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Mood Selectively Moderates the Implicit Alcohol Association–Drinking Relation in College Student Heavy Episodic Drinkers

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Multiple studies indicate that implicit alcohol-related associations (i.e., indices of relatively fast, spontaneous processes) predict drinking. An important next step is to investigate moderators of the implicit association-drinking relationship. Mood state has been proposed as a moderator of this relationship: implicit associations have been theorized to be stronger predictors of drinking under positive mood states. From the same theoretical perspective, explicit measures (indices of relatively slow, reflective processes) have been proposed to be stronger predictors of drinking under negative mood states. The current study evaluated these hypotheses by investigating whether mood state (manipulated via exposure to a brief video clip) moderated the relations between three types of implicit alcohol-related associations (alcohol excite, alcohol approach, and drinking identity), their explicit counterparts, and drinking in a taste test that included beer and soft drinks. A sample of 152 undergraduate social drinkers (81 men; 71 women) completed baseline measures of implicit alcohol-related associations, their explicit counterparts, and typical drinking behaviors. Participants then viewed a mood-state-inducing video clip (positive, neutral, or negative), and completed the taste test. Results were mixed but generally indicated that prediction of drinking by baseline implicit alcohol excite (but not alcohol approach or drinking identity) associations was moderated by mood. Specifically, implicit alcohol excite associations were more negatively associated with drinking after viewing the sad video and more positively associated with drinking after watching the happy/neutral video. Moderation was also observed for the explicit counterpart of alcohol excite. Findings are discussed in terms of models of negative reinforcement drinking.

Keywords: alcohol taste test, IAT, implicit alcohol associations, moderators, mood

Alcohol misuse among young adults (i.e., individuals aged 18–25), including college students, represents a significant public health burden in the U.S. Individuals in this age group not only drink more frequently but also drink more per occasion than any other age group (Substance Abuse and Mental Health Services Administration, 2013). With respect to college students in particular, survey research indicates that more than 63% reported drinking in the last 30 days, and roughly 38% reported having been drunk at least once in the past month (Johnston, O'Malley, Bachman, Schulenberg, & Miech, 2016). Excessive drinking is associated with severe consequences, including death, physical injury, and/or illness, sexual and/or physical assault, blackouts, unpro-

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tected sex, legal trouble, and driving while intoxicated (Merrill & Carey, 2016). Thus, calls have been issued to identify additional risk factors that could be targeted in future college student prevention and intervention efforts (e.g., U.S. Department of Health & Human Services, 2007).

Implicit alcohol-related associations—associations about alcohol and drinking that are thought to reflect cognitive processes that are relatively automatic, spontaneous, and impulsive—are potential risk factors that have received substantial attention during the past 15 years (Stacy & Wiers, 2010; Wiers, Van Woerden, Smulders, & De Jong, 2002). Research findings indicate that implicit alcohol-related associations predict college student drinking cross-sectionally and over time (see Lindgren et al., 2013; Lindgren, Neighbors, et al., 2016). Moreover, measures of implicit associations predict drinking over and above measures of their explicit counterparts (see Lindgren et al., 2013; Lindgren, Neighbors, et al., 2016). As the study of implicit alcohol-related associations has matured, theory and research efforts have begun to focus on identifying boundary conditions (i.e., moderators) of the relationship between implicit alcohol-related associations and drinking. For example, Hofmann, Friese, and Wiers (2008) proposed a theoretical framework that identified potential moderators of the relationship between implicit processes and health behaviors, including drinking. Mood state was one of the factors identified as a potential moderator. Indeed, research has found that individuals who were in a positive (vs. negative mood) state relied more on associative networks in memory (see review by Hofmann et al., 2008), and measures of implicit associations have been conceptualized as means to assess underlying associative networks in memory (see Greenwald et al., 2002, but see De Houwer, 2014, for an alternative view). Thus, Hofmann et al. (2008) hypothesized that the relationship between implicit associations and health behaviors would be stronger for individuals in a positive (vs. negative) mood state because of the "shallower" processing associated with positive moods. Conversely, it was hypothesized that the relationship between explicit measure counterparts and health behaviors would be stronger for individuals in a negative (vs. positive) mood state because negative moods would be associated with "deeper" processing or greater reliance on reflective processing. Note that in this formulation, both implicit associations and their explicit counterparts are conceptualized as largely dispositional or trait-like (vs. state-like). Findings from initial studies on health behaviors were largely consistent with this framework (Holland, de Vries, Hermsen, & van Knippenberg, 2012).

In the domain of alcohol, there is scant research examining mood state, implicit associations, and drinking outcomes. The few studies that have done so differed in their theoretical conceptualization of the relationships among mood state, implicit associations, and drinking. Studies have instead focused on whether a particular mood state activates implicit associations related to alcohol and whether those associations in turn predict drinking (e.g., Birch et al., 2008; Ostafin & Brooks, 2011). Thus, in this conceptualization, implicit associations are posited to function as a mediator of the relationship between mood state and drinking. We know of one study (e.g., Wardell, Read, Curtin, & Merrill, 2012) that evaluated a related implicit construct (alcohol expectancies assessed via a timed expectancy task), and its aims included testing *both* the implicit association as mediator model and whether mood states and implicit processes interacted to predict drinking. The study included a mood induction, an evaluation of subsequent implicit alcohol expectancies, and ad libitum drinking in a taste test. Interestingly, results did not support the mediation model. Instead, there was some support for interactions between mood and subsequently evaluated implicit alcohol expectancies: males' (but not females') implicit expectancies of tension reduction effects were stronger predictors of alcohol consumption following greater mood arousal (positive or negative) relative to a neutral mood induction condition. Given the very particular focus of the implicit measure, the evaluation of the implicit measure after the mood induction, and the interaction with gender in this particular sample, the question of whether mood state moderates baseline or underlying implicit alcohol associations' (and their explicit counterparts') prediction of drinking more generally remains largely unanswered. This moderation question is important because it can highlight specific conditions or contexts (e.g., different mood states) when baseline implicit alcohol associations may serve as more or less of a vulnerability marker for problem drinking and could guide the development of future personalized interventions (e.g., mood-specific coping strategies).

