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The effect of acute negative affect on approach biases to alcohol cues in coping-motivated drinkers

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Abstract

Drinking to cope with negative affect has been linked to greater alcohol consumption and consequences of use. The combination of negative affect and implicit cognition, or unconscious processing has been theorized as a potential mechanism by which individuals become dependent on alcohol or other drugs. Literature has demonstrated stronger implicit cognitive biases toward alcohol cues in those who drink to cope but has not examined if this effect extends to approach biases to alcohol cues. 63 drinkers classified as high or low in coping motivation were randomized to either a negative affect induction group or a neutral affect control group. Approach biases were assessed both before and after the affect manipulation. It was hypothesized that coping motivated drinkers in the negative affect induction condition would show greater increases in implicit biases to alcohol cues compared to coping motivated drinkers in the neutral affect condition, and non-coping motivated drinkers in either affect condition. Results of testing a hierarchical linear regression model showed that neither coping motivation nor affect condition was associated with approach biases to alcohol. Results from this study have implications for future research on the effect of negative affect on implicit cognition, specifically in terms of the developmental course of implicit biases.

The effect of acute negative affect on approach biases to alcohol cues in coping-motivated drinkers

by

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Table of Contents

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Consequences of coping-motivated drinking

Research examining motivation or reasons for drinking has identified four primary motives: enhancement (drinking because of positive or enjoyable effects of intoxication), coping (drinking to ameliorate negative affect states), social (drinking to enhance social interactions), and conformity (drinking to avoid social rejection or isolation; Cooper, 1994). Research on coping-motivated (CM) drinking has been substantiated by the development of the negative reinforcement model of addiction, which posits that drinking to reduce negative affect is the foremost motive for problematic drinking (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004). In fact, one study of undergraduate students found that 42.3% reported using alcohol to cope (Park & Levenson, 2002). Furthermore, CM drinking has been associated with an increased likelihood of developing problematic drinking (Brady & Sonne, 1999; Weiss et al., 2001).

Role of implicit cognition in alcohol and non-prescribed drug use

The dual-process model of decision-making posits that decision-making can be carried out via two pathways: one involving explicit cognitive processes and one involving implicit cognitive processes. The explicit pathway has been described as conscious, flexible and easy to learn, but slow to execute and requiring substantial cognitive resources to implement (Daw, Niv, & Dayan, 2005; Redish, Jensen, Johnson, & Kurth-Nelson, 2007; Redish et al., 2008). The implicit pathway has been explained as operating outside of consciousness, rigid and difficult to learn, but requiring little time, effort or resources to implement once the associations between situations and behaviors have been learned (Daw et al., 2005; Redish, et al., 2007; Redish, et al., 2008).

Measures of implicit cognition offer several advantages when applied to substance use research. First, implicit cognition can be useful in explaining behavior in situations in which executive control and higher order cognitive functioning is diminished or compromised, such as acute alcohol intoxication (Thush et al., 2008). Research has shown that the acute effects of alcohol consumption compromise higher order executive functioning, while leaving automatic processes relatively intact (Fillmore, Vogel-Sprott, Wiers, & Stacy, 2006), possibly via neuronal damage in areas of the cerebral cortex, hypothalamus, and cerebellum associated with deficits in frontal lobe activity (Lyvers & Maltzman, 1991; Maylor & Rabbitt, 1993). In fact, Ostafin, Marlatt, and Greenwald (2008) found that when heavy drinkers' self-control resources were depleted, measures of implicit cognition were better able to explain patterns of alcohol consumption when compared to measures of explicit cognition.

One of the most prevalent data collection methods in the study of human behavior is the use of self-report measures to assess internal states. A substantial limitation in any application of a self-report measure is potential misrepresentation by the participant. Measures of implicit attitudes and beliefs are designed, via employment of reaction time instruments, to be unaffected by "self-presentation" effects, and therefore can offer an accurate representation of participants' beliefs about and attitudes toward alcohol (Fazio & Olson, 2003; Hofmann, Gawronski, Gschwendner, Le, & Schmitt, 2005; Wiers, Van Woerden, Smulders, & De Jong, 2002b). Given the sensitivity of topics such as alcohol use disorder, and intentionally biased reporting due to stigma attached to it, in some contexts measures of implicit cognition may offer a significant advantage over self-report measures.

A final advantage of studying implicit cognition is that results may serve to offer additional insight into the fundamentally paradoxical nature of substance use, namely the dissonance often present between individual's reports of their attitudes and beliefs toward a substance, and the continuance of drug-seeking behavior in those who use substances. For example, Houben and Wiers (2006) found that drinkers' negative ratings of alcohol on measures of explicit attitudes toward alcohol contrasted with positive associations toward alcohol on measures of implicit attitudes. That is, participants showed positive implicit associations toward alcohol *despite* explicitly stating that alcohol use is irresponsible. For these reasons, an increasing number of researchers have begun to investigate the role of implicit cognition in substance use disorders.

Application of implicit cognition measures to alcohol use

Measures of implicit cognition, particularly attention bias, implicit associations, and approach motivation have been applied recently to the study of alcohol use. Research on attention bias is grounded in the assumption that responses will be facilitated when they are spatially or conceptually related to the object of attention. Results have shown that heavy drinkers preferentially attend to alcohol stimuli over neutral stimuli, to a significantly greater degree than light drinkers or abstainers as indicated by larger Stroop (1935) effects (Bruce & Jones, 2004; Johnsen, Laberg, Cox, Vaksdal, & Hugdahl, 1994; Sharma, Albery, & Cook, 2001; Stetter, Ackermann, Bizer, Straube, & Mann, 1995; Stormark, Laberg, Nordby, & Hugdahl, 2000) and performance on dot-probe tasks (Field, Mogg, Zetteler, & Bradley, 2004; Townshend & Duka, 2001). These results suggest that heavy alcohol users have a greater attentional bias toward alcohol cues than light or non-drinkers.

Implicit associations have been defined as impulsive, pre-conscious, evaluative judgments that are automatically activated and can affect behavior (Greenwald & Banaji, 1995; Perugini, 2005). The investigation of implicit associations with alcohol has yielded interesting and unexpected results. In studies comparing heavy drinkers, light drinkers, and non-drinkers, all three groups demonstrated primarily negative associations with alcohol (De Houwer, Crombez, Koster, & De Beul, 2004; Houben & Wiers, 2006; Wiers et al., 2002a; Wiers, Van De Luitgaarden, Van Den Wildenberg, & Smulders, 2005). When implicit associations have been investigated on an arousal/sedation dimension, results have shown differences between heavy and light drinkers; heavy drinkers show stronger arousal associations towards alcohol when compared to light drinkers, despite showing no differences on a valence dimension (De Houwer et al., 2004; Houben & Wiers, 2006; Wiers et al., 2002a; Wiers et al., 2005). Similarly, studies of approach/avoidance associations have shown that weaker avoidance tendencies have been associated with hazardous drinking, including a higher number of binge drinking episodes (Ostafin, Palfai, & Wechsler, 2003; Palfai & Ostafin, 2003). These results support the conclusion that heavy/problem drinkers are differentiated from light/non-problem drinkers by stronger arousal and approach associations with alcohol.

