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Implicit Affect and Alcohol Outcome Expectancies

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by

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Abstract

Expectancy theory provides a useful framework within which to examine the link between cognitive representations of anticipated alcohol related outcomes and affective processes that ought to shape behavior at the level of implicit, or automatic, processing. The role of affect in alcohol expectancies is an important one as it reflects the approach-avoid contingency associated with reward learning presumed to underlie addictive processes. This study examined the relationship between affect and expectancy operation by using suboptimally presented alcohol related cues to prime affectively congruent evaluations of otherwise unrelated targets. Hypotheses predicted that drinkers who reported higher positive and arousing expectancies for alcohol outcomes would make affective evaluations (but not semantic categorizations) more accurately when target stimuli were preceded with an alcohol picture or word prime. Analysis of drinking and expectancy variables revealed positive relationships between drinking frequency and social/physical pleasure expectancies, as well as tension reduction expectancies. No relationships were found between drinking quantity and expectancies. Evaluation response accuracy was not related to alcohol expectancies. Discussion centers on potential reasons for lack of findings, including experimenter error and design limitations.

Introduction

The ability of animals to store information for later recall to aid in the interpretation of, and selection of behavioral response to, future events is the premise upon which Tolman (1932) emphasized the organizational aspect of learning. Memories of response-outcome relationships enable an organism to predict outcomes from similar contingencies, often automatically. These memories and their associative linkages constitute expectancy templates, which guide behavior in response to familiarity derived from ongoing life events as they unfold (Goldman, 2002; Maddux, 1999). As reflected in expectancy operation, information storage and processing is not limited to "cold" cognition, but includes affect, which operates interactively with cognitive systems to guide decision-making in the presence of multiple choices (Goldman, 2002; Goldman, Darkes, & Del Boca, 1999). Alcohol outcome expectancies comprise those templates representing direct or vicarious experiences with alcohol and anticipated effects of future use (Goldman, Brown, & Christiansen, 1987; Goldman, 2002). Expectancy theory provides a useful framework within which to examine the link between cognitive representations of anticipated alcohol related outcomes and affective processes that ought to shape behavior at the level of implicit, or automatic, processing.

Research has highlighted several antecedent factors related to the onset and maintenance of problem drinking, including affect regulation, level of response (sensitivity) to alcohol, and tendency to engage in deviant behavior in general, with each of these areas differing on dimensions of genetic contribution, environmental influence, and personality variability (Sher, Grekin, & Williams, 2005). Two decades of research have yielded abundant evidence that expectancies mediate the relationship between antecedent risk factors for drinking and actual drinking behavior (Brown, 1985b; Brown, Goldman, & Christiansen, 1985; Roehrich & Goldman, 1995), and that expectancies predict drinking behavior (Christiansen, Smith, Roehling, & Goldman, 1989). To demonstrate the mediating role of expectancies, Darkes and Goldman (1993; see also Dunn, Lau, & Cruz, 2000) used an expectancy challenge, which resulted in reduced drinking after six weeks among a sample of college students. The model's predictive quality is borne out in the relationship of drinker class delineations to alcohol expectancy dimensions: light drinkers tend to endorse the negative and sedating effects of alcohol, while heavy drinkers report more positive and arousing effects (Goldman, Darkes, & Del Boca, 1999).