To obtain a broader assessment of the moderation of baseline implicit associations as predictors of drinking, the current study focused on three types of implicit alcohol associations that have been previously validated and are conceptually related to well-validated explicit predictors of young adult alcohol misuse. All three alcohol associations are measured using variants of the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998), a computerized task that measures the strength of associations between various concepts. First, implicit alcohol approach associations are based on motivational models of substance use that assert that substance-related cues may elicit an appetitive response to approach and consume a substance (e.g., Robinson & Berridge, 1993). The alcohol approach IAT (Ostafin & Palfai, 2006) thus measures the strength of implicit associations between alcohol and words representing approach relative to words representing avoid. Second, assessments of alcohol excite associations are based on theoretical models of drinking that assert that individuals choose to drink for a variety of motives (Cox & Klinger, 1988), and research that demonstrates that enhancement motives (e.g., drinking to have fun) are primary motives for young adult drinking (Neighbors, Lee, Lewis, Fossos, & Larimer, 2007). The alcohol excite IAT (Lindgren, Hendershot, Neighbors, Blayney, & Otto, 2011; closely related to the alcohol arousal IAT, see Wiers et al., 2002) measures the strength of associations between alcohol and words that represent excitement relative to words that represent depressed mood. Finally, implicit drinking identity stems from recent theoretical models that emphasize the role of one's self-concept as an important predictor of substance misuse (Lindgren, Neighbors, Gasser, Ramirez, & Cvencek, 2017). The drinking identity IAT (Lindgren et al., 2013) measures the association between drinking and the self relative to others. These implicit associations have been found to predict unique variance in young adult drinking outcomes relative to their explicit counterparts concurrently and prospectively (e.g., Lindgren et al., 2013; Lindgren, Neighbors, et al., 2016), although relative to each other, there is evidence that implicit drinking identity may be the most consistent predictor of young adult drinking outcomes in the U.S. (Lindgren et al., 2013; Lindgren, Neighbors, et al., 2016).

These three alcohol-related associations (alcohol approach, alcohol excite, and drinking identity) have all been theorized and demonstrated to be associated with young adult drinking outcomes, and clearly have some conceptual similarities. However, they also differ in term of their specific content and have originated from and often "live" in different literatures (i.e., alcohol approach associations can be linked to incentive-sensitization theory [Robinson & Berridge, 1993], alcohol excite associations to motivational accounts of alcohol use [Cooper, 1994; Cox & Klinger, 1988], and drinking identity to social identity accounts of addiction [Dingle, Cruwys, & Frings, 2015]). A result of these differences is that it is common for a single implicit association to be evaluated in a given study. Although there are some exceptions (see, e.g., Lindgren et al., 2013; Lindgren, Neighbors, et al., 2016; Wiers et al., 2002), there is no clear evidence to date that certain associations are more related to particular outcomes (e.g., consumption vs. problems) than others. As a result, we elected to investigate all three of these associations and had identical hypotheses for each one, namely that mood state would moderate the relationship between the associations and alcohol consumption in the lab.

Study Overview

Our primary goal was to test whether mood state moderated the relationship between baseline implicit alcohol associations and alcohol consumption. An experimental approach that used an ad libitum alcohol taste test was selected to test whether implicit associations and mood had direct effects on alcohol consumption. Participant' mood was manipulated via the use of video clips (happy, sad, and neutral). Consistent with Hofmann et al.'s (2008) theoretical framework that suggests that there should be shallower processing during positive mood states and, therefore, a stronger influence of automatic or associative processes on drinking, we expected to find a significant mood by implicit alcohol association interaction. Specifically, a stronger positive relationship between implicit alcohol associations and alcohol consumption was expected for participants who viewed the happy clip relative to participants who viewed the sad clip. Participants who viewed the neutral clip were expected to have a relationship between implicit alcohol and alcohol consumption that was in between those in the happy and sad clip conditions. The pattern of findings was expected to be the same across all three implicit alcohol associations. Explicit measure counterparts to the implicit alcohol associations were also evaluated. Consistent with Hofmann et al. (2008), the opposite pattern of findings was expected. Specifically, stronger positive relationships between explicit measures and alcohol consumption were expected following exposure to the sad clip (relative to neutral and happy clips).

Method

Participants

Participants were 152 students (71 female, 81 male) in their third or fourth year at a large public university. Individuals were aged 21–25 ($M = 21.55$, $SD = 0.68$). Seven percent of participants identified as Hispanic or Latino. Fifty-five percent identified as White, 24% identified as Asian, 13% identified as more than one race, 6% as African American, Native Hawaiian or Pacific Islander, American Indian or Alaskan Native, or unknown, and 2% declined to answer. Three participants were excluded from analyses due to computer malfunction during the mood manipulation; thus, 149 participants were included in analyses.

Measures and Materials

Baseline.

Implicit alcohol-related associations. Alcohol associations were assessed using the Implicit Association Test (IAT; Greenwald et al., 1998). The IAT is a computer-based reaction time (RT) task measuring the strength of the association between two sets of constructs. Three variants of the IAT were included to evaluate associations between identity and drinking (drinking identity IAT; Lindgren et al., 2013), approach and alcohol (alcohol approach IAT; Ostafin & Palfai, 2006), and excitement and alcohol (alcohol excite IAT; Lindgren et al., 2013). In each IAT, participants classify stimuli into categories representing each construct. In the drinking identity IAT, for example, participants classify stimuli representing two target categories (i.e., "me" and "not me") and two attribute categories (i.e., "drinker" and "non-drinker").

The IATs used the traditional seven-block structure. Each block includes multiple trials in which a single stimulus appears at the center of the screen. Participants use designated keys (*e* for left and *i* for right) to classify the stimulus as quickly as possible according to the categories listed on the left and right sides of the screen. Blocks 1, 2, and 5 were practice blocks, which included only the target *or* attribute categories on each side of the screen. In the drinking identity IAT, for example, participants might start by classifying stimuli into the categories "me" or "not me." The remaining blocks (3, 4, 6, & 7) were test blocks, which paired one target *and* one attribute category on each side of the screen. Participants must classify each stimulus according to the pairing. In the drinking identity IAT, blocks 3 and 4 might pair "me" with "drinker" on the left, and "not me" and "non-drinker" on the right. Blocks 6 and 7 would then reverse this pairing so that "me" is classified with "non-drinker" and "not me" is paired with "drinker." Faster response times indicate a stronger association between two categories. To reduce the possibility of order effects, the presentation of the target-attribute pairings were counterbalanced across participants, and the order in which participants completed the three IATs was randomized. To reduce the possibility of fatigue, the assessment was also structured so that the IATs were interspersed among self-report measures.

IAT category labels and stimuli were identical to those used in previous studies (e.g., Lindgren et al., 2013; Lindgren, Neighbors, et al., 2016). They were as follows (category labels are italicized): drinking identity IAT (Lindgren et al., 2013) *drinker*: drinker, partier, drunk, drink; *nondrinker*: nondrinker, abstainer, sober, abstain; *me*: me, my, mine, self; and *not me*: they, them, theirs, other; alcohol approach IAT (Ostafin & Palfai, 2006) *alcohol*: pictures of alcohol; *water*: pictures of water; *approach*: approach, closer, advance; forward, toward; and *avoid*: avoid, away, leave, withdraw, escape; and alcohol excite IAT (Lindgren et al., 2013; Wiers et al., 2002); *alcohol*: pictures of alcohol; *water*: pictures of water; *excite*: cheer, fun, high, amplify, excite; and *depress*: sedate, deplete, lessen, depress, quiet. Also identical to Lindgren et al. (2013; Lindgren, Neighbors, et al., 2016), alcohol pictures used in

the alcohol approach and alcohol excite IAT were selected by participants, and the same pictures were used for both IATs. Participants were asked to select four alcohol pictures (of 12) that best represented the kinds of alcohol they consumed most often. The stimuli selected using this approach have been shown to correspond to college students' alcohol preferences (Lindgren, Westgate, Kilmer, Kaysen, & Teachman, 2012).

