Interactive Effects of Alcohol Outcome Expectancies and Alcohol Cues on Nonconsumptive Behavior

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Experimental research and popular belief suggest that, among its many effects, alcohol consumption reduces tension and facilitates aggression. Such observations could result from direct, pharmacological effects of alcohol on neural control of behavior but also may be accounted for by positing that drinking behavior activates mental representations of relaxation-related or aggression-related alcohol expectancies in long-term memory. Building on this latter view, in 2 experiments, the authors investigated whether rudimentary drinking-related cues, which presumably activate encoded alcohol expectancies, facilitate tension reduction and hostility in the complete absence of actual or placebo alcohol consumption. In Experiment 1, following contextual exposure to alcohol-related words, individuals with stronger expectancies that drinking reduces tension showed an increased willingness to meet with an opposite-gender stranger under relatively anxiety-provoking circumstances, suggesting that they experienced less apprehension regarding the meeting. Analogously, in Experiment 2, following near-subliminal exposure to alcohol-related words, individuals with stronger expectancies that drinking fosters aggression showed greater hostility toward a target person following an experimentally engineered provocation. Neither of the latter effects was obtained following exposure to nonalcoholic beverage words, which presumably did not activate alcohol outcome expectancy representations in long-term memory. Moreover, the strength of relevant, content-specific expectancies (i.e., for tension reduction or aggression, respectively) moderated alcohol cue exposure effects, but the strength of other expectancies (e.g., for sociability or sexual arousal) did not. Together, these findings demonstrate that exposure to rudimentary alcohol cues independently engenders expectancy-consistent behavior, thereby attesting to the remarkable breadth and subtlety of the behavioral impact of alcohol expectancy activation.

Keywords: alcohol expectancies, alcohol, tension reduction, aggression

Over the past several decades, research on alcohol use has firmly supported the notion that alcohol outcome expectancies, beliefs regarding cognitive and behavioral changes presumed to result from alcohol consumption, influence alcohol-related behavior (Goldman, Darkes, & Del Boca, 1999; Jones, Corbin, & Fromme, 2001). Alcohol outcome expectancies have been found to emerge prior to the onset of drinking (Kraus, Smith, & Ratner, 1994; Miller, Smith, & Goldman, 1990) and are associated with the onset and maintenance of alcohol use (Sher, Wood, Wood, & Raskin, 1996; Smith, Goldman, Greenbaum, & Christiansen, 1995).

Some studies have demonstrated that alcohol outcome expectancies can be activated implicitly (i.e., automatically) by alcohol-related cues, without intentional retrieval of expectancy information into conscious thought and in the absence of a deliberated decision about whether to drink (e.g., Goldman, 1999; Stacy, 1997). Even when implicitly primed, expectancies influence alcohol consumption (Roehrich & Goldman, 1995; Stein, Goldman, & Del Boca, 2000). However, little is currently known about whether contextually activated alcohol expectancies, implicitly primed or otherwise, can influence expectancy-relevant nonconsumptive behaviors. The purpose of the present studies was to determine whether contextually activated alcohol expectancies influence expectancy-relevant behaviors in the absence of either actual or presumed alcohol consumption.

Memory network models of substance use motivation (e.g., Goldman, 1999; Stacy, 1995) posit that the accessibility and strength of associations between substance use behaviors and outcomes are related to the use and abuse of these substances. As Stacy (1995) noted, Bolles's (1972) model of expectancies implies that exposure to relevant cues should activate memories for both the associated outcomes and behaviors. For substance-related cues, the strength of this activation should be influenced by the extent

of substance involvement through the frequent pairing of substance use behavior with certain outcomes.

A number of studies have demonstrated that alcohol cues influence expectancy-relevant cognitions and that this influence varies as a function of level of involvement with alcohol. For example, in a modified Stroop task, alcohol cues have been shown to create differential interference in the accessibility of alcohol expectancy words relating to arousal and sedation for heavy compared with light drinkers (Kramer & Goldman, 2003). Responses in word association tasks to both alcohol (Reich & Goldman, 2005) and marijuana (Stacy, 1997) cues have been shown to be associated with use of the respective substance. Alcohol-related contextual cues have been found to affect the accessibility of both implicit and explicit alcohol expectancies (Krank, Wall, Stewart, Wiers, & Goldman, 2005; Wall, Hinson, McKee, & Goldstein, 2001). Contextual cues have also been found to influence memory for alcohol expectancy words (Reich, Goldman, & Noll, 2004). There is also evidence that alcohol cues can influence the accessibility of motivationally relevant cognitions. Ostafin, Palfai, and Wechsler (2003) found that alcohol cues affected the accessibility of approach and avoidance motivations, with less accessibility of avoidance motivation in individuals with more frequent binge drinking and alcohol-related problems.

In complementary fashion, studies have also demonstrated that expectancy-relevant cues can activate substance-related cognitions. For example, Stacy, Leigh, and Weingardt (1994) utilized a word association task in which participants were asked to list the first action or behavior that came to mind when reading about a range of behavioral outcomes, including potential outcomes of drinking (e.g., feeling more relaxed). These authors found that alcohol use frequency predicted the likelihood of an alcohol-related response to the outcomes commonly associated with alcohol. Studies have also assessed the effect of mood or affective cues on substance-related cognitions, as mood–affective changes are a commonly expected outcome from substance use (Brandon, Juliano, & Copeland, 1999; Goldman et al., 1999; Jones et al., 2001). Mood and affect cues have been shown to activate concepts related to both alcohol (Zack, Poulos, Fragopoulos, & MacLeod, 2003; Zack, Toneatto, & MacLeod, 1999) and cigarette smoking (McKee, Wall, Hinson, Goldstein, & Bissonnette, 2003).

Evidence that memory associations have implications for motivation is provided not only by the effect of cues on the activation of related cognitions but by their influence on associated behavior. In the alcohol literature, balanced placebo design studies have demonstrated that the belief that one has consumed alcohol can influence behaviors known to be associated with consumption, including sexual desire (George & Marlatt, 1986), relaxation (Wilson & Abrams, 1977), hostility (Lang, Goeckner, Adesso, & Marlatt, 1975), and memory accuracy (Assefi & Garry, 2003).

