential avoidance, and emotion regulation, among others (Baer et al., 2006; Baer et al., 2008; Bränström, Kvillemo, Brandberg, & Moskowitz, 2010; Carmody & Baer, 2008).

The Mindfulness–Substance Use Link and the Debate Over the Validity of Self-Report Assessment of Mindfulness

There are many reasons to expect that dispositional mindfulness as measured by self-report instruments should be associated with less substance use. First, preliminary evidence from treatment outcome studies suggests that mindfulness training may lead to fewer episodes of relapse and fewer negative consequences of substance use (Zgierska et al., 2009). Second, the attentional and behavioral control associated with mindfulness may facilitate disruption of maladaptive thought and behavior chains that may lead to substance use (Jha, Krompinger, & Baime, 2007; van Vugt & Jha, 2011). Finally, mindfulness is linked to less fear and avoidance of internal experiences such as emotions and cognitions, and may therefore reduce substance use motivated by the desire to avoid unpleasant thoughts and feelings (Baer et al., 2006).

Despite these considerations, studies examining the association of dispositional mindfulness with substance use show mixed findings, with some linking mindfulness to greater use. In one cross-sectional study of 196 college students, Leigh, Bowen, and Marlatt (2005) found that smokers and binge drinkers scored higher than nonusers on the Freiburg Mindfulness Inventory; this pattern was attributable to a subscale of the FMI measuring mind–body awareness. In a sample of 212 students, Leigh and Neighbors (2009) found that the mind–body awareness subscale of the FMI was again related to greater self-reported alcohol use. Although the FMI has not been fully validated for use in student samples, such findings remain inconsistent with theory and evidence suggesting that dispositional mindfulness is generally beneficial and that mindfulness training is generally associated with less substance use.

Recently, these unexpected links between levels of mind–body awareness and greater substance use have been referenced in a broader debate regarding the validity of self-report mindfulness instruments. Some have argued that self-report mindfulness questionnaires relate to substance use in unexpected ways because they actually measure constructs

tangentially related to mindfulness rather than the traditional Buddhist construct of mindfulness (Grossman, 2008, 2010; Grossman & Van Dam, 2011). These authors state that the “synergistic and mutually reinforcing” nature of the various aspects of mindfulness cannot be captured using the unidimensional subscales that constitute measures such as the FFMQ (Grossman & Van Dam, 2011, p. 220).

Questionnaire items asking respondents to report on how much they tend to observe their present-moment experiences may be interpreted differently depending on the respondent’s level of meditation experience (Baer, 2011; Baer et al., 2006). Experienced meditators may be more likely to interpret *observing* to mean attending to experience in a nonjudgmental and nonreactive way (consistent with mindfulness) whereas nonmeditators may not imbue *observing* items with such mindful qualities of attention. Nonmeditators who consistently observe their inner experiences in reactive or judgmental ways may be more likely to ruminate about them or to try to avoid them through maladaptive behaviors such as substance abuse. It stands to reason, then, that subscales or measures designed to capture observation *only* would not necessarily behave in expected ways (i.e., as a protective factor for substance use) in nonmeditating samples.

A Potential Solution: Combining the What and the How of Mindful Attention

Some authors have argued that because the construct of mindfulness is characterized by “multifarious interacting factors,” it may be too complex to be accurately studied using self-report instruments (Grossman & Van Dam, 2011, p. 223). On the other hand, the good psychometric properties of the FFMQ may be exploited to better understand such interactive mindfulness processes. The *observing* subscale of the FFMQ is designed to assess *only* the tendency to notice experiences (i.e., the “what” of mindfulness), without consideration of the *quality* of attention, while the *nonjudging* and *nonreactivity* subscales are designed to assess *only* tendencies to take a nonevaluative or nonattached stance toward what is observed, respectively (i.e., the “how” of mindfulness). Therefore, it is possible that some complex mindfulness processes can be best understood through interactions among the subscales of instruments such as the FFMQ. Such real-world interactions among the facets of mindfulness can be represented statistically; for example, interaction terms created by taking the product of two FFMQ subscales (e.g., *observing* × *nonreactivity*) may predict substance use over and above the additive predictive abilities of these subscales.