The promising results from studies of associations on the arousal and approach dimensions inspired a new line of research assessing approach versus avoidance behavioral tendencies. To complete the Approach Avoidance Task (AAT; Rinck & Becker, 2007), participants are first trained to respond (e.g. push/pull a joystick, or move an avatar towards/away from the stimulus) to feature-level, or neutral aspects of a control stimulus, such as portrait versus landscape orientation (Rinck & Becker, 2007). Target stimuli are then inserted in place of control stimuli, and differences in approach (pull) versus avoid (push) behaviors are observed. The AAT measures reaction time and assumes that responses will be facilitated (i.e., response times will be faster) when the combination of approach or avoid behavior and stimulus is congruent with the implicit association in memory. In other words, an approach/alcohol response should be faster than an avoid/alcohol response for those who have strong approach associations with alcohol in memory. Results from studies using the AAT and similar paradigms (e.g., Stimulus-Response Compatibility Task; De Houwer, Crombez, Baeyens, & Hermans, 2001) have shown that heavy drinkers are in fact faster to approach alcohol than avoid alcohol cues when compared to light drinkers (Field, Kiernan, Eastwood, & Child, 2008; Sharbanee et al., 2013; Wiers, Rinck, Dictus, & Van den Wildenberg, 2009). Additionally, research examining the AAT and similar measures of alcohol approach bias has demonstrated that approach bias predicts greater alcohol consumption, as well as more hazardous alcohol use (Kersbergen, Woud, & Field, 2014). Overall, results from studies of implicit cognition in alcohol users have demonstrated that alcohol cues activate implicit cognitive biases to a greater degree in heavy drinkers when compared to light or non-drinkers.

Implicit cognition and negative affect

The results of research on the effect of negative affect on implicit cognitive biases toward drug and alcohol cues are consistent with the negative affect model of addiction (Baker et al., 2004). According to this model, the prepotent motive for substance use is the alleviation of negative affect, and chronic substance use creates biases in unconscious information-processing systems that foster continued substance use. The results from existing literature on the interaction of negative affect and implicit cognition are mixed, but offer some points of convergence worthy of further investigation. After inducing negative affect and neutral affect in smokers and non-smokers, Bradley, Garner, Hudson, and Mogg (2007) concluded that smokers did not show greater attention bias for smoking cues in the negative affect condition compared to the neutral condition. Similarly, neither current opiate users nor ex-opiate users showed a greater attention bias to opiate cues after negative affect was induced (Constantinou et al., 2010). Interestingly, this study also revealed that former opiate users showed an attention bias *away* from opiate cues in the negative affect condition, and that the strength of this bias correlated positively with length of abstinence, suggesting a potential effect of treatment. Findings from Tull, McDermott, Gratz, Coffey, and Lejuez (2011) corroborate the suggestion of a treatment effect on attention bias; their comparison of cocaine dependent inpatients with and without posttraumatic stress disorder (PTSD) also showed an attention bias away from cocaine cues in a neutral affect condition, but not the negative affect condition. However, Tull and colleagues (2011) did find a greater attention bias toward drug cues in the negative affect condition in participants with a PTSD diagnosis. These studies suggest that there may be an effect of negative affect on attention bias, but additional mediating or moderating variables may be necessary to fully explain the relationship.

Results from studies in alcohol users show more convergence than those from studies of other substances. Field and Powell (2007) demonstrated that negative affect induction was associated with greater attention bias for alcohol cues in alcohol users, but only those drinkers who cited CM as their primary motivation for alcohol use. These findings were replicated and extended by comparing results from different stimuli presentation durations to show that negative affect is associated with greater attention bias at both the initial orienting and maintenance of attention stages (Field & Quigley, 2009). Although the prior studies have all included the use of a visual probe task to assess attention bias, results from Grant, Stewart, and Birch (2007) showed that an greater Stroop effect is also observed in CM drinkers after negative affect induction. In addition, the Stroop effect is greater in enhancement-motivated drinkers after positive affect is induced, suggesting that motivation to drink, specifically CM, may play a role in the relationship between negative affect and attention bias.

Research on the effect of negative affect on implicit associations in substance users is even more limited, and more contradictory. Cohn and colleagues (2012) failed to find a greater IAT effect after negative mood induction, while Ostafin and Brooks (2011) did find an increased IAT effect for approach associations in CM drinkers. An important distinction between these two studies is the sample characteristics; Cohn and colleagues (2012) only included drinkers whose drinking patterns qualified them as "hazardous" drinkers. The authors suggest that this limited range may have contributed to the lack of IAT effect, as they also failed to find a correlation between alcohol consumption and IAT effect, which is contrary to prior research (Palfai & Ostafin, 2003). Further research is needed to clarify the relationship between negative affect and implicit associations with alcohol.

Research investigating the relationship between negative affect and implicit cognition is not without limitations. As Grant et al. (2007) noted, research conducted thus far consists only of measures of cognition (e.g. attention bias, implicit associations), not of behavior, a procedure that has not changed in recent years. The AAT may serve as an important bridge between cognitive attitudes toward alcohol cues and alcohol using behavior by measuring behavioral action tendencies (Rinck & Becker, 2007).

Overall, research examining the effect of negative affect induction on implicit biases to alcohol cues has elicited further questions rather than answers, as implicit biases toward alcohol cues have been observed in response to negative affect in some studies, but not others. A key difference may be the inclusion of drinking motivation as a moderating variable; studies that included an assessment of motivation for use found a significant interaction of affect condition and drinking motivation on implicit biases (Field & Powell, 2007; Field & Quigley, 2009; Grant et al., 2007; Ostafin & Brooks, 2011), while studies that did not include an assessment of motivation for use failed to find an effect (Bradley et al., 2007; Cohn et al., 2012; Constantinou et al., 2010). Additionally, research in this area has been limited to the study of cognition, and has not addressed if this translates into increased substance use behavior.