Affect in Expectancies

The affective quality of alcohol expectancies has been demonstrated in Goldman and colleagues' multidimensional mapping of expectancy words generated by nearly 10,000 college-aged drinkers (Rather, Goldman, Roehrich, & Brannick, 1992; Goldman & Rather, 1993; Rather & Goldman, 1994; Goldman & Darkes, 2004). The words generated in response to the cue, "Alcohol makes me…" fit best along intuitive dimensions of valence and arousal, many of the words being affective in nature, (e.g, *happy, horny, social)*. The role of affect in alcohol expectancies is an important one as it reflects the approach-avoid contingency associated with reward learning presumed to underlie addictive processes (Holland & Gallagher, 2004; e.g., Winkielman, Knutson, Paulus, & Trujillo, 2007). Robinson and Berridge (1993) discussed this relationship in terms of incentive sensitization. According to this hypothesis, drugs create real changes in the neural substrates of reward-response, resulting in hypersensitization of the neural pathways associated with reward learning, so that drug-related cues acquire salient properties previously associated with the drug itself (Berridge & Robinson, 2003). Essentially, anticipation of reward effects creates a state within the organism in which the cue activates behavior as effectively as if the reward were immediately available; the cue's prediction of reward eventually comes to elicit the greater part of the organism's response (Wise, 2002). Especially relevant is the hypothesized role of these changes in the organism's drug-seeking behavior. Incentive sensitization theory posits that reward representation hypersensitization, termed pathological "wanting," can be activated implicitly, resulting in unplanned, unconscious stimulation of drug-seeking behavior. Presumably, drinkers with stronger or more abundant associations between alcohol- and positive outcome-related representations would be particularly sensitive to such manipulation.

Goldman (2002; Rather & Goldman, 1994) suggests that for heavier drinkers, associations among expectancies within the individual's conceptual network are more "tightly packed." Therefore, for heavier drinkers, the activation of a drinking related concept is more likely to lead to activation of related representations, and hence a greater range of positive and arousing expectations for alcohol. Activation of expectancy network associations is not necessarily volitional, but is often automatic given the presence of a priming cue, e.g., environmental (bottle of beer) or internal (memory of drinking event). Several experiments have demonstrated the automaticity of expectancy activation through implicit priming (expectancy word priming; Stein, Goldman, & Del Boca, 2001; modified Stroop task; Kramer & Goldman, 2003; false memory; Reich, Goldman, & Noll, 2004).

As mentioned above, expectancies serve the basic purpose of guiding behavior based on an organism's experience with previous events. The critical role of affect in this process is to afford the organism the ability to discriminate between an event that is to be approached (life-preserving) and one that is to be avoided (life-threatening). Obviously, the notion of subjective emotion at the evolutionary genesis of the ability to parse "good" from "bad," is anachronistic. It follows that an organism's ability to quickly distinguish advantageous from deleterious situations would bear little resemblance to what modern humans consider to be emotion, (i.e., "feelings," or nuanced and circumstantial gradations of mood), but is more likely analogous to the activation of a "switch" indicating "good" or "bad"; that is, an automatic evaluation of the encountered stimulus.

Affective Priming

The study of automatic evaluations has increased significantly over the past few decades as social and cognitive theories of automatic processing have driven much research on human interactions, e.g., stereotyping and appraisals (Klauer & Musch, 2003). Work in this area has helped to generate a series of procedures, such as the affective priming paradigm, designed to study evaluative associations in memory. Affective priming, as first demonstrated by Fazio, Sanbonmatsu, Powell, and Kardes (1986) is defined as the facilitation of evaluative judgment of a stimulus following an affectively congruent priming stimulus. Theoretical discussion of the affective priming effect has involved some vigorous debate, centering mostly on mechanism. Spreading activation (Bower, 1991; Fazio et al., 1986; Neely, 1991), response competition (i.e., Stroop-like mechanism; e.g., Klinger et al., 2000), and an affective matching-mechanism (e.g., Klauer & Stern, 1992), are three models that have been proposed to explain the facilitation of affectively congruent prime-target pairs. Fazio (2001) has argued that it is not likely that one theory of mechanism explains affective priming. Rather, each likely contributes to the effect differentially, providing moderating influence according to the organism's goal orientation. Whether a prime-target relationship facilitates the spreading of like associations, or their congruency speeds processing as a result of their associative compatability, the significant outcome is the activation of a readiness state. Readiness confers upon an organism the ability to anticipate some outcome by calling on previously established contingencies. This is, of course, the fundamental premise of expectancy theory.