The Present Study

The current study tested the hypothesis that in a nonmeditating sample, the effect on substance use of the quantity of attention paid to internal and external stimuli (as measured by the *observing* subscale of the FFMQ) is moderated by the tendency to be nonreactive and nonjudgmental toward one’s experiences (as measured by the *nonreactivity* and *nonjudging* subscales of the FFMQ). Because previous work has linked greater substance use specifically to aspects of mindfulness consistent with the *observing* facet of the FFMQ, the current study did not examine potential moderation of other mindfulness variables related to quantity of mindfulness (i.e., the *describing* or *acting with awareness* subscales of the FFMQ).

The present investigation also controlled for personality traits as defined by the Five-Factor Model (FFM; *neuroticism*, *extraversion*, *openness*, *agreeableness*, and *conscientiousness*; Costa & McCrae, 1992) in all analyses. Basic personality traits are known to be associated with substance use (Booth-Kewley & Vickers, 1994; see Kotov, Gamez, Schmidt, & Watson, 2010); therefore, we controlled for these personality variables to examine whether mindfulness facets or their products predict substance use *over and above* such traits. We predicted that the product of the *observing* and *nonreactivity* subscales and the product of

the *observing* and *nonjudging* subscales would each uniquely predict lower rates of tobacco and alcohol use, controlling for FFM personality traits and the FFMQ subscales.

Method

Participants and Recruitment

Participants were 296 introductory psychology students who completed the study in partial fulfillment of course requirements during the 2009–2010 academic year. Participants' ages ranged from 18 to 26 years ($M = 18.48$ years, $SD = 0.91$), and women constituted 54.7% of this sample. The racial and ethnic characteristics of participants were as follows: 77.4% White/Caucasian, 14.9% African American, 2.7% Asian, 2.7% Biracial, 1.7% Hispanic/Latino(a), 0.3% Native Hawaiian/Pacific Islander, and 0.3% Other.

As part of the general recruitment process, introductory psychology students completed a screening measure designed to identify individuals at elevated risk for substance use by asking whether they had engaged in a number of delinquent acts. Individuals were contacted to take part in the study if they scored in the top 25% of their gender on the screening measure, resulting in an oversampling of at-risk individuals. Approximately 19% of the current sample was recruited through the screening procedure. The rest of the sample consisted of first-year students also enrolled in introductory psychology courses.

Measures

Five-Facet Mindfulness Questionnaire—The FFMQ is a 39-item self-report questionnaire created through factor analysis of previously existing self-report mindfulness measures, including the Freiburg Mindfulness Inventory (Buchheld, Grossman, & Walach, 2001), the Mindful Attention and Awareness Scale (Brown & Ryan, 2003), the Mindfulness Questionnaire (later published as the Southampton Mindfulness Questionnaire; Chadwick et al., 2008), the Kentucky Inventory of Mindfulness Skills (Baer, Smith, & Allen, 2004), and the Cognitive and Affective Mindfulness Scale (Feldman, Hayes, Kuman, Greeson, & Laurenceau, 2007). It is designed to measure five facets of mindfulness: *observing*, *describing*, *acting with awareness*, *nonjudging of inner experience*, and *nonreactivity to inner experience* (Baer et al., 2006). Participants indicate the degree to which each item applies to them using a 5-point Likert-type scale (1 = *never or very rarely true*, 5 = *almost always or always true*). The present study used only the *observing*, *nonjudging*, and *nonreactivity* subscales. Subscales demonstrated good to acceptable internal consistency (α *observing* = .76, α *nonjudging* = .88, α *nonreactivity* = .70). Furthermore, descriptive statistics for each subscale, which can be found in Table 1, were comparable with those reported in other studies of mindfulness and substance use (e.g., Fernandez, Wood, Stein, & Rossi, 2010).

Five-Factor Model Rating Form—The Five-Factor Model Rating Form (FFMRF) asks participants to rate themselves on the 30 facets of the FFM of personality (Mullins-Sweatt, Jamerson, Samuel, Olson, & Widiger, 2006). Each item is rated on a 5-point Likert-type scale, where 1 is *extremely low* and 5 is *extremely high*. Individual facets were combined to construct the FFM domains: *neuroticism*, *extraversion*, *openness to experience*, *agreeableness*, and *conscientiousness*. Although the *neuroticism* and *conscientiousness* subscales demonstrated adequate internal consistencies in the present sample (α s = .71 and .70, respectively), internal consistencies for the *extraversion*, *openness*, and *agreeableness* were somewhat lower (α s = .68, .64, and .61, respectively) but were consistent with the previously reported psychometric properties of this short form scale (Mullins-Sweatt et al., 2006). Descriptive statistics for each scale, which can be found in Table 1, are consistent with those provided in the normative sample (Mullins-Sweatt et al., 2006).