Potential moderators: distress tolerance and anxiety sensitivity

Distress tolerance (DT), has been conceptualized in the field of substance use research as the ability to tolerate aversive emotional or physical states. Research has demonstrated that DT has a direct negative relationship to CM substance use in marijuana users (Bujarski, Norberg, & Copeland, 2012). Research on DT among alcohol users suggests that low DT is prospectively related to increased alcohol problems among men and has demonstrated significant negative associations with CM alcohol use (Simons & Gaher, 2005).

Anxiety sensitivity (AS) represents the extent to which an individual reacts negatively to anxiety and arousal-related sensations (McNally, 2002). Correlational research on the relationship between anxiety sensitivity and alcohol use suggests that higher AS is associated with greater alcohol consumption (Stewart, Peterson, & Pihl, 1995), and prospective longitudinal research shows that AS predicts the development of alcohol use disorder (AUD) at a 24-month follow-up (Schmidt, Buckner, & Keough, 2007). Consistent with the negative reinforcement model of addiction (Baker et al., 2004), AS has not only been associated with greater endorsement of CM alcohol use, but also a greater likelihood of endorsing CM as the primary motivation for alcohol use (Stewart et al., 1995).

DT and AS have surfaced as a potential risk factors for several forms of psychopathology, including substance use disorders (DeMartini & Carey, 2011; Leyro, Zvolensky, & Bernstein, 2010; Schmidt, Zvolensky, & Maner, 2006). It has been suggested that DT and AS are related but distinct constructs, as evidenced by research demonstrating unique variance in CM marijuana use predicted by each construct (Zvolensky et al., 2009). When investigated as predictors of CM alcohol use, DT emerged as a significant predictor of CM drinking, but AS did not (Howell, Leyro, Hogan, Buckner, & Zvolensky, 2010). As both constructs represent a compromised ability to cope adaptively with negative affect, it is possible that the pattern of changes in unconscious information processing suggested by the negative reinforcement model (Baker et al., 2004) may be more pronounced in individuals who are less able to cope with negative affect. Additionally, motivation for substance use is a construct highly influenced by contextual circumstances (Cooper, 1994) and therefore examination of more stable, dispositional constructs such as DT and AS may provide additional clinical utility in assessing those with problematic substance use behaviors.

Conclusions

Literature has shown that heavy substance users differ from light substance users in terms of attention bias (for a review, see Field & Cox, 2008), arousal and approach associations (Palfai & Ostafin, 2003; Wiers et al., 2002b), and approach behavioral tendencies to drug/alcohol cues (Field et al., 2008; Wiers et al., 2009). The negative reinforcement model of addition posits that the alleviation of negative affect is the most prominent motivation for substance use, and that continued experience with substance use and its ability to alleviate negative affect causes changes in unconscious information processing systems that foster continued substance use (Baker et al., 2004). Empirical investigations of the negative reinforcement model have yielded mixed results, as several studies have shown a significant effect of acute negative affect on implicit biases to drug/alcohol cues (Field & Powell, 2007; Field & Quigley, 2009; Grant et al., 2007; Ostafin & Brooks, 2011; Tull et al., 2011), and other studies did not show a significant effect (Bradley et al., 2007; Cohn et al., 2012; Constantinou et al., 2010). Research in this area has not investigated measures of approach biases, and literature suggests that several moderators may be important in fully explicating the nature of this relationship, namely CM substance use and potentially related constructs such as DT and AS.

Specific Aims/Hypotheses

The purpose of the study was to replicate the findings of increased implicit biases to alcohol cues in response to negative affect induction in CM drinkers while extending the findings to include a more behavioral assessment of implicit biases, approach/avoidance motivation as assessed by the AAT. We assessed the effect of negative affect induction on approach biases to alcohol cues in an alcohol using population classified as either high or low in CM drinking. Approach bias was measured both before and after negative affect induction. It was hypothesized that high-CM drinkers experience a greater increase in approach bias in response to negative affect when compared to low-CM drinkers. Additionally, exploratory analyses were conducted to test for the potential moderating roles of DT and AS on the relationship between negative affect and approach bias to alcohol cues. It was hypothesized that the influence of negative affect on approach motivation to alcohol cues is more pronounced in those who are low in DT and/or high in AS.

Methods

Participants

Participants were 63 undergraduates who participated in the study for course credit. Participants gave written consent, and all procedures were approved by Syracuse University's Institutional Review Board. Inclusion criteria included being between 18 and 25 years of age, English speaking, being a moderate or heavy drinker based on the Quantity-Frequency-Variability Index (QFV; Cahalan, Cisin, & Crossley, 1969), and having scored either one-half standard deviation above or below the mean on the coping subscale of the Drinking Motives Questionnaire (DMQ-R; Cooper, 1994). The alcohol consumption criterion was designed to capture current drinkers' most recent pattern of drinking, and the CM criterion identified participants who were either higher than average or lower than average in CM drinking. The one-half standard deviation criterion was chosen to maintain a theoretical distinction between groups while allowing data collection to occur over the course of one semester. This was to ensure that participants' drinking experiences were influenced as little as possible by differing environmental factors associated with an academic calendar (i.e., differential alcohol accessibility over winter break). The one-half standard deviation criterion is in comparison to similar studies that have used more conservative criteria (e.g., one standard deviation; Grant et al., 2007) and more liberal criteria (e.g., median split; Field & Powell, 2007; Field & Quigley, 2009) to classify individuals as high or low in coping motivation. Participants were recruited using Syracuse University's online research participation pool, and completed the QFV and the DMQ-R online as a pre-screening procedure. Those classified as moderate or heavy drinkers who also scored either one-half standard deviation above or below the mean on the CM subscale were invited to continue the study, and final eligibility (e.g., verification of age, English-speaking) was determined in person prior to beginning the experimental procedures.

Power Analysis

A priori power analyses were conducted in G*Power version 3.1 (Faul, Erdfelder, Lang, & Buchner, 2007) to determine a target sample size based on the primary aim of the study. As no study has examined the effect of negative affect on approach biases, literature examining similar measures of implicit cognition (e.g., attention bias, implicit associations) was consulted and suggested small to medium effect sizes (e.g., $\eta_p^2 = .31, .44$; Grant et al., 2007; Cohen's $d = 0.28$; Ostafin & Brooks, 2011).

Based on the literature and the primary aim of this study, the power analysis suggested that a sample of $N = 53$ would achieve a power of .80 to detect a small to medium effect size (f = .25) with an α of .05, and 4 predictors. Therefore, a sample size of $N = 65$ was planned to allow for the possibility of data removal due to outliers in accuracy and/or reaction time on the AAT. Data from a total of 63 participants were collected, and data from 9 participants were removed due to poor accuracy on the AAT. Therefore, data from 54 participants were included in the final analyses.