Early affective priming research appeared to suggest that affective associations may be fragile and difficult to measure with more than minimal effects. The paradigm was scrutinized as a replicable measure when some researchers failed to replicate aspects of the findings of Fazio et al (1986). For example, De Houwer and Eleen (1998) obtained associative, but not affective priming, and De Houwer, Hermans, Rothermund, and Wentura (2002) failed to obtain affective priming in semantic tasks. Others failed to obtain effects using a pronunciation task (e.g., Glaser & Banaji, 1999; Glaser, 2003; Klauer & Musch, 2001). These apparent shortcomings may have been reflective of the complexities inherent in psychological phenomena rather than methodological or theoretical flaws (Wittenbrink & Schwarz, 2007).

Further testing of the phenomenon has demonstrated an interactive effect of context such that the association set activated by a priming mechanism (as indexed by the presence of priming effects) depends on the instruction set provided to the participant (Klauer & Musch, 2003). Refined designs have revealed that activation of a set of associations in memory, such as that which facilitates evaluation of an associated stimulus, depends on how the participant has focused his attention; that is, what his operational goal is. For example, instructing the participant to focus on a non-evaluative dimension of a stimulus (e.g., whether it is a living or non-living thing) typically shows no effect of affective congruency between the prime and target, while a focus on the affective dimension of the same pairing results in robust priming effects (e.g., De Houwer et al., 2002; Klinger, Burton, & Pitts, 2000; Klauer & Musch, 2002).

The task dependence of the affective priming effect supports the notion that association sets do not operate independently in terms of the processes activating them, but according to the functional demand being made of them. Associations can be activated in accordance with goal state, not merely as a function of pure associative strength. This is a similar relationship to that suggested by the multidimensional space created by the mapping of alcohol outcome expectancies, which are thought to reflect multiple, dynamic, and interactive affective and cognitive processes. Wittenbrink (2007) notes that this reflects a strength of the affective priming paradigm as an index of implicit processing in that it is not dependent on high accessibility of targeted concepts. This may reflect the paradigm's ability to access very basic memory organization, regardless of relative strength between nodes. Wittenbrink (*ibid*.) underscores this possibility in addressing the apparent attentional conditionality (e.g., task dependence) of the paradigm, which suggests that it is not necessary that one holds a goal orientation toward a specific concept, but merely that an organism have a general attentional focus activated, for example, to assess the goodness or badness of its surroundings. This is relevant to the instance of specific primes, such as alcohol cues, which are often quite complex and include interaction of internal and external, as well as personal and social goals.

The automaticity of priming effects is supported by a number of studies that examined the interval between the onset of the prime and the onset of the target, the Stimulus Onset Asynchrony (SOA). In these studies, SOA was manipulated between 300 ms and 1000 ms (De Houwer, Hermans, & Eelen, 1998; Fazio et al., 1986, Experiment 2; Hermans et al., 1994, Experiment 1; Hermans, Spruyt, De Houwer,& Eelen, 2003). In each of these studies, priming was observed at the 300 ms SOA, but not at 1000 ms. Other research examining the effects of SOA variation found that priming effects are strongest between 0 ms and 300 ms, after which they begin to dissipate quickly (Hermans, De Houwer, & Eleen, 2001). Because conscious processes are presumed to be more time-consuming, priming effects observed at the shorter SOA, but not at the longer SOA provides strong, though indirect, evidence for automatic processing of the prime-target relationship.

Suboptimal Affective Priming

Several studies have demonstrated the reliability of suboptimal priming (i.e, stimuli presented in such a way that conscious recognition is improbable) in eliciting basic affective reactions (Dimberg & Thunberg, 1998; Murphy & Zajonc, 1993; Niedenthal, 1990; Winkielman & Cacioppo, 2001). Rotteveel, DeGroot, Geutskens, and Phaf (2001) found a stronger effect of suboptimal than optimal priming, as observed in both facial electromyography (EMG) values and subjective ratings of ideographs. Whether a priming stimulus can be considered subliminal has been subject to some debate. Many use the term “suboptimal” (Murphy & Zajonc, 1993; Rotteveel et al., 2001), noting that a lack of awareness in tasks measuring conscious effects does not guarantee that all conscious processes have been circumvented.