However, what is currently less clear is the extent to which activation of alcohol concepts in memory can trigger expectancy-consistent behaviors in the absence of any beverage consumption. The same memory-based models that predict substance use and abuse from the outcomes associated with those behaviors (e.g., Goldman, 1999) can be used to predict whether substance use cues will engender behaviors associated with its anticipated effects. One recent study showed evidence in support of this idea. Friedman, McCarthy, Förster, and Denzler (2005) tested whether the implicit activation of alcohol expectancies was sufficient to influence behaviors associated with sexual arousal. In two samples of undergraduate men, Friedman et al. briefly exposed participants to alcohol-related versus control beverage-related words (e.g., *beer* vs. *juice*) under suboptimal viewing conditions (i.e., conditions limiting the duration and extent of processing). Participants were then asked to rate either the attractiveness or intelligence of a series of young women in photographs. In the alcohol priming condition, stronger expectancies that alcohol enhances sexual arousal were found to increase attractiveness ratings, that is, to facilitate expectancy-consistent behavior. No interactive effect was found in the intelligence rating condition. Moreover, these effects were specific to alcohol expectancies regarding sexual desire, controlling for alternative expectancy domains (e.g., sociability).

Friedman et al.'s (2005) findings are consistent with recent work in the field of social cognition (e.g., Bargh & Chartrand, 1999), suggesting that representations in long-term memory are associated with behavioral scripts or plans for how behavior related to these representations should be enacted. For instance, the mental representation of sociability is not only linked to related semantic constructs (e.g., friendly, party) but also to plans for behaving in a sociable manner (e.g., smiling, touching, gazing). Critically, it is assumed that activation of a given mental construct will coactivate the behavioral scripts with which it is associated. This notion has been well supported empirically across several behavioral domains (Bargh & Chartrand, 1999).

The present studies sought to assess the influence of contextually activated alcohol expectancies on nonconsumptive behavior within two distinct domains associated with alcohol use. Domains were chosen that are clinically relevant, have been extensively examined in placebo research (which provides the closest empirical precedent for the current study), and for which well-validated measures of alcohol outcome expectancies were readily available. Specifically, in the first experiment, we examined the influence of contextual alcohol priming on stress–tension reduction. Although the relationship between alcohol use and stress is complex (Brady & Sonne, 1999), stress or tension reduction is thought to be an important motivation for alcohol consumption (Sayette, 1999). Most alcohol expectancy scales assess tension reduction as a presumed outcome of alcohol use, and these expectancies are typically found to predict drinking behavior (for reviews, see Goldman et al., 1999; Jones et al., 2001). Administration of alcohol has been found to reduce stress-related responses (Levenson, Sher, Grossman, Newman, & Newlin, 1980; Sher & Walitzer, 1986), at least under some conditions (see Sayette, 1993), although placebo effects on stress response are not clear. Laboratory studies have demonstrated increased alcohol consumption in response to anxiety-inducing social situations (R. L. Higgins & Marlatt, 1975). This effect appears

stronger for participants with social phobia (Abrams, Kushner, Medina, & Voight, 2002) and is influenced by level of tension-reduction alcohol expectancies (Kidorf & Lang, 1999). In their study of outcome-association tasks, Stacy and colleagues (1994) found "feeling more relaxed" to have the strongest association with alcohol responses.

Experiment 1 was designed to test the interaction of contextual alcohol primes and alcohol expectancies on response to a socially stressful situation. Male participants were briefly exposed to either alcohol-related or control words. Afterwards, they were led to believe that they would be observed interacting with a female undergraduate of undisclosed identity, a situation likely to produce apprehension (see, e.g., Arkowitz, Hinton, Perl, & Himadi, 1978; Greeley & Oei, 1999). Prior to this expected meeting, participants were asked to indicate the extent to which they would prefer for their observed interaction with the unknown woman to occur under more versus less anxiety-provoking circumstances (i.e., alone vs. in a group, face to face vs. over the Internet, and for a longer vs. shorter period of time). We predicted an interactive effect on preference expression such that following exposure to alcohol cues but not nonalcohol cues, participants with stronger beliefs that alcohol facilitates tension reduction would be more willing to interact under relatively stressful conditions.

A follow-up experiment examined the influence of activating alcohol concepts on hostility–aggression. Alcohol use and aggressive behaviors have long been associated, both in popular culture (Critchlow, 1986) and in the psychological laboratory (Ito, Miller, & Pollock, 1996). Laboratory studies of alcohol administration have found that alcohol increases aggressive behavior, although this effect is inconsistent in placebo conditions (Bushman & Cooper, 1990). Hostility and aggression are also identified as anticipated outcomes of alcohol use on many expectancy scales (Goldman et al., 1999; Jones et al., 2001). Expectancies that alcohol increases aggressiveness have been found to be correlated with self-reported alcohol-related violence (Quigley, Corbett, & Tedeschi, 2002) and to moderate the association between alcohol consumption and aggressive behavior (Dermen & George, 1989).

Experiment 2 was designed to extend the test of our interaction hypothesis to the domain of aggression. Specifically, participants were exposed to either alcohol or control words as in Experiment 1. Subsequently, following an experimentally rigged provocation, participants were given the opportunity to respond in a manner that could presumably harm another person. We predicted that after exposure to alcohol cues, but not nonalcohol cues, participants with stronger beliefs that alcohol fuels aggression would tender relatively hostile responses.

Experiment 1

Method

Participants

Participants were 71 male undergraduates, aged 18–25 years, enrolled in introductory psychology at the University of Missouri—Columbia. The sample was primarily Caucasian (86%); 6% were African American and 8% did not identify their ethnicity. Participants were run in groups of up to 8 at visually isolated computer stations and received course credit for participation.

Procedure

Participants were provided with the cover story that they would be completing a set of tasks related to a number of different projects. They then completed a lexical decision task (LDT) in which they were presented a screen with a series of letter strings and asked to indicate whether each string was a word. This task actually served as the vehicle for presenting participants with alcohol versus control words meant (in the alcohol condition) to activate alcohol-related concepts in memory.

Participants were given 110 LDT trials. Each trial began with the presentation of a plus sign (i.e., +) in the center of the screen. This was replaced after 1,000 ms by a forward masking string (i.e., &&&&&&&&&) presented for 400 ms, which in the alcohol cue condition was subsequently replaced by 1 of 14 randomly selected alcohol-related words (e.g., *beer*, *vodka*) and in the nonalcohol cue condition by 1 of 14 control beverage words (e.g., *water*, *juice*) for 250 ms. These cue words, printed in capital letters, were then replaced by a backward masking string (i.e., XXXXXXXXXX) presented for 400 ms. This priming methodology was meant to limit the duration and extent of processing of the cue words (Bargh & Chartrand, 2000; Neely, 1991) and to thereby permit a relatively strong test of our expectancy–activation hypothesis.[1] After each backward mask disappeared, participants were randomly presented with a letter string (e.g., *irony* or *nogzp*). They were asked to press the Z key if the string was a word and the / key if it was not a word, and to respond as quickly as possible. Participants were informed that masked words would be briefly presented to them before each letter string appeared on screen and that these words would come from one of a number of randomly selected categories such as beverages, furniture, or vegetables. Participants were asked to "get ready to respond" upon seeing the plus sign preceding each trial, thereby ensuring their gaze was fixated in the direction of the masked cues to be presented immediately afterwards.