Research Design

Participants were classified as high- or low-CM and randomly assigned within groups to either the negative affect induced or neutral affect induced condition in a 2 (high- or low-CM) by 2 (negative or neutral affect condition) by 2 (pre and post affect induction) mixed factorial design.

Measures

Alcohol consumption. Typical alcohol consumption in the past three months was assessed in two ways. A binge drinking questionnaire (NIAAA National Advisory Council, 2004) and the QFV (Cahalan et al., 1969) were used to represent participants' usual drinking patterns in the last 90 days. Measures included frequency of drinking, drinks per drinking day, and number of binge (e.g., greater than 5 drinks/2-hour period for males, 4 drinks/2-hour period for females) days in the past 90 days. Responses were reverse-coded in order to minimize participant under-reporting, therefore higher scores indicate more frequent drinking, more drinks per drinking day, and more binge-drinking episodes.

Alcohol-related problems. Alcohol-related problems were assessed using the Rutgers Alcohol Problem Index (RAPI; White & Labouvie, 1989). Items describe 23 alcohol-related problems or situations, and participants indicated how often they experienced each problem or situation on a 5-point Likert scale (0 = never, 4 = very often). This scale was designed to measure the occurrence of alcohol-related problems in adolescents and young adults. The RAPI has demonstrated strong internal consistency ($\alpha = .92$), and construct and convergent validity by its moderate correlations in expected directions with measures of alcohol consumption (White & Labouvie, 1989). The scale demonstrated good internal consistency ($\alpha = .85$) in this sample.

Drinking motivation. The Drinking Motives Questionnaire-Revised (DMQ-R) is a self-report measure containing 20 items that assess the number of times a participant endorses drinking for each of the four motivational factors proposed by Cooper (1994): coping, enhancement, conformity, and social. Each item represents a different reason for drinking, which loads onto one of the four factors. Participants were asked to report the frequency of their drinking for each reason over the past 90 days on a six-point scale ranging from 1 (“never/almost never”) to 6 (“almost always/always”). Factor analyses performed by MacLean and Lecci (2000) and Kuntsche, Knibbe, Gmel, and Engels (2006) supported the four-factor structure and demonstrated high internal consistency for each of the factors ($\alpha = .82$-$.88$). Additionally, the DMQ-R has demonstrated good construct and predictive validity by successfully discriminating different antecedents and patterns of drinking behavior based on each of the four motives, which remain relatively consistent across age, gender and race (Cooper, 1994). The DMQ-R has also demonstrated construct validity by its associations with the NEO-PI personality dimensions (Stewart & Devine, 2000), trait anxiety, sensation seeking, and anxiety sensitivity (Comeau, Stewart, & Loba, 2001) and discriminant validity by the differences in patterns predicted by the

DMQ-R and a measure of marijuana use motives (Simons, Correia, Carey, & Borsari, 1998). The scale demonstrated good internal consistency (α = .89) and the coping subscale demonstrated excellent internal consistency (α = .90) in this sample.

Alcohol approach motivation. The Approach Avoidance Task (AAT; Wiers, Rinck, Dictus & Wildenberg, 2009) was used to assess automatic approach motivation to alcohol cues. This task is adapted from the original AAT (Rinck & Becker, 2007) to include alcohol-related stimuli. In this task, participants were trained to respond to feature-level (e.g., portrait versus landscape orientation) aspects of picture stimuli by either pushing the computer mouse away from them or pulling the mouse toward them. When the mouse was pushed away, the picture “zoomed out” and grew smaller, and when the mouse was pulled towards the participant, the picture “zoomed in” and grew bigger. Participants completed 20 practice trials, during which they were presented with plain gray rectangles in either portrait or landscape format, and were trained to respond with the appropriate push/pull motion. During the practice trials, a red “error” message appeared on the screen if the participant responded incorrectly. Participants then completed 80 test trials, in which the plain gray rectangles were replaced with picture stimuli belonging to one of four categories: alcohol, shape- and color-matched neutral stimuli (e.g., soda bottles), general positive (e.g., baby animal) and general negative (e.g., spider). The test stimuli were presented in a semi-random order (i.e., no more than three of the same category or three in the same orientation were presented in a row). Format/movement pairings were counterbalanced across participants (i.e., approximately half the participants were trained to push landscape pictures, and approximately half were trained to pull landscape pictures). Counterbalance was randomly assigned prior to the experimental session. Error rates greater than 25% and mean reaction time (RTs) greater than 3 standard deviations (SD) were discarded as outliers. The dependent measure was an "approach bias" score, which was calculated by subtracting median RTs for pull trials from median RTs on push trials. A positive score represents a bias toward approaching versus avoiding the stimulus.

State affect. Baseline and post mood induction state affect were assessed using the Positive and Negative Affect Scales (PANAS; Watson, Clark, & Tellegen, 1988). The PANAS consists of 20 items, 10 measuring negative affect and 10 measuring positive affect. Participants were instructed to rate their current affect on a 5-point Likert scale from 1 ("very slightly or not at all") to 5 ("extremely").

Distress tolerance. The Distress Tolerance Scale (DTS; Simons & Gaher 2005) is a 15-item self-report measure, in which participants reported the extent to which they can tolerate aversive or stressful psychological states on a 5-point Likert scale (1 = "strongly agree" to 5 = "strongly disagree"). Research on the DTS shows that it has good reliability; each factor displayed high internal consistency (α = .72–.82), and the scale's test-retest reliability was good (r = .61) when tested after a 6-month interval. The scale demonstrated excellent internal consistency (α = .92) in this sample.

Anxiety sensitivity. The Anxiety Sensitivity Index-3 (ASI-3; Taylor et al., 2007) is an 18-item self-report scale in which participants reported the extent to which they react negatively to anxiety and arousal-related sensations (McNally, 2002) on a 5-point Likert scale (0 = "very little" to 4 = "very much"). The ASI-3 has demonstrated good internal consistency, with reported coefficient alphas for the subscales ranging from .73-.91 in a variety of clinical and non-clinical samples (Taylor et al., 2007). The scale demonstrated excellent internal consistency (α = .90) in this sample.

Procedure

Upon arrival at the laboratory, participants were seated at a desk with a computer in a private room. The experimenter reviewed the consent form with and obtained consent from all participants. Participants then completed a battery of questionnaires, including those assessing alcohol consumption, the RAPI, DTS, and ASI. Due to experimenter error, one question was omitted from the RAPI ("had withdrawal symptoms, that is, felt sick because you stopped or cut down on drinking") and therefore participants' total RAPI score was computed from the remaining 22 items. Participants then completed the AAT and PANAS as baseline measures of approach motivation and state affect.