Winkielman, Zajonc, and Schwarz (1997), studied suboptimal affective priming using masked facial expressions. The authors found that the priming effect remained robust even when subjects were told what to expect to feel in response to suboptimal stimuli, suggesting that such priming “resists attributional interventions,” affect being activated automatically. Winkielman, Berridge, and Wilbarger (2005) conducted two experiments in which subjects increased both consumption behavior (i.e., juice consumed by thirsty subjects) and willingness to pay for the juice immediately following suboptimal exposure to positive facial expressions, while subjects reported no change in subjective mood. Because mood ratings were obtained immediately after priming trials, the methodology utilized in these studies significantly reduces the likelihood that subjects' failure to report any change in feeling was due to errors of attention or memory. While the salience of facial expressions makes evolutionary sense in terms of threat detection, Winkielman et al. (2005) suggest that, for modern humans, the influence of suboptimal facial expressions on approach-avoidance behavior may involve more general changes in positive and negative affect. If this is the case, several classes of salient stimuli should evoke similar behaviors even when presented suboptimally. Examples of potential stimuli include survival-related pictures such as snakes or potential mates, social stimuli such as money or other such status symbols, and stimuli related to social behavior of specific groups. This study proposes to test this hypothesis by using alcohol pictures (in addition to words) to prime affective evaluations in drinkers whose alcohol expectancies presumably predispose them to attach positive, approach-oriented meaning to representations associated with alcohol related concepts.

Affective Priming Cues

Affective priming has been reliably demonstrated using words, drawings (Giner-Sorolla, Garcia, & Bargh, 1999), photos of angry and happy faces (Murphy & Zajonc, 1993), familiar v. strange faces and names (Banse, 1999), and even odors (Hermans, Baeyens & Eleen, 1998), and several dependent variables have been utilized in the affective priming paradigm, ranging from simple liking ratings (Murphy & Zajonc, 1993) to consumption behavior (Winkielman et al., 2005). Much of this research has focused on the phenomenon itself, limiting experimental manipulations to those with the most robust effect sizes. This strategy has resulted in a rich literature supporting the affective priming effect, but has left unexplored the role of other potentially influential cue types.

Under normal viewing conditions, words are perceptually unambiguous. On the other hand, pictures are relativeley complex and thus potentially ambiguous, especially given extremely brief exposures, such as those used in suboptimal priming. Much of the work demonstrating affective priming effects with pictures has utilized real facial expressions which are inherently salient stimuli (e.g., Winkielman et al., 2005). Additionally, non-face picture primes have typically involved simple line drawings, rather than life-like depictions (e.g., Giner-Sorolla et al., 1999). Of course, human environments are not limited to words, faces, and simple drawings. Rather, the stimuli these cues are theorized to represent are complex and often ambiguously perceived in most situations, given the sheer number of cues available at any moment in a given environment. Recently, affective priming has been shown using more varied pictures, for example, scenes of people and animals engaged in a variety of activities (Avero & Calvo, 2006), but the vast majority of studies have been limited to word pairings. The inclusion of alcohol pictures as affective primes in this study is apparently unique.

Preliminary Findings

This study is a continuation of previous work examining the role of affect in activating alcohol outcome expectancies using pictures as primes (Ray, Darkes, & Goldman, 2007). In that recent study, participants grouped by expectancy endorsement (high v. low positive/arousing) viewed pictures of neutral objects and rated them on dimensions of valence and arousal. As hypothesized, affective priming with facial expressions (highly salient, potentially universal cues) was replicated; this was reflected in higher subjective ratings of face-primed neutral pictures. Alcohol-primed pictures were also rated higher, but not significantly, and no main effect of expectancy group was realized, though this also trended in the hypothesized direction.