After completing the priming task, participants were informed on screen that they would next be participating in a "communication study" that would involve their interacting with another participant in a different room. To bolster this cover story, we printed the room number below the aforementioned instructions in command line (Lucida Console) font, meant to make it look as if it had just been generated

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[1] It is important to note that despite their brevity and the fact that they were backward masked, primes presented under these conditions were consciously perceptible. Theoretically speaking, we do not believe, nor have we any evidence to suggest, that alcohol cues must be processed outside awareness in order to produce expectancy-consistent behavioral change.

by the computer, as opposed to having been preprogrammed prior to the session. To further support the cover story, we had posted a sign on the door to the lab ostensibly instructing newly arrived female participants to go to the room in which our (all-male) participants would be informed that their interaction was slated to take place. Afterwards, the computer presented a well-known animated display depicting a small red square moving along a wire between a telephone and a computer and reading "Connecting to server . . . ." Above the animation, a line read "Here is some information about your partner." After 5 s, the animation was replaced by a text box reading the following on three separate lines:

> Age: 19
> Sex: Female
> Major: music,

with the partner-specific information following each colon (e.g., 19) printed in Lucida Console font. The *m* in *music* was printed in lowercase to bolster the cover story that the information had been generated by an undergraduate and not preprepared or forged by the experimenter, who would presumably have been more cautious in entering the data. To additionally support the cover story that this information had been generated by the partner, upon their initial arrival at the lab, we had participants enter their own age, gender, and major into the computer, thereby suggesting that the computer had acquired the partner's information in an analogous fashion.

Participants then completed a computer-based assessment of tension reduction. Following this assessment, participants were informed that while the experimenter was setting up their meeting, we would like for them "to complete a separate survey conducted by the University of Missouri—Columbia's Center for Research on Addictions . . . about [their] personal beliefs regarding alcohol." Participants were then asked to complete questionnaire measures of alcohol expectancy. After completing these measures, participants were probed for suspicions, process debriefed, and released. No suspicions regarding the procedure were expressed.

Measures

Behavioral assessment of tension reduction. Participants were presented with a display reading "Before we begin, please answer the following questions. Please Note: Your responses to these questions will be kept confidential from your partner." At this point, participants were asked "How long a meeting would you prefer? (0–10 minutes)"; "Would you prefer to have a face-to-face interaction or interact on-line?" with responses ranging from 1 (*face-to-face*) to 7 (*interact on-line*), with an explicit midpoint at 4 (*either face-to-face or interact on-line*); and "Would you prefer to meet with your partner alone or with a group of other participants?" with responses ranging from 1 (*very much prefer to meet alone*) to 7 (*very much prefer to meet with a group of other participants*). Again, it was assumed that engaging in an observed interaction with a stranger of the opposite gender (which has been found, and/or explicitly used, to elicit tension in numerous previous studies; e.g., Arkowitz et al., 1978; R. L. Higgins & Marlatt, 1975; Holroyd, 1978; Yankofsky, Wilson, Adler, Hay, & Vrana, 1986; see also Greeley & Oei, 1999) would be considered more stressful when the interaction was to take place alone and face to face with the partner, and when the meeting would be longer rather than shorter. As such, an increased willingness to meet under these more stressful circumstances was used to operationalize reduced tension on the part of participants. Composite tension reduction scores were computed by reverse scoring the two scale items such that they were coded toward an increased willingness to meet under more stressful circumstances (i.e., alone and face to face) and then taking the average of these two scores and participants' self-reported meeting-length preferences (ranging from 0 to 10 min).

Expectancy assessment. Three domains of alcohol-related expectancy were assessed: expectancies that alcohol would reduce tension, increase sociability, and affect sexual desire. Scales for these domains were taken from the Comprehensive Effects of Alcohol Questionnaire (CEOA; Fromme, Stroot, & Kaplan, 1993), the Alcohol Expectancy Questionnaire (AEQ; Brown, Goldman, Inn, & Anderson, 1980; Goldman, Greenbaum, & Darkes, 1997), and the Sexual Effects of Drinking Questionnaire (Skinner, 1992).

The Tension Reduction and Sociability subscales from the CEOA were used. The full CEOA is a 38 item self-report questionnaire using a 4-point Likert scale (1 = *disagree*, 4 = *agree*) that assesses both positive and negative expectancies concerning alcohol's effects. Seven factors have been found for this measure, four classified as assessing positive expectancies (Sociability, Tension Reduction, Liquid Courage,[2] and Sexuality) and three as assessing negative expectancies (Cognitive and Behavioral Impairment, Risk and Aggression, and Self-Perception). The CEOA has demonstrated good test–retest and internal consistency reliability, and scores on the measure have been associated with alcohol use in adolescent and college student populations (Fromme & D'Amico, 2000; Fromme et al., 1993).

The Social Assertiveness subscale from the AEQ short form (Goldman et al., 1997) was used as an additional measure of social facilitation expectancies. This version of the AEQ has 68 items and has been found to have moderate to good internal consistency reliability. Validity evidence indicates that the AEQ is related to various aspects of drinking behavior (Goldman et al., 1997).

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[2] Inasmuch as the CEOA Liquid Courage subscale assesses expectancies that alcohol will instill bravery, scores on this subscale, which is highly correlated with the Tension Reduction subscale (see Fromme et al., 1993), may predict an increased willingness to meet an opposite-gender stranger under more threatening circumstances. However, we opted not to administer the Liquid Courage subscale in the present study because it also gauges expectancies not directly related to bravery, including beliefs that alcohol will increase creativity and enhance feelings of powerfulness.

In addition, expectancies regarding the effects of alcohol on sexual desire were assessed using the Sexual Effects of Drinking Questionnaire (Skinner, 1992). This measure has been used in past research assessing alcohol and expectancy effects on sexual desire (see George, Stoner, Norris, Lopez, & Lehman, 2000). Items include the statement "Having a few drinks would increase or decrease your feelings of sexual _____," followed by six subjective states ("arousal," "interest," "enjoyment," "excitement," "pleasure," and "desire"). Responses were tendered on a 5-point scale ranging from 1 (*decrease a lot*) to 5 (*increase a lot*).