After completing baseline measures, participants in the neutral affect condition were given a set of 18 easily solvable anagrams to complete. Participants in the negative affect condition completed the computerized Mirror-Tracing Persistence Task (MTPT-C; Strong et al., 2003). To complete the MTPT-C, participants were required to trace the image of a star on the computer screen using the mouse cursor, which is programmed to move in the opposite direction of the actual mouse. The task consisted of four trials of increasing difficulty. The first three trials lasted 90 seconds each, and the last trial could last up to seven minutes. However, the participant was instructed that he or she could end the task at any time during the last trial. This task has demonstrated its ability to increase negative affect as measured by both physiological indices of negative affect (e.g., increases in heart rate, blood pressure; Steptoe, Gibson, Hame & Wardle, 2007) and subjective reports of negative affect (Ameral, Palm Reed, Cameron, & Armstrong, 2014). All participants then completed the AAT. After debriefing, participants were released.

Data Analytic Strategy

Descriptive statistics were computed to characterize sample demographics. Approach bias to alcohol cues was calculated by subtracting median RTs for pull trials from median RTs on push trials; higher scores indicated a greater approach bias to alcohol cues. As suggested by Wiers and colleagues (2009), median response times were used to minimize the influence of outliers, and participants who did not achieve 75% accuracy were excluded from the analysis (*n* = 9). Distributions of all continuous variables were examined, and transformations were computed and substituted for the original variables to increase normality as appropriate.

It was hypothesized that high CM drinkers in the negative affect condition would show greater increases in AAT approach bias scores compared to high CM drinkers in the neutral affect condition, and low CM drinkers in either condition. This hypothesis was tested using hierarchical linear regression. In the model, baseline AAT score was entered in the first step as a covariate. ANOVAs were conducted to examine the data for baseline differences on demographic and relevant study variables among groups. The groups differed on age, ASI score and RAPI score, and thus bivariate correlations were computed to test if either age, ASI score, or RAPI score were related to the outcome variable (approach bias). Age, ASI score, and RAPI score were not significantly correlated with post-affect induction AAT scores, and therefore were not included in the model as covariates. Coping group (0 = low CM, 1 = high CM) and affect condition (0 = neutral affect, 1 = negative affect) were dummy-coded and entered into the second step of the model to test for main effects of coping group and affect condition. Although dichotomization of the CM variable may limit variability compared to a continuous variable, this method was chosen in order to maintain consistency with literature comparing CM and non-CM drinkers on measures of implicit cognition[1] (Field & Powell, 2007; Field & Quigley, 2009; Grant et al., 2007; Ostafin & Brooks, 2011). Finally, a coping x affect condition interaction term was computed and entered into the third step of the model. There were no missing data on any

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[1] Follow-up analyses in which CM was retained as a continuous predictor yielded similar results to the primary analyses in which CM was dichotomized.

variables included in the model. SPSS statistical software version 23 was used for all analyses, and alpha was set at .05 for all statistical tests.

In addition to the primary analyses, exploratory analyses examined the potential moderating roles of DT and AS. Bivariate correlations were computed to examine the relationships between CM, DT, and AS. Next, separate hierarchical linear regression models were used to test DT and AS. DT and AS were retained as continuous predictors and mean centered. The DT model included baseline AAT as a covariate in the first step of the model, followed by CM group and DTS score in the second step of the model. A coping group x DT interaction term was created and entered in the final step of the model. An identical model was used to test AS, in which ASI score and a coping group x ASI interaction term were substituted in place of DTS score and the CM group x DT interaction. There were no missing data on any variables included in the models. SPSS version 23 statistical software was used for all analyses, and alpha was set at .05 for all statistical tests.

Results

Preliminary Analyses

Descriptive statistics of all continuous variables were examined. Several variables, including frequency of alcohol use and RAPI score were log-transformed based on excess (e.g., >1.0) skewness. The log-transformed frequency and RAPI variables demonstrated acceptable levels of skewness.

Table 1 presents demographic information for the overall sample, as well as for the four groups (high CM/negative affect, high CM/neutral affect, low CM/negative affect, low CM/neutral affect). ANOVAs were conducted to examine differences between the four groups on demographic and relevant study variables. Results suggested that the groups differed on age, ASI score and RAPI score. Post-hoc contrasts revealed that the low CM/neutral affect group differed from the high CM/neutral affect group on age (p = .04), the low CM/negative affect group differed from the high CM/negative affect group (p = .01) on the ASI, and the low CM/neutral affect group differed from the high CM/negative affect group on the RAPI (p = .02). Bivariate correlations revealed that age (r = .06, p = .35), ASI score (r = .03, p = .86), and RAPI score (r = .03, p = .85) were not related to the outcome variable, therefore none of the variables were included as covariates. The groups did not differ on any other demographic variables (p's > .05).

Manipulation check

An independent-samples t-test indicated that the neutral and negative affect groups differed on baseline negative affect (t (43) = -4.09, p < .001). Due to experimenter error during preparation for data collection, the response indicator was initially positioned at "0" on the 0-100 scale for the neutral affect group, whereas the indicator was initially positioned at "50" on the 0-100 scale for the negative affect group. Therefore, participants in the neutral affect group were responding relative to "0" as the initial position of the indicator and participants in the negative affect group were responding relative to "50" as the initial position of the indicator. As such, the neutral affect group may have been biased to under-report negative affect compared to the negative affect group. Therefore, an ANCOVA was used to test the effectiveness of the manipulation while controlling for potential effects of differences in baseline negative affect. A significant Levene's test suggested that the error variances differed among groups, likely due to the difference in group size. Therefore, the baseline and post-manipulation negative affect ratings were log-transformed to reduce the differences in error variance among the groups, which resulted in a nonsignificant Levene's test. Results of an ANCOVA using log-transformed negative affect ratings suggested main effects of both baseline negative affect ($F(1, 51) = 61.88$, $p < .001$) and negative affect condition ($F(1, 51) = 28.41$, $p < .001$). These represent large effect sizes for both baseline negative affect ($\eta_p^2 = .55$) and negative affect group ($\eta_p^2 = .35$). The mean increase in negative affect was 16.76 (14.13) in the negative affect condition, which represents a 106% increase from baseline. The mean increase in negative affect was 0.88 (9.87) in the neutral affect condition, which represents a 19% increase from baseline.