IAT scores were calculated using the D-600 score algorithm (Greenwald, Nosek, & Banaji, 2003). The D score indicates the standardized difference in average response time (i.e., latency) across the two pairings and thus the relative strength of each association. Higher scores on the drinking identity IAT, alcohol approach IAT, and alcohol excite IAT indicate stronger associations between drinker and me, alcohol and approach, and alcohol and excite, respectively. As recommended by Nosek and colleagues (2007), IAT scores were excluded for individuals who were faster than 300 milliseconds on 10% or more trials or had errors on 30% or more trials. One alcohol approach score and two drinking identity scores were excluded based on these criteria. Internal consistency for the IAT was calculated by correlating two D scores, one for blocks 3 and 6 and one for blocks 4 and 7 (Greenwald et al., 2003). Consistency for these IATs typically ranges from .5 to .6 (Lindgren et al., 2013). In the present study, $r = .49$ for drinking identity, $r = .58$ for alcohol approach, and $r = .53$ for alcohol excite.

Explicit Counterparts to the Implicit alcohol-related Associations. *Explicit drinking identity* was evaluated using the Alcohol Self-Concept Scale (ASCS; Lindgren et al., 2013), an adaptation of the Smoker Self-Concept scale (Shadel & Mermelstein, 1996). The measure includes five items assessing the extent to which drinking plays a role in one's life and personality (e.g., "Drinking is part of who I am"). Participants rate their agreement with these statements on a 7-point scale (-3 = *strongly disagree* and 3 = *strongly agree*). Cronbach's alpha was .92. Typically, summary scores are the mean of five items. Because of considerable positive skew in the distribution of summary scores and consistent with practices described in Lindgren, Ramirez, Olin, and Neighbors (2016), summary scores were recoded as binary, with 0s indicating absolutely no drinking identity (mean score = -3) and 1s indicating endorsement of anything other than strong disagreement with all items (mean score > -3).

Explicit alcohol approach was assessed using the inclined/indulgent subscale of the Approach and Avoidance of Alcohol Questionnaire (AAAQ; McEvoy, Stritzke, French, Lang, & Ketterman, 2004). The subscale includes five items evaluating participants' inclinations to approach alcohol over the past week (e.g., "I would like to have a drink or two"). Participants rate their agreement with each item on a 9-point scale (0 = *not at all* and 8 = *very strongly*). Cronbach's alpha was .82.

Explicit alcohol excite was evaluated with the enhancement subscale of the Drinking Motives Questionnaire (DMQ; Cooper, 1994). The subscale includes five items examining the extent to which one drinks to increase positive mood (e.g., "Because it gives you a pleasant feeling"). Participants respond on a 5-point scale (1 = *Never/almost never* and 5 = *Almost always/always*). Cronbach's alpha was .83.

Weekly alcohol consumption. The Daily Drinking Questionnaire (DDQ; Collins, Parks, & Marlatt, 1985) assesses daily alcohol consumption within a typical week over the past 3 months. Items ask participants to report the total number of alcoholic drinks consumed per day in standard drinks. Participants were provided information about U.S. standard drink equivalencies (e.g., 12 oz. beer, 10 oz. microbrew beer, 5 oz. wine, 1.5 oz., 80-proof hard liquor).

Mood state manipulation. Three-minute video clips were used for the mood state manipulation. Video clips were validated for mood state manipulation in previous research (see Holland et al., 2012; Rottenberg, Ray, & Gross, 2007). The happy clip was from *The Muppet Show* ("mahnah, mahnah," used in Holland et al., 2012). The sad clip was from *Schindler's List* (also used in Holland et al., 2012). The neutral clip was from the nature documentary, *Alaska's Wild Denali* (as described in Rottenberg et al., 2007). Participants' mood state was evaluated using Holland et al.'s (2012) 6-item Brief Affect Measure. Mood was assessed immediately following the video clip (e.g., "How negative/sad/angry/positive/satisfied/happy are you feeling right now?"). Participants rated items on 9-point scales (1 = *not at all* and 9 = *very much).* Mean scores were calculated for the three negative and the three positive items, respectively. Cronbach's alpha was .92 for the negative mood subscale and .95 for the positive mood subscale.

Taste test. Alcohol consumption was evaluated using a modified taste-test procedure (Wiers, Rinck, Kordts, Houben, & Strack, 2010). Participants were told that the purpose of the taste test was to evaluate consumer preferences for alcoholic and nonalcoholic beverages. Participants were presented with three 12 oz. beers (Bud Light, Coors Light, and Miller Lite) and three 12 oz. sodas (Coke Zero, Sprite Zero, and Diet Pepsi), each in an unlabeled cup. When presented with the drinks, participants were given rating forms and asked to take their time tasting and rating each drink. The rating forms included multiple beverage descriptors (e.g., taste, bitterness, strength), which participants rated on 7-point scales. In addition, participants were asked to guess the consumer brand of each drink. Participants had 10 min to taste and rate the beverages but were not informed of this time limit.

Procedures

Study procedures were approved by the university's institutional review board. Participants were recruited via e-mail for a lab-based study involving tasting and rating alcoholic beverages. Initial contact information was obtained from the university's registrar's list of full-time students in their third or fourth year of college, who were over the age of 21. If interested, individuals were asked to contact the study research team via phone or e-mail. Participant eligibility (full-time student, English fluency, 21 or older, not disliking beer) was determined via a phone screening. Participants also had to report having at least one heavy drinking episode in the last month ($\geq$4 drinks for women, $\geq$ 5 drinks for men on a single occasion). Eligible participants then completed a brief medical screening to rule out health conditions (including problematic drinking) that would preclude participation in the taste test. Eligible participants who were not ruled out from the medical screening were scheduled for the lab session. Participants were instructed not to drink any alcohol or take any drugs on the day of the session, not drive to or from the laboratory, and to abstain from food or drink (other than water) for three hours prior to their session.

At the lab session, participants were asked for government identification (for proof of age and name). They completed written

informed consent procedures. Female participants also took pregnancy tests, required for compliance with U.S. federal guidelines restricting pregnant women from alcohol administration studies. All subsequent procedures took place in a private room. Participants also reviewed their medical screening to ensure accuracy. An initial blood alcohol reading using a hand-held breath alcohol tester (Alco-Sensor IV, Intoximeter, Inc.) was used to establish that participants had a blood alcohol concentration of 0.00 g/210 L. Participants then completed the baseline assessment (which included the IATs, the explicit counterparts, and drinking measures and were presented in a randomized order with the exception of spacing out the IATs to prevent back-to-back completion) on the computer. Next, they were randomly assigned to video condition and completed the mood state manipulation. Those procedures were completed alone and via the computer; participants watched the video clip and then completed the mood state assessment. The taste test immediately followed. An experimenter brought participants the drinks and paper-based rating sheets and then left the room. Participants completed the tasting and ratings alone. Following the taste test, the experimenter returned and removed the beverages and ratings form. Next, participants completed three additional blood alcohol readings, each 5 min apart, during which time participants were offered entertainment, food, and nonalcoholic drinks. Blood alcohol readings continued to be taken at 10–20 min intervals for participants whose blood alcohol concentration remained at or above 0.03 g/210 L. Participants were debriefed once their blood alcohol concentration was below 0.03 g/210 L and were thanked for their participation in the study. Participants were compensated $15 per hour; mean length of lab sessions was 112 min (SD = 17 min).