Life history calendar—The Life History Calendar (LHC) is a retrospective method for collecting data on a wide range of life events and behaviors (Caspi et al., 1996). The LHC attempts to contextualize the past in terms of grade in school, place of residence, and peer group in order to facilitate more accurate recall. It is completed in collaboration with an interviewer. Participants were asked to report on their substance use behaviors from the age of 13 years to the time of testing. Each year was divided into three 4-month periods, where rows corresponded to different substance use behaviors of interest and columns represented blocks of time. In the present study, the LHC was used to examine lifetime patterns of tobacco and alcohol use only. Specifically, we examined the total number of 4-month periods between the age of 13 years and the present for which participants reported the occurrence of the following four behaviors: any cigarette use, heavy cigarette use (typically smoking ½ pack or more daily), any alcohol use, and heavy alcohol use (typically drinking five or more drinks per sitting). The strong reliability and validity of the LHC have been documented in previous studies relating data from the LHC to adult personality and psychopathology (e.g., Flory, Lynam, Milich, Leukefeld, & Clayton, 2004; Lynam & Miller, 2004; Miller & Lynam, 2003).

Procedure

The current study is part of a larger longitudinal project designed to assess multiple predictors of substance use and abuse in young adults. Thus, any questionnaires and tasks not listed in this article are available on request.

Participants were individually invited to the laboratory to complete an experiment lasting approximately 2.5 to 3.0 hours. At the beginning of each session, informed consent was explained and acquired. Next, a saliva drug test (Accutest SalivaScreen-5: Jant Pharmacal Corporation, Encino, CA) and field sobriety test were administered. Participants who did not pass the saliva drug test or field sobriety test were asked to reschedule the session. Following these tests, participants completed a variety of computer-based questionnaires, computer-based behavioral tasks, and computer-assisted structured interviews assessing substance use behaviors. Questionnaires and tasks were alternated during the protocol to minimize participant boredom. A 5-minute break was given at the halfway point during the study. At the end of the session, participants were debriefed and given a summary form that provided information regarding the purpose of the study. For their participation, students received \$30 and research participation credit for an introductory psychology class.

Results

Preliminary Data Screening and Analyses

Descriptive statistics for primary study variables can be found in Table 1. All FFM and FFMQ variables were approximately normally distributed. However, the dependent measures were heavily positively skewed and exhibited both more zeroes and greater dispersion than would be compatible with Poisson regression models. Therefore, zero-inflated negative binomial (ZINB) regression models were used in multivariate analyses.¹ When the inflation intercept could not be estimated, we fit negative binomial (NB) regression models instead.

Planned Hypothesis Tests

ZINB or NB regression models were fit in SAS PROC COUNTREG, regressing each of the substance use variables (periods of alcohol use, periods of heavy alcohol use, periods of tobacco use, and periods of heavy tobacco use) onto the FFM variables (*neuroticism*, *extraversion*, *openness*, *agreeableness*, and *conscientiousness*) in Step 1, the FFM variables plus the three relevant FFMQ variables (*observing*, *nonreactivity*, and *nonjudging*) in Step 2,

and the preceding plus the products of *observing* with *nonjudging* and *observing* with *nonreactivity* in Step 3. All continuous predictors were standardized prior to use in regression models. Regression results, presented in tables that follow, also include *p* values for changes in log likelihood (a measure of model fit) in proceeding from Step 1 to Step 2 and from Step 2 to Step 3.