Although generally combined into overall positive and negative expectancies in prediction of alcohol use, specific expectancy subscales occasionally have been correlated with drinking behavior in past research (e.g., Valdivia & Stewart, 2005). In general, the CEOA Sociability subscale and the AEQ Social Assertiveness subscale are more consistently associated with drinking behavior than the CEOA Tension Reduction subscale (Kidorf, Sherman, Johnson, & Bigelow, 1995; see also Corcoran & Parker, 1991). Specific subscale correlations with drinking behavior in the current sample are given in Table 1.

Alcohol use. Selected items from the Drinking Styles Questionnaire (Smith, McCarthy, & Goldman, 1995) were used to assess typical frequency and quantity of alcohol use. The Drinking Styles Questionnaire has demonstrated good reliability and validity in high school (Smith, McCarthy, & Goldman, 1995) as well as college (McCarthy, Miller, Smith, & Smith, 2001) samples. Items on the Drinking Styles Questionnaire use forced-choice response options. In the present study, drinking frequency was assessed by asking participants "Which of the following best describes HOW OFTEN you drink alcohol? (Choose only one)," with points labeled 1 (*I have never had a drink of alcohol*), 2 (*I have only had 1, 2, 3, or 4 drinks of alcohol in my life*), 3 (*I only drink alcohol 3 or 4 times a year*), 4 (*I drink alcohol about once a month*), 5 (*I drink alcohol once or twice a week*), and 6 (*I drink alcohol almost daily*). Drinking quantity was assessed by asking participants "Which of the following best describes how much alcohol you usually drink AT ONE TIME? (Choose only one)," with points labeled 1 (*I don't drink alcohol at all*), 2 (*I usually drink only small amounts of alcohol* [*about 1 drink or less*]), 3 (*I usually drink moderate amounts of alcohol* [*between 2–3 drinks*]), 4 (*I usually drink quite a bit of alcohol* [*between 4–8 drinks*]), 5 (*I usually drink a lot of alcohol* [*more than 9 drinks*]).

Results

Four percent of participants reported drinking alcohol almost daily, the majority reported drinking either 1–2 times per week (41%) or once a month (28%), 8% reported drinking only 3 or 4 times a year, 10% reported drinking fewer than 5 times in their lives, and 8% reported being lifetime abstainers. Thirteen percent of participants reported that they usually drink more than 9 drinks on a given occasion, most reported that they usually drink either 4–8 drinks per occasion (42%) or 2–3 drinks per occasion (24%), 10% reported that they usually drink about 1 drink or less, and 11% reported that they do not drink alcohol at all. Thirty-five percent of the sample reported weekly heavy drinking (4 or more drinks per occasion). There were no between-groups differences in drinking habits (ts < 0.6).

Mean tension reduction scores and alcohol outcome expectancies indexed by experimental condition are presented in Table 2. Table 1 reports correlations among alcohol use and alcohol expectancy measures. Preliminary analyses revealed no main effects of condition (alcohol vs. nonalcohol cue) on any of these measures (ts < 1.6).

We predicted a two-way interaction between cue (alcohol vs. control beverage) and alcohol expectancies regarding tension reduction on tension reduction scores. This interaction was hypothesized to reflect that stronger expectancies regarding alcohol's tension-reducing properties predict an increased willingness to meet the interaction partner under relatively stressful circumstances following exposure to alcohol cues but not following exposure to control cues. To test this prediction, we computed a series of simultaneous multiple regression equations on our behavioral tension reduction index, including cue (alcohol vs. control beverage) and CEOA Tension Reduction expectancy scores as predictors. Analyses indeed revealed a Cue × Expectancy interaction ($b = -1.91$), $t(67) = 2.89$, $p < .006$ (see Table 3). As predicted, decomposition of this interaction uncovered a reliable positive association between CEOA Tension Reduction scores and behavioral tension reduction scores in the alcohol cue group ($b = 0.98$), $t(35) = 3.51$, $p < .002$, but not in the control beverage group ($b = -0.29$, $t < 1$). Of note, there were no significant main effects or interactions when either drinking frequency or quantity variables were included in these models, nor were there any main effects of these variables on tension-reduction indices.

Table 1
Correlations Among Alcohol Use and Alcohol Expectancy Measures in Experiment 1

Variable	1	2	3	4	5	6
1. DSQ Drinking Frequency	—					
2. DSQ Drinking Quantity	.80**	—				
3. CEOA Tension Reduction	.13	.10	(.76)			
4. CEOA Sociability	.35**	.44**	.44**	(.84)		
5. SEDQ	.35**	.39**	.19*	.51**	(.92)	
6. AEQ Social Assertiveness	.34**	.44**	.39**	.70**	.50**	(.86)

Note. Cronbach's alphas appear along the diagonal in parentheses. DSQ = Drinking Styles Questionnaire; CEOA = Comprehensive Effects of Alcohol Questionnaire; AEQ = Alcohol Expectancy Questionnaire; SEDQ = Sexual Effects of Drinking Questionnaire.
* $p < .05$. ** $p < .01$.

Table 2
Descriptive Statistics Indexed by Experimental Condition in Experiment 1

| | Cue condition | | | |
| | Alcohol ($n = 37$) | | Control ($n = 34$) | |
Measure	M	SD	M	SD
DSQ Drinking Frequency	3.92	1.28	4.00	1.46
DSQ Drinking Quantity	3.43	1.17	3.26	1.19
CEOA Tension Reduction	2.67	0.70	3.00	0.73
CEOA Sociability	3.38	0.64	3.39	0.66
AEQ Social Assertiveness	2.81	0.84	2.83	0.76
SEDQ	3.86	0.73	3.61	0.69
Tension reduction score[a]	0.54	1.35	0.47	1.43

Note. DSQ = Drinking Styles Questionnaire; CEOA = Comprehensive Effects of Alcohol Questionnaire; AEQ = Alcohol Expectancy Questionnaire; SEDQ = Sexual Effects of Drinking Questionnaire.
[a] Mean of three meeting preference indices, all coded toward increased proclivity to meet under more stressful circumstances (range = 1–8).