Effect of negative affect on approach bias

Results from the regression model testing the effect of negative affect on approach bias can be found in Table 2. The first step of the model was not associated with significant increases in proportion variance accounted for ($\Delta R^2 = .01$, $\Delta F = 0.53$, $p = .47$), and baseline AAT score was not a significant predictor of post-affect manipulation AAT score ($\beta = -.10$, $p = .47$). The second step of the model was also not associated with significant increases in proportion variance accounted for ($\Delta R^2 = .03$, $\Delta F = 0.85$, $p = .43$). In the second step, baseline AAT score ($\beta = -.11$, $p = .42$), CM group ($\beta = .16$, $p = .26$), and affect condition ($\beta = .10$ $p = .48$) were not significant predictors of post-affect induction AAT scores. The final step of the model was not associated with significant increases in proportion variance accounted for ($\Delta R^2 = .00$, $\Delta F = 0.01$; $p = .93$). Baseline AAT score ($\beta = -.11$, $p = .43$), CM group ($\beta = .17$, $p = ..43$), affect condition ($\beta = .11$, $p = .60$), and the CM x affect condition interaction ($\beta = -.03$, $p = .93$) were not significant predictors of post-affect induction AAT scores. Results show that the overall model did not predict significant variance in post-manipulation AAT scores ($R^2 = .04$).

In order to examine the possible influence of the high variability in AAT scores, the model was also conducted using the D-measure as originally described by Greenwald, Nosek, and Banaji (2003) as the dependent variable. Although Levene's test of equality of error variances show that assumptions of equality of error variances were not violated ($F = 2.01$, $p = .13$), descriptive statistics show both high variability and an uneven distribution of variability in the dependent measure across groups. The D-measure was calculated by dividing approach bias scores by the pooled standard deviation. The model predicting approach bias as indicated by the D-measure yielded similar results.

Exploratory analyses

Results from examinations of bivariate correlations among study variables and the two proposed moderators, DT and AS can be found in Table 3. Significant correlations were found between DT and CM drinking ($r = -.30$, $p = .03$) as well as between AS and CM drinking ($r = .47$, $p < .001$). A negative relationship with DT suggests that as participants' ability to tolerate distress increases, their frequency of CM drinking decreases. A positive relationship with AS suggests that as participants' tendency to react negatively to anxiety increases, their frequency of CM drinking also increases. DT was also significantly related to AS ($r = -.59$, $p < .001$), frequency of drinking ($r = -.31$, $p = .02$) and alcohol related problems ($r = -.33$, $p = .02$). AS was also significantly related to drinks per drinking day ($r = .33$, $p = .02$) and binge days ($r = .27$, $p = .049$). As drinking frequency, drinks per drinking day, and binge days were reverse-coded, bivariate correlations between DT and drinking frequency, and AS and drinks per drinking day and binge days were opposite of the expected direction.

Results from the regression model testing the relationship of DT and CM on approach bias can be found in Table 4. The first step of the model was not associated with significant increases in proportion variance accounted for ($\Delta R^2 = .01$, $\Delta F = 0.53$, $p = .47$), and baseline AAT score was not a significant predictor of post-affect manipulation AAT score ($\beta = -.10$, $p = .47$). The second step of the model was also not associated with significant increases in proportion variance accounted for (ΔR^2 = .07, ΔF = 1.78, p = .18). In the second step, baseline AAT score (β = -.08, p = ..56), CM group (β = .19, p = .18), and DT (β = .21, p = .14) were not significant predictors of post-affect induction AAT scores. The final step of the model was not associated with significant increases in proportion variance accounted for (ΔR^2 = .001, ΔF = 0.06; p = .81). Baseline AAT score (β = -.08, p = .59), CM group (β = .18, p = .19), DT (β = .17, p = .41), and the CM x DT interaction (β = .05, p = .81) were not significant predictors of post-affect induction AAT scores. Results show that the overall model accounted for 4% of the variance in post-manipulation AAT scores (R^2 = .08).

Results from the regression model testing the relationship of AS and CM on approach bias can be found in Table 5. The first step of the model was not associated with significant increases in proportion variance accounted for (ΔR^2 = .01, ΔF = 0.53, p = .47), and baseline AAT score was not a significant predictor of post-affect manipulation AAT score (β = -.10, p = .47). The second step of the model was also not associated with significant increases in proportion variance accounted for (ΔR^2 = .02, ΔF = 0.60, p = .55). In the second step, baseline AAT score (β = -.11, p = .44), CM group (β = .16, p = .32), and AS (β = -.01, p = .95) were not significant predictors of post-affect induction AAT scores. The final step of the model was not associated with significant increases in proportion variance accounted for (ΔR^2 = .001, ΔF = 0.08; p = .79). Baseline AAT score (β = -.11, p = .43), CM group (β = .17, p = .31), AS (β = -.10, p = .79), and the CM x AS interaction (β = .09, p = .79) were not significant predictors of post-affect induction AAT scores. Results show that the overall model accounted for 4% of the variance in post-manipulation AAT scores (R^2 = .04).

Discussion

The purpose of this study was to examine the effect of negative affect on approach biases to alcohol cues in CM versus non-CM drinkers. A secondary aim of this study was to evaluate two constructs related to CM drinking, DT and AS, as potential moderators of the effect of negative affect on approach biases. Contrary to hypotheses, experimentally induced negative affect was not associated with increases in approach biases in CM drinkers. The results of previous research on the effect of negative affect on related measures of implicit cognition are mixed; the findings of this study are consistent with those reporting no significant effects of negative affect on attention bias (Bradley et al., 2007; Constantinou et al., 2010) or approach associations (Cohn et al., 2012) to drug or alcohol cues. The results of these latter studies can be contrasted with those reporting significant effects of negative affect on attention bias (Field & Powell, 2007; Field & Quigley, 2009; Grant et al., 2007; Tull et al., 2011) and approach associations (Ostafin & Brooks, 2011) to drug and alcohol cues. Additionally, although significant associations were found among CM drinking, DT, AS, and alcohol use variables, DT and AS were not associated with approach biases to alcohol cues.

The lack of significant relationships between approach biases to alcohol cues and any relevant study variables suggests that participants in this study did not evidence approach biases to alcohol, despite being selected based on characteristics that previous research suggests are associated with approach biases to alcohol cues (e.g., drinking status). One possible explanation for the lack of approach biases in this study is the age of the sample. The mean age of this sample was 18.48, and most of the participants (72%) were completing their first semester of college (i.e., data collection occurred in the Fall). In comparison, other studies of approach biases have reported older samples. For example, Wiers and colleagues (2009) reported the mean age of their sample was 22, and Field and colleagues (2008) reported a mean age of 21 in their sample.