Regression Models Predicting Periods of Alcohol Use

Results of ZINB models for lifetime periods of alcohol use appear in Table 2. Among the five factors of personality, *neuroticism* and *extraversion* were each significant predictors of greater lifetime periods of alcohol use (*neuroticism*, estimated $\beta = .087$, $SE = .041$, $t = 2.11$, $p = .034$; *extraversion*, estimated $\beta = .16$, $SE = .045$, $t = 3.56$, $p = .0003$), such that a 1-*SD* increase in *neuroticism* increased mean periods of alcohol use by an estimated 9.08% while a 1-*SD* increase in *extraversion* increased mean periods of alcohol use by an estimated 17.35%. Although neither *observing* nor *nonreactivity* significantly predicted periods of alcohol use when the other variable was at its mean level (*observing*, estimated $\beta = .0044$, $SE = .045$, $t = 0.10$, $p = .92$; *nonreactivity*, estimated $\beta = .015$, $SE = .043$, $t = 0.36$, $p = .72$), there was a significant interaction between *observing* and *nonreactivity* (estimated $\beta = -.082$, $SE = .042$, $t = -1.99$, $p = .050$), such that the association between either variable and periods of heavy alcohol use became more negative when the other variable was above its mean. For example, a 1-*SD* increase in *observing* reduced mean periods of alcohol use by an estimated 7.49% ($p = .052$) when *nonreactivity* was 1 *SD* above its mean but increased mean periods of alcohol use by an estimated 9.10% ($p = .04$) when *nonreactivity* was 1 *SD* below its mean; see Figure 1 for a graphical representation.

The *p* values for changes in log likelihood from Step 1 to Step 2 and from Step 2 to Step 3 were .89 and .18, respectively. The latter *p* value appears to belie the significant interaction between *observing* and *nonreactivity*. However, the .18 is a verdict on the two interactions collectively, and the interaction between *observing* and *nonjudging* did not approach significance. Taken together, these results suggest that a model different from any of those fit in Steps 1, 2, and 3 may be best for prediction. In particular, *nonjudging* might be removed altogether whereas the interaction between *observing* and *nonreactivity* might be retained. Determining an optimal model was beyond the scope of this research, though, as we sought to answer specific research questions through our planned hypothesis tests.

Regression Models Predicting Periods of Heavy Alcohol Use

Initial ZINB modeling for periods of heavy alcohol use resulted in a failure to estimate the inflation intercept, indicating that the ZINB framework is not the most appropriate for

¹A Poisson regression model expresses the mean of the dependent variable as an exponentiated linear combination of independent variable values and assumes that the variation of the dependent variable about its mean is described by a Poisson distribution. As such, a Poisson regression model is often considered for data analysis when the dependent variable values are nonnegative integers. However, the assumption that the aforementioned variation is described by a Poisson distribution is not always realistic. One common violation of this assumption arises when the magnitude of the variation is too large to be compatible with a Poisson distribution, which constrains the standard deviation to equal the square root of the mean. Another common violation arises when the relative frequency with which the dependent variable equals zero is too large to be compatible with a Poisson distribution, which constrains this relative frequency to equal the reciprocal of the exponentiated mean. The former violation is often addressed by replacing the Poisson distribution with a negative binomial (NB) distribution, which allows the standard deviation to exceed the square root of the mean, yielding a NB regression model. The latter violation is often addressed by replacing the Poisson distribution with a zero-inflated Poisson distribution, which allows the relative frequency of zeros to exceed the reciprocal of the exponentiated mean, yielding a zero-inflated Poisson regression model. If both violations are present, then one may replace the Poisson distribution with a zero-inflated NB distribution, yielding a zero-inflated NB regression model. When analyzing data in practice, one may decide which type of regression model to employ by identifying which type yields the most favorable value of an information-theoretic criterion, such as the AIC. For each type of regression model, the interpretation of a regression coefficient remains the same as in Poisson regression (provided that the zero-inflation factor, if applicable, is taken to be a constant, which is true in this article), namely that the exponentiated regression coefficient equals the factor by which the mean of the dependent variable is multiplied when the value of the corresponding independent variable is increased by one unit while the values of all other independent variables are unchanged.

testing this model. We proceeded by fitting NB models instead. The results of NB modeling for periods of heavy alcohol use appear in Table 3. Among the five factors of personality, *extraversion* was the only significant predictor (estimated $\beta = .35$, $SE = .11$, $t = 3.18$, $p = .0009$), such that a 1-*SD* increase in *extraversion* increased mean periods of heavy alcohol use by an estimated 41.90%. Although neither *observing* nor *nonreactivity* significantly predicted periods of heavy alcohol use when the other variable was at its mean level (*observing*, estimated $\beta = -.12$, $SE = .12$, $t = -1.01$, $p = .31$; *nonreactivity*, estimated $\beta = .019$, $SE = .11$, $t = 0.17$, $p = .86$), there was a significant interaction between *observing* and *nonreactivity* (estimated $\beta = -.25$, $SE = .12$, $t = -2.08$, $p = .03$), such that the association between either variable and periods of heavy alcohol use became more negative when the other variable was above its mean. For example, a 1-*SD* increase in *observing* reduced mean periods of alcohol use by an estimated 30.90% ($p = .02$) when *nonreactivity* was 1 *SD* above its mean but did not influence periods of heavy alcohol use when *nonreactivity* was 1 *SD* below its mean ($p = .95$); see Figure 2 for a graphical representation. The p values for changes in log likelihood from Step 1 to Step 2 and from Step 2 to Step 3 were .74 and .11, respectively.