Results

Preliminary Results

Results from two one-way ANOVAs indicated significant differences in positive and negative mood state ratings as a function of video clip (positive mood: $F(2, 146) = 42.83$, $p < .001$, $\eta^2 = .31$, negative mood: $F(2, 146) = 49.92$, $p < .001$, $\eta^2 = .34$,), as expected. However, contrary to expectations, planned follow-up comparisons revealed that the positive and negative mood state ratings for the happy and neutral film clips did not differ significantly (all ps $> .05$; see Table 1). After viewing either clip, participants' reported similarly high positive mood (mean scores for both were approximately 6, one above the midpoint on a 9-point unipolar scale evaluating positive mood state) and similarly low negative mood (means scores for both were approximately 2, only one point higher than the lowest score on a 9-point unipolar scale evaluating negative mood state). Thus, it appears that participants were endorsing little negative mood and endorsing positive mood above moderate levels. Participants' ratings for the happy and neutral clips were significantly different (and in the expected direction) from the sad film clip (ps $< .001$). Consequently, the happy and neutral film clip conditions were collapsed into a single condition, subsequently referred to as the happy/neutral clip condition. Key baseline and outcome variables are reported as a function of (collapsed) video condition in Table 2.

Table 1
Mood State Ratings as a Function of Video Clip Condition

Mood state ratings	Happy clip (n = 49) M (SD)	Neutral clip (n = 50) M (SD)	Sad clip (n = 50) M (SD)
Positive mood	6.09 (1.91)[a]	5.97 (1.52)[b]	3.40 (1.45)[ab]
Negative mood	1.90 (1.36)[a]	1.89 (1.24)[b]	4.73 (2.15)[ab]

Note. Conditions sharing the same superscript differ significantly ($p < .001$). Mood state was measured using Holland et al.'s (2012) brief affective state measure; higher scores equal stronger positive/negative mood. Happy clip = *The Muppet Show*; neutral clip = Denali nature documentary; sad clip = *Schindler's List*.

Analytic Framework

Our analytic framework was based on the generalized linear model for which the general linear model is a special case where outcomes are normally distributed. Alcohol outcomes are frequently count variables (e.g., number of standard drinks or, in this case, number of milliliters consumed) that are limited to nonnegative integers and have a large positive skew. In this study, the primary outcome evaluated was the amount of alcohol (beer) consumed in milliliters (ml). Consumption ranged from 17 to 869 ml and the distribution of consumption was positively skewed. Because there were no values less than 17 ml and the distribution was skewed, consumption was best approximated by a truncated (at 16 ml) negative binomial distribution (Cameron & Trivedi, 2013). Thus, a truncated negative binomial regression model was employed to examine the amount of alcohol consumed using the tnbreg procedure in Stata/*SE* 15.0. The secondary outcome evaluated was the percentage of total alcohol consumed in the taste test relative to the total volume of liquid consumed (Beer ml/[Beer ml + Soda ml]). This outcome approximated a normal distribution and was, therefore, evaluated using ordinary least squares (OLS) regression (Cohen, Cohen, West, & Aiken, 2003). The two outcomes were correlated at .43. Alpha was adjusted from .05 to .034 to compensate for separate tests of two correlated outcomes (Sankoh, Huque, & Dubey, 1997). Each model included video condition, the IAT for the given construct (identity, approach, or excite) and its explicit measure counterpart, and the two-way interactions between video condition and the IAT/explicit measure controlling for weekly drinking and gender. Gender and video condition were both dummy coded. Gender was coded as either male = 0 and female = 1. Video condition was coded as happy/neutral (Muppets or Denali) = 0 or sad (*Schindler's List*) = 1. All predictors were mean-centered prior to the creation of product terms, and all predictors were entered simultaneously.

We initially ran models that included all of the implicit and explicit measures for identity, approach, and excite constructs in the same models ("combined models") but elected to run them separately for more parsimonious interpretations ("separate models"). Three of the four interactions (those associated with implicit and explicit alcohol excite) were consistent with respect to statistical significance and pattern regardless of modeling strategy. In the combined models, there was also an approach IAT × video condition interaction that was significant; it was not significant in the separate model. In the separate model, there was a significant explicit identity × video condition interaction; it was not significant in the combined models.

Table 2
Key Baseline and Outcome Variables as a Function of (Collapsed) Video Clip Condition

Variable	Sad clip ($N = 50$)		Happy/Neutral clip ($N = 99$)	
	M	*SD*	*M*	*SD*
Gender	23 F/27 M		47 F/52 M	
Weekly consumption	12.80	9.49	10.59	7.44
Identity IAT	.18	.38	.17	.38
Approach IAT	−.02	.48	−.15	.42
Excite IAT	.02	.51	.02	.39
Explicit identity	.70	.46	.64	.48
Explicit approach	5.89	1.67	5.71	1.69
Explicit excite	15.74	4.77	15.52	4.26
Beer consumption (ml)	156.96	117.78	174.36	135.95
Beer consumption (% of total)	53.20%	14.73%	55.11%	14.25%

Note. Collapsed video condition = exposure to sad (*Schindler's List*) or happy/neutral (Muppets or Denali) video clip. Weekly consumption equals total typical weekly alcohol consumption in U.S. standard drinks as reported on the Daily Drinking Questionnaire. IAT = score on the Implicit Association Test; higher scores = stronger associations with alcohol and the construct in the IAT's name (i.e., identity, approach, or excite). Explicit measures = score on explicit measure counterpart (identity = drinking identity [alcohol self-concept scale], approach, = alcohol approach inclinations [inclined/indulgent subscale of Alcohol Approach Avoidance Questionnaire]; excite = drinking enhancement motives [drinking motives questionnaire]). Variables do not differ significantly as a function of video condition (all *ps* > .05).

Exploratory models were also conducted to evaluate whether gender moderated the effects of mood, IATs/explicit measures, and mood × IAT/explicit interactions on alcohol consumption. No two-way or three-way interactions emerged in any model. For brevity, exploratory models are not presented but are available from the first author.