As a subsequent step in the analysis, we tested the specificity of this effect by examining whether alcohol expectancies regarding sociability or sexuality (CEOA Sociability scale, AEQ Social Assertiveness scale, and Sexual Effects of Drinking Questionnaire) moderated the influence of the priming manipulation. Regression analyses indicated that neither sociability nor sexuality expectancies (entered as continuous variables) interacted with the priming manipulation to predict behavior indicative of tension reduction.

Discussion

The results of Experiment 1 support the hypothesis that contextual exposure to alcohol cues activates expectancies related to outcomes of alcohol use, which in turn engenders expectancy-consistent behavioral decisions. Participants who were exposed to alcohol words (but not those exposed to control words) showed an enhanced proclivity to engage in an observed interaction with a stranger of the opposite gender under relatively stressful conditions (i.e., alone, face to face, and for a comparatively long period of time), a situation used in other research to arouse anxiety (e.g., Arkowitz et al., 1978; R. L. Higgins & Marlatt, 1975; Holroyd, 1978; Yankofsky et al., 1986).[3] Critically, this pattern held only among individuals who expressed stronger expectancies that alcohol consumption reduces tension, despite the fact that they did not consume (or even believe

they consumed) any alcohol. Moreover, other expectancy domains, including that alcohol consumption increases either sexuality or sociability, had no effect on the tendency for alcohol cue-exposed participants to elect relatively more stressful interaction circumstances. This pattern suggests that the effects of alcohol cues on tension reduction were uniquely driven by expectancies pertinent to this specific behavioral domain rather than by generalized positive or negative expectancies regarding the effects of alcohol consumption (cf. Leigh, 1989b).

Despite this intriguing pattern of results from Experiment 1, it is important to know whether these effects generalize across other behavioral domains. As noted previously, another common belief concerning the effects of drinking alcohol is that doing so facilitates aggression (Critchlow, 1986; Goldman et al, 1999; Jones et al., 2001), and numerous studies have documented such effects (see Ito et al., 1996). Although it is apparent that alcohol consumption can increase aggression pharmacologically through the

Table 3
Regression Analysis of Cue × Expectancy Interaction in Experiment 1

Measure	b	SE	t(1)	p
Cue	5.34	1.94	2.76	.01
CEOA TR	1.04	0.66	1.57	.12
Cue × CEOA TR	−1.91	0.66	−2.89	.01

Note. $R^2 = .14$; $F(3, 67) = 3.63$, $p = .02$. CEOA TR = Comprehensive Effects of Alcohol Questionnaire Tension Reduction scale.

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[3] Given the stressfulness of the situation, it may be considered surprising that participants, even those who strongly endorsed alcohol expectancies regarding tension reduction, would not invariably attempt to minimize stress by choosing the least anxiety-provoking interaction conditions possible. Although speculative, we argue that for undergraduate men, although the prospect of meeting alone with an opposite-gender stranger may be primarily stress inducing, it is also titillating. To the extent that exposure to alcohol cues mitigates aversive arousal, it may allow feelings of eagerness to emerge, engendering an increased proclivity to meet under more threatening, albeit more exhilarating, circumstances. Presumably, if the situation had been predominantly construed as bearing on appetitive as opposed to aversive motives, activated alcohol expectancies regarding sexual desire and sociability would have become more applicable (E. T. Higgins, 1996) and would have moderated the behavioral effects of alcohol cues in a manner similar to tension-reduction expectancies (i.e., with stronger expectancies promoting increased willingness to meet the partner alone, face to face, and for a longer period of time, circumstances that are relatively titillating or conducive to making friends).

impairment of cognitive processes (see Giancola, 2000), other research using balanced placebo designs indicates that the mere belief that alcohol has been consumed can increase aggressive tendencies (e.g., Lang et al., 1975; Rohsenow & Bachorowski, 1984). To the extent that such results reflect activation of expectancies from long-term memory, similar effects should occur when expectancies are activated by the mere presence of alcohol cues. In other words, neither alcohol nor placebo consumption should be necessary to facilitate increased aggressiveness so long as alcohol cues are present.

We tested this proposition in Experiment 2 using a priming procedure similar to that used in Experiment 1 but including a dependent measure associated with aggression as opposed to tension reduction. In addition, we took the opportunity to explore the subtlety and generality of the priming effect by substantially reducing prime exposure duration. Finally, unlike in Experiment 1, we assessed alcohol expectancies both before as well as after the experimental session. Doing so allowed us to test the generality of expectancy activation effects across different measures of the same expectancy content domain. Moreover, administering a pretest allowed us to address whether the interactive effects of alcohol cues and alcohol outcome expectancies spuriously result from sequence effects in expectancy assessment. In Experiment 1, alcohol expectancies were only assessed after the priming manipulation. As such, it is possible that alcohol cues altered or shaped expectancies online. This would contradict our proposition that mere cuing effects on nonconsumptive behavior result from activation of stored expectancies in long-term memory. By conceptually replicating Experiment 1 using a pretest measure of alcohol expectancies, we hoped to mitigate this concern.

Experiment 2

Method

Participants

Participants were 76 undergraduates (35 men and 41 women; aged 18–22 years) enrolled in introductory psychology at the University of Missouri—Columbia who had completed a Web-based, 300-item battery of diverse survey measures approximately 8 weeks earlier. Again the sample was primarily Caucasian (83%); 6% were African American, 6% were Asian American, and 5% did not identify their ethnicity. Participants were run individually and received course credit for participation. One male participant, with whom the experimenter had a personal relationship, was excluded from the analyses.

Procedure

Expectancy assessment. Participants' expectancies that alcohol would make them aggressive were initially assessed using the Risk and Aggression subscale from the CEOA (CEOA RA; Fromme et al., 1993), administered via the Web-based pretest survey mentioned previously. At the end of each session, aggression-related expectancies were reassessed using the aggression items from the Arousal–Aggression subscale of the AEQ (Goldman et al., 1997). Expectancies regarding the sociability-enhancing effects of alcohol were also assessed at this time using the CEOA Sociability subscale and the AEQ Social Assertiveness subscale. The CEOA RA (Valdivia & Stewart, 2005) and the AEQ Arousal–Aggression subscales (e.g., Leigh, 1989a) have been shown to specifically predict drinking behavior in previous studies. Associations among the specific subscales and alcohol use in the current sample are shown in Table 4.

Priming task. The priming procedure for Experiment 2 was identical to that for the first experiment, with the exception that the exposure duration of the alcohol-related and control primes was reduced from 250 ms to 40 ms. This suboptimal priming methodology (see Bargh & Chartrand, 2000, for a review) was intended to render cue words difficult if not impossible to consciously identify and to thereby permit a particularly robust test of our expectancy-activation hypothesis.