Regression Models Predicting Periods of Tobacco Use

Results of ZINB modeling for periods of tobacco use appear in Table 4. Among the five factors of personality, only *agreeableness* was a significant predictor (estimated $\beta = -.27$, $SE = .10$, $t = -2.67$, $p = .0075$), such that a 1-*SD* increase in *agreeableness* decreased mean periods of tobacco use by an estimated 23.66%. Although neither *observing* nor *nonreactivity* significantly predicted periods of tobacco use when the other variable was at its mean level (*observing*, estimated $\beta = -.056$, $SE = .093$, $t = -0.60$, $p = .55$; *nonreactivity*, estimated $\beta = -.16$, $SE = .09$, $t = -1.75$, $p = .07$), there was a significant interaction between *observing* and *nonreactivity* (estimated $\beta = -.24$, $SE = .11$, $t = -2.21$, $p = .02$), such that the association between either variable and periods of tobacco use became more negative when the other variable was above its mean. For example, a one-unit increase in *observing* reduced mean periods of tobacco use by an estimated 25.01% ($p = .01$) when *nonreactivity* was 1 *SD* above its mean but did not influence periods of tobacco use when *nonreactivity* was 1 *SD* below its mean ($p = .66$); see Figure 3 for a graphical representation. The p values for changes in log likelihood from Step 1 to Step 2 and from Step 2 to Step 3 were .11 and .10, respectively.

Regression Models Predicting Periods of Heavy Tobacco Use

Results of ZINB modeling for periods of heavy tobacco use appear in Table 5. Among the five factors of personality, *openness*, *agreeableness*, and *conscientiousness* were all significant predictors (estimated *openness* $\beta = .85$, $SE = .28$, $t = 3.01$, $p = .0026$; estimated *agreeableness* $\beta = -.61$, $SE = .20$, $t = -3.02$, $p = .0025$; estimated *conscientiousness* $\beta = .36$, $SE = .18$, $t = 1.99$, $p = .046$), such that a 1-*SD* increase in *openness* increased mean periods of heavy tobacco use by an estimated 133.96%, a 1-*SD* increase in *agreeableness* decreased mean periods of heavy tobacco use by an estimated 45.66%, and a 1-*SD* increase in *conscientiousness* increased mean periods of heavy tobacco use by an estimated 43.33%. However, neither the individual mindfulness facets nor their products (i.e., *observing* $\times$ *nonjudging* and *observing* $\times$ *nonreactivity*) predicted periods of heavy tobacco use. The p values for changes in log likelihood from Step 1 to Step 2 and from Step 2 to Step 3 were .30 and .21, respectively.

Discussion

Recent studies using self-report measures of mindfulness have found that dispositional mindfulness—particularly as measured by a subscale of the Freiburg Mindfulness Inventory

reflecting mind–body awareness—is unexpectedly associated with greater substance use in college students (Leigh et al., 2005; Leigh & Neighbors, 2009). Such findings have been cited by authors who question the validity of self-report mindfulness questionnaires and call for the discontinuation of their use in the study of mindfulness (e.g., Grossman & Van Dam, 2011). The present study investigated the link between substance use and self-reported mindfulness by examining the interaction between quantity of attention to present-moment experience (as measured by the *observing* subscale of the FFMQ) and the quality of this attention (as measured by the *nonreactivity* and *nonjudging* subscales of the FFMQ). Results indicated that (a) *observing* was associated with fewer periods of tobacco use and alcohol use only at higher levels of *nonreactivity* and (b) *observing* was associated with more periods of heavy alcohol use at lower levels of *nonreactivity* but was associated with fewer periods of heavy alcohol use at higher levels of *nonreactivity*.