Drinking as a Function of Video Condition and Implicit and Explicit Identity

Table 3 presents results for analyses evaluating drinking as a function of video condition, identity IAT score and explicit identity. The top portion of the table presents truncated negative binomial results for analyses evaluating alcohol consumption as a function of video condition, identity IAT, explicit identity (dummy coded: 0 = no or no endorsement of drinking identity, 1 = yes or anything other than strong disagreement with all items), and the two-way interactions between video condition and identity IATs/explicit identity controlling for weekly drinking and gender. There was a significant gender effect, indicating that women consumed 34% less alcohol than men, based on the IRR (Incident Rate Ratio). The IRR is the exponentiated value of parameter estimate *B* (i.e., e^B) and is interpreted as the proportional rate of change in alcohol consumed per unit increase in the predictor (Atkins & Gallop, 2007). Here the IRR for gender (with women coded as 1; men coded as 0) was .66 (66%), indicating that predicted alcohol consumption (in ml) decreased by 34% for female participants.

Results also revealed a significant interaction between video condition and explicit identity, suggesting that the effect of explicit identity on alcohol consumption varied significantly depending on the video clip to which participants were exposed. The interaction and simple slopes are presented in Figure 1a. The figure presents predicted values calculated from the negative binomial regression equation for the scores for explicit

Table 3
Results Testing Video Condition as a Moderator of Implicit and Explicit Drinking Identity on Alcohol Consumption

Alcohol consumed (ml)	$B = ln\ e^B$	*SE* (*B*)	*z*	*p*	e^B	LL95%	UL95%
Intercept	5.039	.056	89.58	<.001	154.29	138.18	172.28
Weekly consumption	.009	.008	1.23	.22	1.01	.99	1.03
Gender	**−.423**	**.118**	**−3.58**	**<.001**	**.66**	**.52**	**.83**
Video condition	−.114	.119	−.96	.34	.89	.71	1.13
Identity IAT	.002	.158	.01	.99	1.00	.74	1.37
Explicit identity	−.070	.122	−.58	.56	.93	.73	1.18
Video × Identity IAT	−.398	.327	−1.21	.22	.67	.35	1.28
Video × Explicit identity	**.667**	**.265**	**2.51**	**.01**	**1.95**	**1.16**	**3.28**
Alpha (dispersion parameter)	.436	.059				.34	.57
Alcohol percent of total	***B***	***SE* (*B*)**	***t***	***p***	**β**	**UL95%**	**UL95%**
Intercept	.581	.027	21.14	<.001	—	—	—
Weekly consumption	.003	.002	1.97	.05	.18	.00	.35
Gender	−.004	.024	−.14	.89	−.01	−.18	.16
Video condition	−.071	.045	−1.59	.12	−.10	−.27	.06
Identity IAT	.032	.040	.80	.43	.03	−.14	.20
Explicit Identity	−.041	.031	−1.33	.19	−.07	−.24	.10
Video × Identity IAT	−.062	.069	−.90	.37	−.08	−.25	.09
Video × Explicit identity	.060	.055	1.09	.28	.10	−.08	.27

Note. Bolded rows indicated significant effects; α = .034. IAT = Implicit Association Test; *B* = unstandardized parameter estimate, log-linked for truncated negative binomial regression of alcohol consumed (ml); *SE* = standard error of the parameter estimate; e^B = exponentiated coefficient also known as the Incident Rate Ratio; LL95% and UL95% = lower and upper limits of 95% confidence intervals. Weekly consumption equals total typical weekly alcohol consumption in US standard drinks as reported on the Daily Drinking Questionnaire. Gender was coded 0 = male, 1 = female. Video condition = exposure to either happy/neutral (Muppets or Denali) or sad (*Schindler's List*) video clip; video condition was coded 0 = happy/neutral, 1 = sad. Predictors were mean centered prior to creation of product terms.

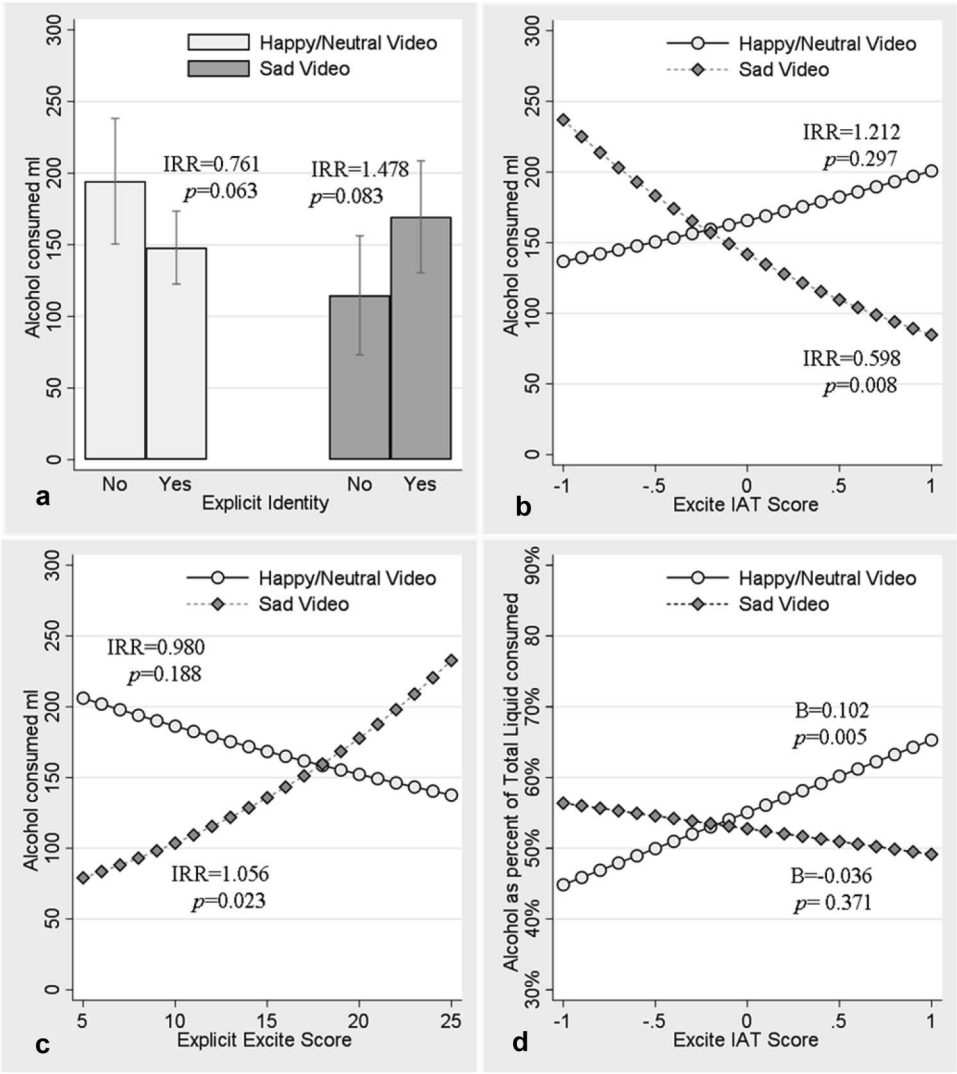

Figure 1. Total alcohol consumption (a–c) and percentage of liquid consumed that was alcohol (d) as a function of explicit identity, excite IAT scores, or explicit excite scores and video condition. Explicit identity = no (absolutely no drinking identity) or yes (anything other than strong disagreement with all items). Higher excite IAT scores = stronger alcohol excite associations as assessed by the Implicit Association Test. Higher explicit excite scores = stronger enhancement drinking motives; IRR= Incident Rate Ratio.