Additionally, it is important to note that both the above-referenced studies took place in Europe, where the legal drinking age is lower than that of the United States. Therefore, it is possible that participants in previous studies of approach biases to alcohol cues had more and better established drinking experiences and associations than the sample in the current study. According to the negative reinforcement model of addiction, changes in information processing that foster continued substance use are learned through repeated instances of substance use and the alleviation of negative affect that results (Baker et al., 2004). Consistent with this model, our sample may not have been experienced enough to amass the requisite alcohol consumption-related associations to develop approach biases to alcohol use, compared to samples that may have had more experience with alcohol (e.g., Field et al., 2008; Wiers et al., 2009).

Studies examining implicit alcohol cognitions in younger drinkers have produced mixed findings. Thush and Wiers (2007) found evidence for arousal associations in 12-year old boys, and results from Pieters, van der Vorst, Engels, and Wiers (2010) suggest negative associations predicted alcohol use in 11-year olds. Neither study involved the assessment of approach associations or action tendencies. Additionally, van Hemel-Ruiter, de Jong, and Wiers (2011) found that in an adolescent alcohol-using sample, valence associations were predictive of alcohol use, but approach action tendencies were not. In fact, the authors reported a significant correlation in the opposite direction of that demonstrated in the adult literature: heavier drinkers showed weaker approach tendencies compared to light drinkers (van Hemel-Ruiter et al., 2011). In line with inconsistent research on implicit biases in younger populations, results from this study suggest that a sample wherein most of the participants are in their first semester of college on average may not have had sufficient experience with alcohol to have developed implicit cognitive biases to alcohol cues.

A limitation of this study that may have constrained its ability to detect an effect was the method of negative affect induction, which was chosen specifically to maximize internal validity due to its relatively more standardized administration compared to other methods of negative affect induction, such as personalized imagery (Bradley et al., 2007; Ostafin & Brooks, 2011) or procedures similar to the anticipatory stress component of the Trier Social Stress test (Field & Powell, 2007; Field & Quigley, 2009; Kirschbaum, Pirke, & Hellhammer, 1993). Although the method used in the current study was in fact successful in inducing negative affect, it is possible that it was too dissimilar from participants' experience of negative affect in the natural environment. Indeed, Constantinou and colleagues (2010) also used a standardized laboratory task (e.g., Mental Arithmetic Task) as a means of negative affect induction, and also found non-significant effects of the stressor on attention bias in opiate users. It is possible that in order to elicit biases to drug and alcohol cues, the method of negative affect induction must approximate conditions that are likely to cause negative affect in the natural environment.

Despite non-significant findings, the results of this study offer several directions for future research. First, research in the area of the effect of negative affect on implicit biases should be extended to include subsequent measures of alcohol/drug use behavior. Research on the effect of laboratory-induced negative affect indicates that negative affect is associated with significant increases in both craving for alcohol (Ray, 2011) and consumption of both alcohol and placebo beverages (de Wit, Söderpalm, Nikolayev, & Young, 2003). As research suggests a relationship between negative affect and implicit biases, as well as a relationship between negative affect and drinking behavior, future research should include both measures of implicit biases and drinking behavior as a complete test of the negative reinforcement model of addiction (Baker et al., 2004). Specifically, inclusion of both implicit biases and drinking behavior in response to negative affect would allow for testing of implicit biases as a mediator in the relationship between negative affect and alcohol use.

In addition to laboratory-based assessments of drinking behavior, future directions for this line of research should consider the use of ecological momentary assessment procedures (EMA) to increase the ecological validity of the findings. EMA has been promoted as advantageous in the study of highly flexible constructs, such as affect and coping strategies (Stone & Shiffman, 1994). The context-dependent nature of many of the constructs involved (e.g., drinking motivation, negative affect) suggests that EMA may advance understanding of the relationship among negative affect, implicit biases, and alcohol use. Research on stress-related pathology and drinking shows that increases in PTSD symptoms among combat veterans were associated with immediate (i.e., within three hours) increases in alcohol consumption (Possemato et al., 2015). Additionally, research using EMA to assess implicit biases has demonstrated an association between greater attention bias to smoking cues associated and higher levels of cigarette craving during a quit attempt (Waters et al., 2014). EMA may also serve to address the possible limitation of the ecological validity of negative affect induction procedures suggested by results of this study, as well as by Constantinou and colleagues (2010).

Additionally, the combination of the results of this study with studies of implicit cognition in both younger and older samples offers interesting implications for future research on the development of implicit cognitive biases. The pattern of results tentatively suggests that implicit biases are learned via experience with substance use, which is consistent with the negative reinforcement model of addiction (Baker et al., 2004). Future research should investigate the effect of age, or more directly, experience with drugs or alcohol as a moderating factor in the development of implicit biases. Research suggests that early onset of alcohol use and intoxication, as well as peer, sibling, and parental factors (e.g., number of peers who use alcohol, parental approval of alcohol use) are associated with heavy alcohol use, alcohol-related problems, and CM alcohol use among adolescents (Barnes & Welte, 1986; Hawkins et al., 1997; Stueve & O'Donnell, 2005; Windle, 2000). In keeping with literature on factors associated with adolescent substance use and related problems, alcohol consumption, age of onset of alcohol use, and peer, sibling and parental factors should be investigated as possible predictors of implicit biases to alcohol cues in adolescents.

In conclusion, the results of this study suggest that neither CM drinking nor acute negative affect is associated with greater approach biases to alcohol cues. However, the lack of significant relationships between approach bias and any relevant study variables suggests that this sample may not have developed approach biases to alcohol cues, possibly due to their relatively young age and possible insufficient experience to establish requisite alcohol-related associations. Future research should continue to attempt to extend the findings of greater implicit biases in reaction to acute negative affect to behavioral assessments of drug/alcohol use via both laboratory and EMA paradigms, and also investigate the developmental course of implicit biases via experience with alcohol and other drugs, as well as peer, sibling, and parental factors. Results may further understanding of the etiology of alcohol use disorder by identifying factors that may be associated with increased likelihood of developing AUD (e.g., CM drinking, DT, AS). In addition, implicit cognitive biases to alcohol cues may represent a potential cognitive mechanism of action in the development of AUD that holds both explanatory power and may serve as a target for intervention in treatments for AUD in CM drinkers.