These findings have implications for the use of self-report mindfulness questionnaires. Specifically, interaction terms created by taking the product of two FFMQ subscales may allow one to examine not only *how much* a person is attending to present-moment experience and *how* he or she relates to this experience but also whether the association of one of these aspects of mindfulness with the outcome of interest depends on the other. In the example of the current study, although including both the *observing* and *nonreactivity* subscales as predictors of substance use allows one to estimate the additive effects of these two aspects of mindfulness, inclusion of the product of these two variables allows one to determine whether the association of *observing* with substance use depends on levels of *nonreactivity* (and vice versa). These insights may help us understand why mindfulness as measured in previous substance use studies (i.e., observation items only without reference to the quality of observation) predicts greater substance use. While observation with a nonreactive quality may predict less substance use, more *reactive* forms of observation—such as rumination or other forms of dysfunctional self-focused attention—may predict more use.

Evidence of an interaction between the *observing* and *nonreactivity* subscales suggests that high levels of both *observation* of present-moment experience and *nonreactivity* to observed experience are important in protecting against alcohol and tobacco use. Although the general tendency to attend to experiences may increase risk for substance use or be unrelated to use (Fernandez et al., 2010; Leigh et al., 2005; Leigh & Neighbors, 2009), the tendency to attend nonreactively appears to protect against use. This finding lends some support to the idea that mindfulness may protect against use by preventing or reducing experiential avoidance patterns that strengthen substance use behaviors through negative reinforcement: for example, when substances are used in reaction to a negative mood. A mindful approach to a negative mood, in contrast, would include nonreactive observation of the present-moment experience and a deliberate choice of response rather than an automatic or impulsive use of substances. This may suggest the importance of emphasizing the combination of “what” and “how” mindfulness skills in the context of mindfulness training, particularly when the focus of that training is on improving substance-related outcomes. The “what” and “how” of mindfulness skills are an explicit part of dialectical behavior therapy, which recently has been applied to substance misuse (McMain, Sayrs, Dimeff, & Linehan, 2007) and are implicit in other mindfulness-based treatments.

Contrary to our hypothesis, the product of the *observing* and *nonjudging* subscales of the FFMQ did not predict substance use. There are several possible explanations for this: First, *nonjudging* may be a less important quality of mindful observation than is *nonreactivity*. Second, *nonreactive* observation may simply be more effective in preventing substance use than *nonjudgmental* observation. Finally, it may be that *nonjudgmental* observation is

subsumed in low *neuroticism*, high *openness*, or some other covariate, whereas *nonreactive* observation is not.

The failure of the product of *observing* and *nonreactivity* to predict heavy tobacco use suggests that the pathways leading to heavy tobacco use may differ from the pathways leading to alcohol and less heavy tobacco use. Low *agreeableness* was the strongest predictor of heavy tobacco use, which may indicate that a disregard for social norms may be very strongly predictive of heavy tobacco use prior to college. Additionally, the nicotine dependence characteristic of heavy smoking may render mindfulness less effective in protecting against use.

Limitations and Future Directions

The present study has several limitations that should be addressed in future studies. First, the current findings may not generalize beyond a college student population and should be examined in other samples. Second, because participants completed the study early in their first year of college, we measured substance use prior to college only; many students initiate substance use during their first year of college. Although substance use in adolescence is highly predictive of later use, substance use initiated in the first year of college may have different predictors, and also different clinical implications, than those found in the present study. Because our assessment of substance use was limited to large chunks of time in the precollege period, the clinical relevance of our findings may be limited; although endorsement of heavy alcohol and tobacco use may be more relevant, reports of *any* alcohol and tobacco use during a 4-month period may be less relevant. Although the FFMQ measures a dispositional tendency to be mindful, it is also possible that levels of dispositional mindfulness change during adolescence and young adulthood; future studies should use longitudinal designs to investigate the stability of dispositional mindfulness and its contemporaneous association with substance use. Finally, the results should be generalized only with caution to those with meditation experience, for whom the facets of the FFMQ may behave differently.

Conclusion

An interactive term created by taking the product of the *observing* and *nonreactivity* facets of the FFMQ predicted lesser tobacco use, alcohol use, and heavy alcohol use over and above the main effects of mindfulness facets considered separately and the personality domains of the FFM. Such interactive terms may come closer to approximating complex mindfulness processes than the unidimensional FFMQ subscales and may therefore more consistently relate to outcomes such as substance use in expected (protective) ways, especially when those outcomes involve high levels of self-observation or mind–body awareness that is *reactive* and therefore inconsistent with mindfulness. Future studies should examine interactive mindfulness terms as predictors, particularly when the effects of one aspect of mindfulness may vary as a function of another.