identity (0 and 1) at each level of video condition. Simple slopes were tested following the same logic used to test simple slopes in OLS regression; namely by testing the effect of X (predictor) on Y (outcome) at the specific values of M(moderator; Cohen et al., 2003). The primary difference with negative binomial outcomes is that predictors are linked with the outcome by a natural log function (*ln*). Thus, the parameter estimate for X (e.g., explicit identity) represents the amount of expected change in *ln*Y (alcohol consumption) at the specific value of M (video condition). Exponentiation of the parameter estimate yields an incidence rate ratio (IRR), which can be interpreted as the rate of change in Y for each unit increase in X. Thus, a simple slope value of IRR = .76 for explicit identity in predicting alcohol consumption among participants in the happy/neutral video condition indicates that participants who explicitly endorsed identification with drinking consumed 24% less alcohol than those who did not explicitly endorse identification with drinking. In contrast, a simple slope of IRR = 1.48 indicates that for participants in the sad video condition, those who reported explicit endorsement of a drinking identity consumed 47.8% more than those who did not endorse an explicit alcohol identity. Note also that neither simple slope values were statistically significant.

The bottom portion of Table 3 presents regression results for analyses evaluating the percentage of alcohol consumed relative to total beverage consumption as a function of video condition, implicit and explicit measure of alcohol identity, and the two-way interactions between the identity and video condition variables, again controlling for weekly drinking and gender. None of the effects were significant.

Drinking as a Function of Video Condition and Implicit and Explicit Alcohol Approach

Results for the analyses evaluating drinking as a function of video condition; alcohol approach IAT score and explicit approach score are presented in Table 4. Analyses were identical to those for the identity construct with the exception that the explicit approach measure score was not dichotomous. Gender was the only significant predictor of the amount of alcohol consumed. There were no significant predictors for the percentage of alcohol consumed relative to total beverage consumption.

Drinking as a Function of Video Condition and Implicit and Explicit Alcohol Excite

Analyses for the excite construct were identical to analyses for the approach construct, and results are presented in Table 5. Results evaluating amount of alcohol consumption again indicated a significant main effect of gender. They also revealed significant interactions between video condition and the implicit and explicit excite measures. Contrary to expectations, the interaction plot revealed a crossover interaction between video clip condition and alcohol excite IAT scores (see Figure 1b). Alcohol excite IAT scores were observed to be negatively associated with alcohol consumption for individuals in the sad video condition and positively associated with alcohol consumption for individuals in the happy/neutral video condition. Tests of simple slopes confirmed a significant, negative association between alcohol excite IAT scores and alcohol consumption for the sad video condition. Specifically, a one-unit increase in excite IAT scores was associated with a 40% decrease in the amount of alcohol consumed. In contrast, a test of simple slopes indicated that the observed positive relationship between alcohol excite IAT scores and alcohol consumption for the happy/neutral video condition was not significant.

The interaction between video condition and explicit excite is presented in Figure 1c. There was a cross-over interaction with a positive relationship observed between explicit alcohol excite and drinking for individuals in the sad video condition and a negative relationship between explicit alcohol excite and drinking for individuals in the happy/neutral video condition. Tests of simple slopes indicated that the observed effects were significant for the sad video condition (there was a 6% increase in alcohol consumption for each unit increase in the explicit alcohol excite score) but not for the happy/neutral video condition. Thus, this pattern was consistent with predictions: explicit measures were predicted to be more strongly and positively associated with alcohol consumption for individuals in the sad (vs. happy/neutral) video condition.

Finally, regression results evaluating the proportion of alcohol consumed relative to total beverage consumption as a function of video condition and the excite measures are presented in the bottom portion of Table 5. Results revealed a significant main effect of alcohol excite IAT score, which was qualified by a significant interaction with the video condition. The pattern of the plotted interaction was similar to that observed with alcohol excite IAT scores and amount of alcohol consumed (see Figure 1b and 1d). Tests of simple slopes were conducted, and the positive association between alcohol excite IAT scores and greater relative consumption of alcohol was significant for the happy/neutral video condition (i.e., each unit increase in excite IAT scores was associated with 10% increase in the proportion of alcohol consumed relative to total beverage consumption). In contrast, the negative association observed between alcohol excite IAT scores and

Table 4
Results Testing Video Condition as a Moderator of Implicit and Explicit Alcohol Approach on Alcohol Consumption

Alcohol consumed (ml)	$B = \ln e^B$	*SE* (*B*)	*z*	*p*	e^B	LL95%	UL95%
Intercept	5.069	.058	86.94	<.001	159.03	141.86	178.28
Weekly consumption	.009	.008	1.18	.24	1.01	.99	1.03
Gender	**−.464**	**.122**	**−3.81**	**<.001**	**.63**	**.50**	**.80**
Video condition	−.129	.123	−1.04	.30	.88	.69	1.12
Approach IAT	−.125	.140	−.89	.37	.88	.67	1.16
Explicit approach	.041	.035	1.17	.24	1.04	.97	1.12
Video × Approach IAT	.107	.277	.39	.70	1.11	.65	1.92
Video × Explicit approach	.052	.075	.69	.49	1.05	.91	1.22
Alpha (dispersion parameter)	.473	.064				.362	.617
Alcohol percent of total	***B***	***SE* (*B*)**	***t***	***p***	**β**	**UL95%**	**UL95%**
Intercept	.546	.012	46.72	<.001	—	—	—
Weekly consumption	.003	.002	1.86	.07	.16	−.01	.34
Gender	.004	.025	.16	.88	.01	−.16	.19
Video condition	−.032	.025	−1.27	.21	−.11	−.27	.06
Approach IAT	.052	.028	1.87	.06	.16	−.01	.33
Explicit Approach	.007	.007	1.02	.31	.09	−.08	.25
Video × Approach IAT	−.042	.055	−.77	.44	−.06	−.23	.10
Video × Explicit approach	−.003	.015	−.21	.84	−.02	−.18	.14

Note. Bolded rows indicated significant effects; α = .034. IAT = Implicit Association Test; *B* = unstandardized parameter estimate, log-linked for truncated negative binomial regression of alcohol consumed (ml); *SE* = standard error of the parameter estimate; e^B = exponentiated coefficient also known as the Incident Rate Ratio; LL95% and UL95% = lower and upper limits of 95% confidence intervals. Weekly consumption equals total typical weekly alcohol consumption in US standard drinks as reported on the Daily Drinking Questionnaire. Gender was coded 0 = male, 1 = female. Video condition = exposure to either happy/neutral (Muppets or Denali) or sad (*Schindler's List*) video clip; video condition was coded 0 = happy/neutral, 1 = sad. Predictors were mean centered prior to creation of product terms.