Table 1

Descriptive Statistics of Overall Sample and by Group

	Overall Sample (*N* = 54)		Low CM		High CM	
			Con. (*N*=9)	Exp. (*N*=14)	Con. (*N*=14)	Exp. (*N*=17)
	M(%)	*SD*	*M(SD)*	*M(SD)*	*M(SD)*	*M(SD)*
Age	18.48	0.91	19.22(1.84)[a]	18.50(0.53)	18.14(0.30)[a]	18.35(0.69)
GPA	3.53	0.31	3.40(0.41)	3.57(0.26)	3.66(0.16)	3.43(0.39)
Year (% 1st)	72.2	-	55.6	57.1	100.0	70.6
Gender (% Male)	35.2	-	55.6	50.0	27.3	30.8
Race						
White	77.8	-	66.7	71.4	78.6	88.2
Non-Hispanic	94.4	-	77.8	100.0	100.0	94.1
English	92.6	-	77.8	100.0	92.9	94.1
Greek (% not)	90.7	-	100.0	78.6	100.0	88.2
Negative affect Pre	11.06	12.16	4.27(3.15) [a]	12.58(9.19) [ab]	5.00(6.93) [b]	18.41(16.11) [ab]
Negative affect Post	21.06	21.41	3.33(3.04) [a]	30.71(20.52) [ab]	7.07(15.22) [b]	34.00(19.40) [ab]
AAT Pre	1.32	79.03	0.89(99.60)	-4.71(43.70)	-6.29(58.30)	12.77(105.8)
AAT Post	-6.22	58.61	-24.56(37.61)	-10.79(47.59)	-3.57(38.46)	5.06(85.33)
CM	2.20	1.02	1.20(0.17) [a]	1.21(0.17) [b]	3.10(0.67) [ab]	2.80(0.72) [ab]
DT	3.14	0.79	3.32(0.98)	3.27(0.71)	3.19(0.73)	2.89(0.78)
AS	20.59	12.19	17.44(8.93)	12.79(6.0) [a]	23.86(15.78)	26.00(11.01) [a]
Frequency	4.28	1.30	4.22(1.20)	4.64(1.50)	4.36(1.22)	3.94(1.25)
DDD	7.26	1.09	6.78(1.39)	7.29(0.83)	7.5(1.02)	7.29(1.16)
Binge days	5.43	1.61	5.11(1.17)	5.57(1.51)	5.64(1.60)	5.29(1.96)
RAPI	31.9	7.33	27.78(4.11)[a]	30.64(6.56)	30.07(5.28)	36.47(8.71)[a]

Note. AAT = Approach Avoidance Task; CM = coping motivation; DT = distress tolerance; AS = anxiety sensitivity; frequency = frequency of alcohol use in past three months; DDD = drinks per drinking day in the past three months, binge days = # binge days in the past three months; RAPI = alcohol problems. Variables with matching superscripts indicate significant group differences ($p < .05$).

Table 2

Regression Analysis Predicting Post-Affect Induction AAT Scores from Coping Motives Group and Affect Condition

	Full model	Change statistics		Predictor statistics		
	R^2	ΔR^2	ΔF	$B(SE)$	β	p
Step 1	.01	.01	0.53			
AAT Pre				-0.08(0.10)	-.10	.47
Step 2	.04	.03	0.85			
AAT Pre				-0.08(0.10)	-.11	..42
CM				18.59(16.29)	.16	.26
NA				11.51(16.30)	.10	.48
Step 3	.04	.00	0.01			
AAT Pre				-0.08(0.10)	-.11	.43
CM				20.39(25.49)	.17	.43
NA				13.31(25.48)	.11	.60
CMxNA				-3.10(33.45)	-.03	.93

Note. $N = 54$. AAT Pre = baseline AAT score; CM = coping motives group (0=low, 1=high); NA = affect condition (0=neutral, 1=negative).

Table 3
Bivariate Correlations of Relevant Study Variables

	1	2	3	4	5	6	7	8
1. AAT Pre	-							
2. AAT Post	-.10	-						
3. CM	-.01	-.04	-					
4. DT	-.14	.19	-.30*	-				
5. AS	-.03	.06	.47**	-.59**	-			
6. Frequency	.06	-.04	-.22	-.31*	.17	-		
7. DDD	-.02	.01	.09	-.18	.33*	.27*	-	
8. Binge days	.12	.04	-.12	-.11	.27**	.64**	.60**	-
9. RAPI	-.14	.06	.32*	-.33*	.26	-.13	-.16	-.21

Note. CM = coping motivation; DT = distress tolerance; AS = anxiety sensitivity; frequency = frequency of alcohol use in past three months; DDD = drinks per drinking day in the past three months, binge days = # binge days in the past three months; RAPI = alcohol problems. Frequency and RAPI scores were log-transformed to improve skew.

* $p < .05$
** $p < .01$
*** $p < .001$

Table 4

Exploratory Regression Analysis Predicting Post-Affect Induction AAT Scores from Coping Motives Group and Distress Tolerance

	Full model	Change statistics		Predictor statistics		
	R^2	ΔR^2	ΔF	*B(SE)*	β	*p*
Step 1	.01	.01	0.53			
AAT Pre				-0.08(0.10)	-.10	.47
Step 2	.08	.07	1.78			
AAT Pre				-0.06(0.10)	-.08	.56
CM				21.84(16.19)	.19	.18
DT				15.74(10.36)	.21	.14
Step 3	.08	.001	0.06			
AAT Pre				-0.06(0.10)	-.08	.59
CM				21.66(16.36)	.18	.19
DT				12.90(15.51)	.17	.41
CMxDT				5.19(20.95)	.05	.81

Note. N = 54. AAT Pre = baseline AAT score; CM = coping motives group (0=low, 1=high); DT = distress tolerance. DT was centered prior to creating the interaction term.

Table 5
Exploratory Regression Analysis Predicting Post-Affect Induction AAT Scores from Coping Motives Group and Anxiety Sensitivity

	Full model	Change statistics		Predictor statistics		
	R^2	ΔR^2	ΔF	*B(SE)*	β	*p*
Step 1	.01	.01	0.53			
AAT Pre				-0.08(0.10)	-.10	.47
Step 2	.03	.02	0.60			
AAT Pre				-0.08(0.10)	-.11	.44
CM				-18.34(18.09)	.16	..32
AS				-0.05(0.74)	-.01	.95
Step 3	.04	.001	0.08			
AAT Pre				-0.08(0.11)	-.11	.43
CM				20.49(19.86)	.17	..31
AS				-0.47(1.73)	-.10	.79
CMxAS				0.53(1.92)	.09	.79

Note. N = 54. AAT Pre = baseline AAT score; CM = coping motives group (0=low, 1=high); AS= anxiety sensitivity. AS was centered prior to creating the interaction term.

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