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Figure 1.
Interaction of *observing* and *nonreactivity* FFMQ (Five-Facet Mindfulness Questionnaire) facets predicting periods of alcohol use in an individual's lifetime

Figure 2.
Interaction of *observing* and *nonreactivity* FFMQ (Five-Facet Mindfulness Questionnaire) facets predicting periods of heavy alcohol use in an individual's lifetime

Figure 3.
Interaction of *observing* and *nonreactivity* FFMQ (Five-Facet Mindfulness Questionnaire) facets predicting periods of tobacco use in an individual's lifetime

Table 1

Means and Standard Deviations for Study Variables

Variable	Mean	SD	Range
Age	18.47	0.91	18–26
Observing	3.27	0.59	1–5
Nonjudging	3.23	0.75	1–5
Nonreactivity	3.13	0.51	1–5
Neuroticism	2.53	0.60	1–5
Extraversion	3.66	0.52	1–5
Openness	3.43	0.47	1–5
Agreeableness	3.74	0.45	1–5
Conscientiousness	3.59	0.50	1–5
Lifetime periods of alcohol use	8.28	5.67	0–34
Lifetime periods of heavy alcohol use	3.21	4.26	0–19
Lifetime periods of tobacco use	2.12	3.92	0–21
Lifetime periods of heavy tobacco use	.45	1.80	0–21

Table 2

Zero-Inflated Negative Binomial Regression of Lifetime Periods of Alcohol Use on Five-Factor Model Personality Variables, Four Mindfulness Facets, and Interactions of Observing With Nonjudging and Nonreactivity

Variable	Estimated β	SE	<i>t</i>	<i>p</i>
Dependent variable: Periods of alcohol use				
Step 1				
Neuroticism	.087	.041	2.11	.034
Extraversion	.16	.045	3.58	.0003
Openness	.034	.043	0.80	.42
Agreeableness	-.058	.042	-1.38	.16
Conscientiousness	-.071	.04	-1.75	.08
Step 2				
Neuroticism	.081	.048	1.66	.097
Extraversion	.16	.046	3.46	.0005
Openness	.026	.045	0.59	.55
Agreeableness	-.058	.042	-1.38	.17
Conscientiousness	-.073	.041	-1.79	.074
Observing	.0083	.046	0.18	.85
Nonreactivity	.019	.043	0.45	.65
Nonjudging	-.021	.047	-0.45	.66
Step 3				
Neuroticism	.075	.048	1.55	.12
Extraversion	.16	.046	3.50	.0005
Openness	.025	.044	0.57	.57
Agreeableness	-.05	.042	-1.20	.23
Conscientiousness	-.07	.04	-1.82	.068
Observing	.0044	.045	0.10	.92
Nonreactivity	.015	.043	0.36	.72
Nonjudging	-.013	.047	-0.30	.76
Observing $\times$ Nonjudging	-.033	.043	-0.77	.44
Observing $\times$ Nonreactivity	-.082	.042	-1.99	.050

Note. Change in log likelihood from Step 1 to Step 2: $\chi^2(3) = 0.58, p = .89$. Change in log likelihood from Step 2 to Step 3: $\chi^2(2) = 3.33, p = .18$.

Table 3

Negative Binomial Regression of Lifetime Periods of Heavy Alcohol Use on Five-Factor Model Personality Variables, Three Mindfulness Facets, and Interactions of Observing With Nonjudging and Nonreactivity

Variable	Estimated β	SE	<i>t</i>	<i>p</i>
Dependent variable: Periods of heavy alcohol use				
Step 1				
Neuroticism	.089	.11	0.84	.40
Extraversion	.35	.11	3.33	.0009
Openness	-.0065	.11	-0.06	.96
Agreeableness	-.14	.11	-1.38	.17
Conscientiousness	-.052	.11	-0.49	.62
Step 2				
Neuroticism	.15	.13	1.24	.22
Extraversion	.34	.11	3.22	.0013
Openness	.021	.10	0.19	.84
Agreeableness	-.15	.11	-1.45	.14
Conscientiousness	-.062	.11	-0.58	.56
Observing	-.096	.12	-0.83	.41
Nonreactivity	.042	.11	0.37	.71
Nonjudging	.077	.12	0.65	.51
Step 3				
Neuroticism	.14	.13	1.13	.26
Extraversion	.35	.10	3.27	.0011
Openness	.02	.11	0.26	.79
Agreeableness	-.11	.10	-1.08	.28
Conscientiousness	-.09	.10	-0.91	.36
Observing	-.11	.11	-1.00	.32
Nonreactivity	.019	.11	0.17	.86
Nonjudging	.13	.12	1.10	.27
Observing $\times$ Nonjudging	-.065	.11	-0.55	.58
Observing $\times$ Nonreactivity	-.25	.11	-2.13	.03