Table 5
Results Testing Video Condition as a Moderator of Implicit and Explicit Alcohol Excite on Alcohol Consumption

Alcohol consumed (ml)	$B = \ln e^B$	*SE* (*B*)	*z*	*p*	e^B	LL95%	UL95%
Intercept	5.058	.056	91.13	<.001	157.23	141.03	175.30
Weekly Consumption	.013	.008	1.69	.09	1.01	1.00	1.03
Gender	**−.450**	**.115**	**−3.92**	**<.001**	**.64**	**.51**	**.80**
Video Condition	−.170	.118	−1.45	.15	.84	.67	1.06
Excite IAT	−.042	.138	−.30	.76	.96	.73	1.26
Explicit Excite	.004	.013	.33	.74	1.00	.98	1.03
Video × Excite IAT	**−.706**	**.267**	**−2.64**	**.01**	**.49**	**.29**	**.83**
Video × Explicit Excite	**.074**	**.028**	**2.64**	**.01**	**1.08**	**1.02**	**1.14**
Alpha (dispersion parameter)	.435	.058				.34	.57
Alcohol Percent of Total	***B***	***SE* (*B*)**	***t***	***p***	**β**	**UL95%**	**UL95%**
Intercept	.557	.018	31.41	<.001	—	—	—
Weekly Consumption	.003	.001	2.12	.04	.18	.01	.35
Gender	−.014	.024	−.57	.57	−.05	−.21	.12
Video Condition	−.023	.024	−.95	.34	−.09	−.24	.07
Excite IAT	**.102**	**.036**	**2.84**	**.01**	**.17**	**.01**	**.33**
Explicit Excite	−.002	.003	−.51	.61	.05	−.12	.21
Video × Excite IAT	**−.138**	**.054**	**−2.56**	**.01**	**−.20**	**−.35**	**−.05**
Video × Explicit Excite	.010	.005	1.79	.08	.14	−.02	.30

Note. Bolded rows indicated significant effects; $\alpha = .034$. *B* = unstandardized parameter estimate, log-linked for truncated negative binomial regression of alcohol consumed (ml); *SE* = standard error of the parameter estimate; e^B = exponentiated coefficient also known as the Incident Rate Ratio*; LL95%* and *UL95%* = lower and upper limits of 95% confidence intervals. Weekly consumption equals total typical weekly alcohol consumption in US standard drinks as reported on the Daily Drinking Questionnaire. Gender was coded 0 = male, 1 = female. Video condition = exposure to either happy/neutral (Muppets or Denali) or sad (Schindler's List) video clip; video condition was coded 0 = happy/neutral, 1 = sad. Predictors were mean centered prior to creation of product terms.

greater relative consumption of alcohol was not significant for the sad video condition. This pattern was consistent with expectations.

Discussion

This study is the first we know of to evaluate the potential interactive effects of multiple implicit alcohol associations, their explicit counterparts, and mood state on alcohol consumption in an ad libitum alcohol taste test, and results were mixed. We had expected interactive effects to be observed for all three implicit alcohol associations measured (alcohol excite, alcohol approach, and drinking identity), but results indicated that interactive effects were limited to implicit alcohol excite associations for both alcohol consumption outcomes. Video condition moderated the relationship between explicit alcohol excite and consumption as well as between explicit drinking identity and consumption. We do not interpret the latter interaction strongly because it was not observed when the results were analyzed via a different approach (see Analytic Framework). In contrast, the explicit alcohol excite interaction findings were consistent across modeling approaches. Finally, there was minimal evidence (only one significant main effect) for the implicit or explicit measures predicting drinking during the taste test.

With respect to implicit alcohol excite associations, mood was found to moderate the relationship between alcohol excite IAT scores for both the primary (amount of beer consumed) and secondary (percentage of liquid consumed in the taste test that was beer) outcomes in the study. The pattern of the interactions was similar (though significance of follow-up tests of slopes varied): participants' implicit alcohol excite associations were more negatively associated with drinking after viewing the sad video and more positively associated with drinking after watching the happy/neutral video. The pattern of these interactions was mostly inconsistent with expectations that implicit associations would have stronger relationships with drinking when individuals experience happy (vs. negative or sad) mood states.

Implications for Theory and Measurement

How can these findings be understood? One way to understand this pattern is to consider the alcohol excite IAT in more detail. Although we have termed this IAT the alcohol *excite* IAT, the IAT is a relative measure that assessed the strength of associations between alcohol and excitement relative to the strength of associations between alcohol and *depressed mood*. One could, therefore, conceptualize negative alcohol excite IAT scores as indications of stronger associations with alcohol and depressed mood. When considering the observed pattern of interactions from the vantage of both constructs in the alcohol excite IAT, implicit associations appear to have stronger, positive relationships with drinking when the mood associated with the video condition matched individuals' implicit associations about alcohol and excitement/depressed mood. That is, having stronger alcohol excite associations was linked to more drinking after viewing the happy/neutral clip, whereas having stronger alcohol depressed mood associations (depicted in Figure 1 as negative alcohol excite IAT scores) was linked to more drinking after viewing the sad/clip. This moderation effect, although unexpected from the vantage of Hofmann et al.'s (2008) framework (which "simply" posited stronger, positive relationships between implicit associations and drinking for positive relative to negative mood), is consistent with aspects of alcohol expectancy theory and has been expanded upon by Wardell and

colleagues (2012). Specifically, Wardell and colleagues proposed that there are latent, stable individual differences in implicit alcohol associations related to mood and that they influence drinking only to the degree that they are *relevant* to a given context, such as experiencing a particular mood state. Current study findings are roughly consistent with this formulation.

Interestingly, we found that mood state essentially functioned as a moderator only for the explicit counterpart to alcohol excite (i.e., the enhancement drinking motives subscale). Specifically, participants' enhancement drinking motives were more positively associated with alcohol consumption in the sad (vs. happy/neutral) video condition. This result is consistent with Hofmann et al.'s (2008) framework that proposed a greater correspondence between explicit (reflective) cognitive processes and drinking during negative mood states and also largely consistent with the patterns observed throughout the study. Interestingly, the pattern of finding is largely opposite of the findings for implicit alcohol excite (see Figure 1). Again, we see that when individuals have stronger underlying cognitions about alcohol and mood (here, in relation to drinking as a means to enhance mood), they drink more when sad, presumably because the need to improve their mood state is relevant. Participants' enhancement motives were unrelated to drinking if they viewed the happy/neutral video, presumably because there was no need to drink to improve their mood.