Hostility assessment. Human aggression generally is defined as any behavior directed at another individual that is intended to cause harm (see Anderson & Bushman, 2002). A number of methods have been developed to study aggressive or hostile behavior in the laboratory. The most commonly used method (Baron & Richardson, 1994, p. 65) involves having participants provide an evaluation of another person, often the experimenter him- or herself, which could have potentially harmful implications for that person

Table 4

Correlations Among Alcohol Expectancy and Drinking Measures in Experiment 2

Variable	1	2	3	4	5	6
1. DSQ Drinking Frequency	—					
2. DSQ Drinking Quantity	.78[**]	—				
3. CEOA Risk and Aggression	.45[**]	.39[**]	(.76)			
4. CEOA Sociability	.27[*]	.27[*]	.36[**]	(.84)		
5. AEQ Aggression	.14	.36	.48[**]	.43[**]	(.66)	
6. AEQ Social Assertiveness	.32[**]	.38[**]	.25[*]	.67[**]	.32[**]	(.86)

Note. Cronbach's alphas appear along the diagonal in parentheses. DSQ = Drinking Styles Questionnaire; CEOA = Comprehensive Effects of Alcohol Questionnaire; AEQ = Alcohol Expectancy Questionnaire.
[*] p < .05.   [**] p < .01.

(e.g., see Bushman, Bonacci, Pedersen, Vasquez, & Miller, 2005; Bushman, Bonacci, Van Dijk, & Baumeister, 2003, Experiment 3; Buvinic & Berkowitz, 1976; Chen & Bargh, 1997). As discussed by Baron and Richardson (1994, p. 66), this technique offers several important advantages, including that it does not actually allow for harming anyone, it uses a familiar and well-practiced mode of aggression (verbal disparagement), it is convenient to administer and permits easy quantification of responses, and it is less subject to socialized inhibitions or restraints (which may engender floor effects). On the basis of these points, we opted to use a variant of this well-precedented evaluation-provision method in the present study. Specifically, after participants completed the 110th LDT trial, the computer was programmed to suddenly "freeze" and display "F11 Error: Failure Saving Data" (see Chen & Bargh, 1997). Unable to continue, participants naturally sought out the experimenter, who was instructed to tell them in a courteous tone

> Hmm, I must've set it up incorrectly. Guess that was a waste of time. Well, I'm going to have to ask you to do that task over again at the end of the session since I can't recover your data. But, before we continue, I'm supposed to have you fill out an incident report. We do this any time something goes wrong during a session.

At this point, the experimenter, who was blind to condition, retrieved the ostensible report slip and a sealable envelope addressed to "Ronald S. Friedman, Administrator, Social Psychology Laboratory, 210 McAlester Hall" and told the participant to seal the envelope and place it in a lockbox (which was unobtrusively located on the wall across from the computer station) when he or she had finished answering the questions. The incident report slip read

> Incident Report: Experiment WS05-048
>
> Instructions: Please answer the following questions then seal the completed survey in the envelope provided. Your responses will be entirely anonymous and confidential and will only be used by the lab director to evaluate the performance of the research assistant/experimenter from today's session.

These instructions were followed by three items: "How would you rate the experimenter's overall performance during the study up to this point?" with responses ranging from 1 (*very bad*) to 7 (*very good*); "To what extent would you recommend this experimenter to run other studies in the future?" with responses ranging from 1 (*lowest possible recommendation*) to 7 (*highest possible recommendation*); and "How courteous was the experimenter in handling the problem that arose?" with responses ranging from 1 (*not at all*) to 7 (*extremely*). With their responses to these items, participants were essentially given an opportunity to aggress against the experimenter, whose mistake had cost them time and effort, by submitting a poor evaluation to the experimenter's boss. Thus, following established precedent within this paradigm, lower average scores on these items were taken to indicate hostility.

After depositing their incident reports, participants naturally sought out the experimenter, who was waiting in an adjacent room. Participants were then asked to complete another task before they would ostensibly return to finish the interrupted LDT. At this point, they completed a number of alcohol expectancy postmeasures and were then fully debriefed and released.

Results

Three percent of participants reported drinking alcohol almost daily, the majority reported drinking either 1–2 times per week (49%) or once a month (20%), 12% reported drinking only 3 or 4 times a year, 9% reported drinking fewer than 5 times in their lives, and 7% reported being lifetime abstainers. Twelve percent of participants reported that they usually drink more than 9 drinks on a given occasion, most reported that they usually drink either 4–8 drinks per occasion (41%) or 2–3 drinks per occasion (24%), 12% reported that they usually drink about 1 drink or less, and 11% reported that they do not drink alcohol at all. Forty-five percent of the sample reported weekly heavy drinking (4 or more drinks per occasion). There were no between-groups differences in drinking habits ($ts < 0.9$).

Mean hostility scores (average ratings of the experimenter), alcohol outcome expectancy scores, and LDT performance scores indexed by condition are presented in Table 5. Table 4 reports correlations among alcohol use and alcohol expectancy measures. Preliminary analyses revealed no main effects of condition (alcohol vs. nonalcohol cue) on any of these measures ($Fs < 1$). Analyses did unexpectedly reveal a reliable positive correlation between LDT performance and hostility ratings, $r(74) = 0.42$, $p < .0002$, suggesting that individuals who made more errors on the task were more critical of the experimenter. Although unpredicted, this effect is not surprising. Individuals who performed more poorly may have experienced concomitantly more disappointment or frustration. Such unpleasant affective states may have then been inappropriately used as information (Schwarz & Clore, 1996), swaying judgments

Table 5

Descriptive Statistics Indexed by Experimental Condition in Experiment 2

| | Cue condition | | | |
| | Alcohol ($n = 39$) | | Control ($n = 36$) | |
Measure	M	SD	M	SD
DSQ Drinking Frequency	4.15	1.35	3.89	1.28
DSQ Drinking Quantity	3.44	1.07	3.23	1.26
CEOA Risk and Aggression	2.66	0.94	3.05	1.27
CEOA Sociability	3.31	0.54	3.29	0.65
AEQ Aggression	2.57	0.75	2.77	0.86
AEQ Social Assertiveness	3.67	0.79	3.46	0.81
Lexical decision (% correct)	95.67	3.87	94.73	5.29
Hostility score[a]	6.09	1.03	6.14	0.86