Note. Change in log likelihood from Step 1 to Step 2: $\chi^2(3) = 1.24, p = .74$. Change in log likelihood from Step 2 to Step 3: $\chi^2(2) = 4.33, p = .11$.

Table 4

Zero-Inflated Negative Binomial Regression of Lifetime Periods of Tobacco Use on Five-Factor Model Personality Variables, Three Mindfulness Facets, and Interactions of Observing With Nonjudging and Nonreactivity

Variable	Estimated β	SE	t	p
Dependent variable: Periods of tobacco use				
Step 1				
Neuroticism	-.0032	.084	-0.04	.96
Extraversion	.068	.09	0.76	.44
Openness	.036	.091	0.40	.68
Agreeableness	-.26	.10	-2.67	.0075
Conscientiousness	.041	.096	0.43	.67
Step 2				
Neuroticism	-.032	.091	-0.35	.72
Extraversion	.089	.091	0.98	.32
Openness	.14	.10	1.40	.16
Agreeableness	-.27	.098	-2.78	.0054
Conscientiousness	.063	.094	0.67	.50
Observing	-.11	.092	-1.17	.24
Nonreactivity	-.18	.093	-1.94	.05
Nonjudging	.02	.087	0.23	.81
Step 3				
Neuroticism	-.028	.091	-0.31	.75
Extraversion	.085	.088	0.96	.33
Openness	.092	.10	0.87	.38
Agreeableness	-.22	.097	-2.29	.021
Conscientiousness	.029	.094	0.31	.75
Observing	-.056	.093	-0.60	.55
Nonreactivity	-.15	.09	-1.75	.079
Nonjudging	.045	.086	0.53	.60
Observing $\times$ Nonjudging	-.0084	.094	-0.09	.93
Observing $\times$ Nonreactivity	-.23	.11	-2.21	.026

Note. Change in log likelihood from Step 1 to Step 2: $\chi^2(3) = 5.89, p = .11$. Change in log likelihood from Step 2 to Step 3: $\chi^2(2) = 4.50, p = .10$.

Table 5

Zero-Inflated Negative Binomial Regression of Lifetime Periods of Heavy Tobacco Use on Five-Factor Model Personality Variables, Three Mindfulness Facets, and Interactions of Observing With Nonjudging and Nonreactivity

Variable	Estimated β	SE	t	p
Dependent variable: Periods of heavy tobacco use				
Step 1				
Neuroticism	.30	.27	1.08	.28
Extraversion	-.32	.25	-1.25	.21
Openness	.85	.28	3.01	.0026
Agreeableness	-.61	.20	-3.02	.0025
Conscientiousness	.36	.18	1.99	<.0001
Step 2				
Neuroticism	.35	.28	1.26	.21
Extraversion	-.24	.26	-0.92	.35
Openness	.91	.30	3.05	.0023
Agreeableness	-.74	.24	-3.09	.002
Conscientiousness	.37	.19	1.98	.047
Observing	-.34	.20	-1.73	.084
Nonreactivity	-.04	.18	-0.24	.81
Nonjudging	.0055	.17	0.03	.97
Step 3				
Neuroticism	.39	.26	1.47	.14
Extraversion	-.33	.24	-1.43	.15
Openness	.70	.29	2.45	.014
Agreeableness	-.66	.21	-3.04	.0023
Conscientiousness	.39	.18	2.18	.029
Observing	-.14	.20	-0.70	.48
Nonreactivity	-.03	.16	-0.21	.83
Nonjudging	.13	.15	0.87	.38
Observing $\times$ Nonjudging	.30	.25	1.24	.22
Observing $\times$ Nonreactivity	-.25	.26	-0.94	.35

Note. Change in log likelihood from Step 1 to Step 2: $\chi^2(3) = 3.60, p = .30$. Change in log likelihood from Step 2 to Step 3: $\chi^2(2) = 3.14, p = .21$.