We also note the lack of compelling evidence that mood states moderated the relationship between implicit drinking identity, explicit drinking identity (with the caveat that the overall interaction reached significance), or explicit alcohol-approach and alcohol consumption. It is possible that the nature of the taste test, specifically rating and tasting beer and soft drinks alone, played a role in null findings. As noted elsewhere (see Sayette et al., 2012), individuals recruited for lab-based alcohol consumption studies typically drink alcohol with others, which makes lab-based paradigms that involve drinking in isolation *atypical* drinking situations for those individuals. Our study is certainly no exception to that concern because our population of interest is college students, a population that largely drinks with other people. Beyond possible issues of ecological validity, drinking in isolation may also have been a factor in the null results found for the implicit and explicit measures of drinking identity. Drinking identity measures have been found to be strong, consistent predictors of college students' drinking and problems cross-sectionally and prospectively (see Lindgren et al., 2013; Lindgren, Neighbors, et al., 2016). Recent work provides initial evidence that identification with drinking is not simply about identification with alcohol but also about identification with a social group (i.e., social drinkers, see Ramirez, Olin, & Lindgren, 2017). Thus, drinking in the absence of a social group may have contributed to the unexpected underperformance of the drinking identity measures. Alternatively, drinker identity may represent a more stable cognitive construct than alcohol excite and alcohol approach, regarding the influence of mood. Future studies, including those using ecological momentary assessment methods, will be helpful to clarify whether or not correspondence between underlying implicit alcohol associations and current mood lead to greater alcohol consumption within a given drinking session.

The specificity of the findings—namely that moderation was largely limited to the implicit alcohol excite associations and that moderation was found for positive *and* negative mood—is also of interest from the standpoint of dual process models, negative reinforcement drinking, and questions about what the IAT is capable of measuring more generally. There is a debate about exactly what the IAT measures—relatively simple associations (e.g., alcohol + exciting; see Greenwald et al., 1998) or propositional statements (e.g., alcohol makes things more exciting: see De Houwer, 2014). Questions have also been raised about the extent to which negative reinforcement drinking (i.e., drinking to cope with negative mood) can be represented by an implicit measure. As noted elsewhere (see Wiers, Houben, Smulders, Conrod, & Jones, 2006; Wiers & Stacy, 2010), negative reinforcement drinking is cognitively more complex, requiring an antecedent (I feel bad), a means (I drink alcohol), and an outcome (I feel good or at least less bad), whereas positive reinforcement drinking can be represented as simple, bidirectional relationship (alcohol = fun). Results from this study could be interpreted as providing some evidence that the alcohol excite IAT (specifically, negative scores on the alcohol excite IAT) can serve as an implicit measure of negative reinforcement drinking or something related to negative reinforcement drinking. Some evidence of the IAT's ability to do so—at least when using English-language words—also has been demonstrated previously with an IAT assessing alcohol cope associations (see Lindgren et al., 2011, 2013). Although there is no way for this study to address debates about associative versus propositional accounts of the IAT effect directly, study findings add to the evidence that IATs can sometimes assess cognitively complex formulations of drinking (e.g., negative reinforcement drinking), and that those associations can be predictive of actual drinking.

Applied Implications

Beyond implications for theory and measurement, study findings also have important applied implications. First and foremost, results suggest that there may be novel, albeit complex, ways to conceptualize risk and protective factors for college students with a history of heavy episodic drinking. In particular, results suggest it may be important to know individuals' alcohol excite association levels to help them plan ahead for the particular mood-related situations that could be higher risk for them. Thus, these findings may suggest novel, personalized (mood-coping) intervention strategies. Second, the fact that moderator effects were found for measures of implicit associations indicates the utility of assessing implicit associations. The inclusion of implicit measures represents an additional assessment burden: measures are computer-based and their administration takes longer than self-report questionnaires. However, this additional burden may well be worth it if it can identify unique individuals at risk. Third, providers will want to beware of assuming that only negative mood is a risk factor for increased alcohol consumption—the prominence of 'self-medication' models of drinking has emphasized that drinking is used to reduce negative mood states. However, these findings suggest that providers and their clients need to plan for positive mood states, too. Moreover, celebratory drinking and drinking related to positive motives and expectancies are more commonly reported among college students than drinking in response to negative mood (Neighbors et al., 2007).

Limitations and Future Directions

As with any study, there are limitations. First, although we sought to have a happy, sad, and neutral video clip, and selected clips that had been previously validated and used in mood manipulation studies, the neutral clip and happy clips yielded virtually identical mood ratings and were collapsed for analyses. Their nearly identical ratings could be an indication that the neutral clip actually induced positive affect. However, it also could be an indication that the happy clip failed to induce positive affect. Baseline mood was not assessed in the study, and thus we cannot rule either explanation in or out. Robust mood induction procedures will be critical for future research. Procedures used by Wardell and colleagues (2012), which involved use of the International Affective Picture System (Lang, Bradley, & Cuthbert, 2008) and classical musical pairings, could serve as an excellent starting point.

Also, taste test procedures, although providing a means to assess alcohol consumption in the lab relatively unobtrusively, lack ecological validity. Relatedly, the lack of direct prediction of alcohol consumption by the implicit or explicit measures in this study (there was only one significant main effect) was surprising. It is possible that something about the design of the taste test limited opportunities to observe typical drinking behaviors. Third, beer was selected for the taste test because it is commonly consumed (and misused) by U.S. undergraduate students, but study findings might not generalize to other alcoholic beverages and/or to drinkers who prefer other alcoholic beverages. Fourth, because there was no mood state assessment following the taste test, we cannot tell whether initial mood states persisted or dissipated during the taste test. There are important design tradeoffs that need to be considered when deciding how frequently to ask about current mood state: reporting one's mood state may itself have an impact because of interruption of the ongoing task and/or because of reactivity of measurement and making salient that mood states changes frequently and can guide and be guided by behavior. Additional taste test outcomes could be of interest in future research, including speed-related outcomes (e.g., latency to first sip, intersip interval) or ordinal outcomes (what beverages are consumed first/second). Finally, whereas our conceptualization focused on mood as a moderator of the implicit association-drinking relationship (because of our interest in dual process models and testing Hofmann et al.'s [2008] model), there are alternative approaches, including that implicit associations might mediate the relationship between mood and drinking (e.g., Wardell et al., 2012) or that implicit associations might moderate the effect of mood on drinking.

Conclusion

Despite the above limitations, the study had multiple strengths. It is one of the few studies of implicit alcohol associations to include alcohol administration and behavioral measures of actual alcohol consumption. It is also one of the very few studies focused on implicit alcohol associations and alcohol administration that included female participants and did so in roughly equal proportions to the number of male participants. Gender differences were only significant in the context of the amount of alcohol consumed, with women consuming less beer than men. Finally, the use of experimental methods was a strength by providing causal evidence about conditions that can amplify or weaken the relationship between baseline implicit alcohol associations and alcohol consumption. Results revealed a relatively specific, complex relationship such that participants' underlying implicit alcohol excite and depressed mood associations appear to be related to drinking when the emotional context was relevant. Further, findings evaluating the explicit alcohol-excite measures were generally consistent with models of negative reinforcement drinking. If replicated, these results suggest that, among college students with a history of heavy episodic drinking, it may be particularly important to assess and intervene around implicit alcohol associations related to affect and mood states.

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