Note. DSQ = Drinking Styles Questionnaire; CEOA = Comprehensive Effects of Alcohol Questionnaire; AEQ = Alcohol Expectancy Questionnaire.
[a] Mean of three evaluative ratings of the experimenter.

toward the experimenter in a negative direction. It is also possible that participants who performed more poorly felt resentful for having been placed in a situation that threatened their self-esteem or wasted their time and chose to take their anger out on the experimenter. In any event, LDT performance clearly constituted an extraneous variable with respect to our hostility measures and was therefore statistically controlled for in subsequent analyses.[4]

We predicted a two-way interaction between cue (alcohol vs. control beverage) and aggression-related alcohol expectancies on hostility scores. This interaction was hypothesized to reflect that stronger expectancies regarding alcohol's aggression-eliciting properties predict a tendency to evaluate the experimenter more critically (i.e., to express more hostility) following suboptimal exposure to alcohol cues, relative to control cues. To test this prediction, we computed a series of simultaneous multiple regression equations on mean hostility scores, including cue (alcohol vs. control beverage) and alcohol aggression expectancy indices as predictors and including LDT performance as a covariate. Analyses using the pretest CEOA RA scale revealed a Cue × Expectancy interaction ($b = 0.41$), $t(69) = 2.21$, $p < .04$ (see Table 6). As predicted, decomposition of this interaction uncovered a reliable association between CEOA RA scores and hostility scores in the alcohol cue group ($b = -0.29$), $t(36) = 2.24$, $p < .04$, but not in the control beverage cue group ($b = 0.11$, $t < 1$). This finding suggests that after their exposure to alcohol cues, participants' increased aggression predicted increased hostility (i.e., lower evaluations).

Attesting to the robustness of this effect, as shown in Table 6, a parallel two-way interaction was found between cue and the AEQ-based aggression index ($b = 0.56$), $t(69) = 2.21$, $p < .04$. (Although measured months later, the AEQ index was strongly correlated with the CEOA RA; $r = .48$, $p < .01$). Again, in line with predictions, decomposition of this interaction revealed an association between aggres-

sion-related alcohol expectancies and hostility scores in the alcohol cue group ($b = -0.39$), $t(36) = 2.18$, $p < .04$, but no such association in the control beverage cue group ($b = 0.15$, $t < 1$). Of note, neither drinking frequency nor quantity moderated the interactive effects of alcohol cues and alcohol expectancies, measured either via CEOA or AEQ, nor were there any main effects of these variables on hostility indices (ts < 0.5).

Finally, we tested the specificity of this effect by examining whether alcohol expectancies regarding sociability (CEOA Sociability and AEQ Social Assertiveness) moderated the influence of the priming manipulation. Regression analyses indicated that neither the CEOA nor AEQ sociability expectancies interacted with the priming manipulation in the prediction of hostility scores.

Discussion

As with the first experiment, the results of Experiment 2 provide support for the hypothesis that fleeting exposure to words associated with alcohol activates alcohol outcome expectancies, thereby giving rise to expectancy-consistent behavior in the absence of any beverage consumption. Moreover, Experiment 2 stands as a testament to the generality and robustness of this effect, for a number of reasons: First, the basic pattern of effects obtained in Experiment 1 was replicated in Experiment 2 despite the fact that cue exposure time was reduced substantially (from 250 ms to 40 ms), such that alcohol-related stimuli were exceedingly difficult, if not impossible, to consciously identify. Second, the fact that the same pattern was obtained with alcohol expectancy measures administered both before as well as after the session suggests that the pattern is not due to the influence of the priming manipulation on expectancy magnitude. Third, these results cannot be linked with the contents of a specific aggression-related expectancy scale, given that the same pattern of effects emerged with both the CEOA RA and the AEQ aggression items.

Perhaps most important, the results of Experiment 2 indicate that the effects of cue exposure on expectancy-consistent behavior are not limited to the tension-reduction domain. Although both tension reduction and aggression are

Table 6

Regression Analyses of Cue × Expectancy Interactions in Experiment 2

Measure	b	SE	$t(1)$	p
		CEOA		
Cue	−1.27	0.56	−2.28	.03
RA	−0.69	0.31	−2.26	.03
LDT	8.27	2.12	3.90	.001
Cue × RA	0.41	0.18	2.21	.03
		AEQ		
Cue	−1.35	0.71	−1.89	.06
A	−0.93	0.41	−2.31	.02
LDT	9.59	2.15	4.46	.001
Cue × A	0.56	0.26	2.21	.03

Note. CEOA: $R^2 = .26$; $F(4, 69) = 5.09$, $p = .001$. AEQ: $R^2 = .25$; $F(4, 69) = 5.82$, $p = .001$. CEOA = Comprehensive Effects of Alcohol Questionnaire; RA = Risk and Aggression scale; AEQ = Alcohol Expectancy Questionnaire; A = Aggression subscale; LDT = lexical decision task performance.

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[4] There was no such reliable correlation between LDT performance and measures of nonconsumptive behavior (i.e., tension reduction) in Experiment 1 ($t < 1$). Presumably, as suggested regarding Experiment 2, poorer performers may have experienced greater feelings of irritation or resentment in the first experiment. However, these feelings may not have been deemed as applicable to decisions regarding meeting preferences (used to operationalize tension in Experiment 1) as they were to decisions regarding experimenter evaluation (used to operationalize aggression in Experiment 2): Unlike the experimenter in Experiment 2, the female stranger in Experiment 1 bore no responsibility for the procedure, boring or frustrating as it may have been, and would have not provided an appropriate target for hostility. Moreover, there is currently no reason to believe that negative responses to poor LDT performance, which may be rather varied, would systematically translate into preferences to meet a stranger under more or less anxiety-provoking circumstances.

commonly believed to result from drinking, they represent quite disparate psychological constructs. For example, tension reduction can be characterized as an internalizing phenomenon (i.e., effects directed toward the self), whereas aggression is an externalizing behavior (i.e., effects directed at others). Still, in both cases examined here, only expectancies associated with the particular behavioral opportunity in question were significantly associated with cue exposure in predicting that behavior.

General Discussion

Experimental research (e.g., Greeley & Oei, 1999; Ito et al., 1996; Sayette, 1999) and popular belief (see Critchlow, 1986) suggest that the multifarious effects of alcohol consumption include tension reduction and the facilitation of aggression. Such observations may be accounted for by positing that drinking behavior primes relaxation-related or aggression-related alcohol expectancies in long-term memory (see Lange, 2002). The present findings accord with this view but additionally suggest that once activated by rudimentary drinking-related cues, alcohol expectancies may facilitate tension reduction or hostility in the complete absence of actual or even expected alcohol consumption. In Experiment 1, after fleeting exposure to alcohol-related words, individuals with stronger expectancies that drinking reduces tension showed an increased willingness to meet with an opposite-gender stranger under relatively anxiety-provoking circumstances, suggesting that they experienced less apprehension regarding the meeting. Analogously, in Experiment 2, following near-subliminal exposure to alcohol-related words, individuals with stronger expectancies that drinking fosters aggression showed greater hostility toward a target person in a real, albeit experimentally engineered, social situation. Neither of the latter effects was obtained following exposure to nonalcoholic beverage words, which presumably did not activate alcohol expectancies in long-term memory. These findings lend additional support to the hypothesis that simple exposure to alcohol cues independently engenders expectancy-consistent behavior (cf. Friedman et al., 2005).

Models of alcohol-related memory posit that cues associated with alcohol activate both associated outcomes and behaviors (Stacy, 1995). Considerable research has demonstrated that alcohol cues influence expectancy-related cognitions (Kramer & Goldman, 2003; Krank et al., 2005; Wall et al., 2001). Results of the present studies provide evidence that this activation can influence expectancy-related behavior and that this behavior is consistent with individual differences in expected outcomes of alcohol (i.e., tension reduction, aggression). Moreover, the nonsignificant interaction results for other expectancy domains (i.e., sociability, sexual arousal) support the specificity of this effect. This pattern implies that the influence of alcohol cues on behavior is affected by the strength of association between alcohol and specific outcomes of use.

Despite its strengths, the present study also suffered from methodological limitations that should be considered when interpreting its results. One important shortcoming of the

present research was the indirectness of the dependent measure of tension reduction used in Experiment 1. Anxiety reduction was operationally defined as an increased willingness to meet a stranger of the opposite gender under relatively threatening circumstances. However, anxiety itself was never directly measured, nor was its reduction directly assessed. As such, it is impossible to determine whether tension itself actually changed and, if so, whether the changes at issue indeed constituted an absolute reduction in anxiety as opposed to a diminished increase.

Another potential limitation of the present study was the fact that the two experiments differed on numerous parameters, including prime exposure duration, expectancy content (i.e., tension reduction vs. aggression) and measurement as well as sample composition (i.e., men only vs. mixed gender). The choice to vary multiple parameters across studies reflected an attempt to convergently validate the alcohol cuing effect at issue as well as to document its sheer subtlety and generalizability across content domains. Nevertheless, differences in procedures between these two studies reduce the internal validity of the experiments.

These studies were also limited in their ability to assess potential gender effects or differences. A male-only sample was used in Experiment 1, in order to parallel Wilson and Abrams's (1977) classic study of placebo effects on tension reduction in male participants' interaction with a female confederate. The sample size and design of Experiment 2 provided insufficient statistical power to meaningfully evaluate interactive effects of gender, none of which were found here. Theoretically speaking, gender differences in mere cuing effects should be obtained when male and female participants markedly differ in the content of their underlying alcohol expectancies. There is evidence for gender differences in expectancy endorsement across several domains (see Jones et al., 2001).

Future research is required to explore the precise mechanism by which contextually activated expectancies facilitate effects on nonconsumptive behaviors such as tension reduction or hostility. We offer two nonexclusive possibilities. First, activation of mental representations pertaining to tension reduction or aggression may have engendered a "perceptual assimilation" effect (see E. T. Higgins, 1996, for a review). Specifically, for those with stronger alcohol expectancies, alcohol cues may have spread activation to concepts associated with relaxation (e.g., calm, peaceful) or aggression (e.g., offense, blame) via a semantic network (e.g., Collins & Loftus, 1975), which then implicitly shaped the perception of the social situation, in this case leading participants to view their prospective interaction as less threatening (Experiment 1) or to construe the experimenter's gaffe as more worthy of retribution (Experiment 2). This candidate mechanism draws credibility from recent findings by Bartholow and Heinz (2006), who found that after passive viewing of photographs of alcoholic (relative to nonalcoholic) beverages, participants were more likely to rate the ambiguously aggressive behaviors of a story character as relatively hostile. Bartholow and Heinz suggested that this effect is driven by the implicit use of alcohol

cue-activated aggression representations as templates for social perception (cf. Goldman, 1999).

Another possibility is that exposure to alcohol cues activates not only semantic representations but also motives one to relax or to aggress. It has been argued that motives are represented as mental structures (e.g., action plans or procedural representations; see Huesmann, 1998) and may be triggered with little or no awareness by suboptimal primes akin to those used here and fairly automatically carried out to completion (see Bargh & Chartrand, 1999; Kruglanski et al., 2002; Prinz, 1990).

Both of these possibilities pose testable hypotheses for future study. The activation of concepts in long-term memory is thought to rapidly wane in accessibility level over time (see E. T. Higgins, 1996). However, Bargh, Gollwitzer, Lee-Chai, Barndollar, and Trötschel (2001; see also Förster, Liberman, & Higgins, 2004) have suggested that activated motives maintain their accessibility level until they have been satisfied (e.g., until retaliation has been successfully achieved). The perceptual assimilation explanation would be supported by studies demonstrating that priming effects were relatively brief in their influence on behavior, whereas the motivational explanation would be supported by studies showing that priming effects are not influenced by time delays but rather persist until goal attainment. Future research might parametrically assess decay in the magnitude of alcohol expectancy-activation effects over time and across different stages of goal fulfillment.

Future research can also examine potential differences between priming and placebo effects. Geers, Weiland, Kosbab, Landry, and Helfer (2005) argued that motivational factors play an important role in placebo effects as well, and they have adduced evidence that placebo effects primarily occur when participants possess a goal that stands to be fulfilled by confirming the placebo expectation. As such, despite their surface similarity, placebo effects and alcohol-related priming effects may flow from distinct processes. Studies directly comparing priming and placebo effects would require manipulation of placebo consumption and exposure to alcohol stimuli, and the assessment and/or manipulation of both alcohol expectancies and alcohol motives (Cooper, Frone, Russell, & Mudar, 1995).

In sum, despite the prospective importance of the current data for memory-based models of alcohol use and its effects, a great deal of additional research will be required to fully elucidate the mechanisms and real-world implications of these findings. Continued investigation of these and kindred effects will be essential inasmuch as they potentially constitute a unique, yet hitherto underinvestigated, link among alcohol, cognition, and behavior.

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