The absence of hypothesized alcohol prime effects in the Ray et al. (2007) experiment was likely due to a combination of demand effects related to the subjective ratings instrument and a power deficit related to the diffusion of power across sources of variability within the trial presentation procedure. Participants were instructed to make their ratings as accurately as possible, but were given 2000 ms exposure time, plus 4000 ms intertrial interval time with which to make judgments. It is likely that even this apparently brief window allows for an unacceptable amount of deliberation, and variability, in ratings that are supposed to capture automatic processes. This study sought to minimize the influence of rating latency as a source of variability to increase the power needed to detect an effect of alcohol prime.

The priming procedure found to achieve the strongest effects by minimizing power diffusion via speed/accuracy trade-off is the response window technique developed by Greenwald, Draine, and Abrams (1996). The response window technique has been refined and used extensively by several investigators in subsequent years (e.g., Klauer & Musch, 2002; Klinger et al., 2000; Musch & Klauer, 2001). This procedure allows participants a very brief time to indicate whether they find the target to be positive or negative, with percentage correct being the dependent variable. Percentage correct, or accuracy, is defined in this paradigm by the number of evaluations which accurately reflect actual target valence. By restricting all respondents to similar latencies, speed is controlled and accuracy is used to index the priming effect. This procedure is outlined in detail in the Method section.

This study utilized a dissociation design in which identical affectively congruent prime-target pairs were presented in separate conditions that differed only on instruction set. Specifically, participants evaluated the target affectively in one condition and categorized it on a non-affective dimension in another condition. It was anticipated that priming effects in the affect condition together with the absence of priming effects in the simple categorization condition would demonstrate the presence of an affective component activation in the evaluative trials. It should be noted that this design was not intended to demonstrate independence of affect, but rather to illucidate the activation of affect beyond semantic activation alone.

Specific Aims

Given the potentially important role that implicit processing may play in alcohol expectancies, the purpose of this study was to further explore the relationship between alcohol outcome expectancies and the affective processes that influence behavior at a level beneath conscious awareness. Much of the research on alcohol expectancies to date has focused on the cognitive activation of expectancies, while affective priming has been less-well studied. By exploiting the automatic nature of expectancy activation, both cognitive and affective, this study aimed to elucidate this relationship using an affective priming paradigm.

First, this study aimed to demonstrate the affective component of expectancy operation by using suboptimally presented alcohol related words to automatically activate (prime) affectively congruent evaluations of otherwise unrelated targets. Second, because real world environments involve complex visual cues that cannot be adequately approximated by words, the inclusion of pictures as primes aimed to extend the research supporting alcohol expectancy theory by showing empirically that they are not limited to language-based associations.

Hypotheses

1. Drinkers who report greater positive and arousing expectancies will accurately evaluate a greater percentage of alcohol-primed/positive target word presentations.
    a. There will be no expectancy related difference of accuracy for non-affective categorization.

2. Drinkers who report greater positive and arousing expectancies will accurately evaluate a greater percentage of alcohol-primed/positive target picture presentations.
    a. There will be no expectancy related difference of accuracy for non-affective categorization.

Method

Participants

A sample of young adult drinkers was recruited from the University of South Florida campus via the research participation pool during the Summer and Fall 2008 semesters. Age range was limited to 18-24 years, as this reflects the period of most frequent drinking among young adults (NIH, 2004). To examine potential differences in alcohol expectancies between genders, an effort was made to include equal numbers of males and females in the study. Previous studies have shown at least minimal gender differences within alcohol expectancies (e.g. Des Rosiers, Noll, & Goldman, 2002; Weinberger, Darkes, Del Boca, & Goldman, 2003). Expectancy research suggests that males and females endorse alcohol expectancies similarly, but that variability in semantic meaning behind expectancy words may explain differences between genders.

Standard drinking quantity and frequency questions were included as part of the Psychology Department's participant pool mass testing protocol and served as a screening instrument. Respondents were eligible if on the mass testing measure they reported being a drinker and right handed. For the purposes of this study, a drinker was defined as one who reported consuming alcohol at least once per month. Non-drinkers were excluded via the mass testing screening procedure. The Alcohol Expectancy Questionnaire (AEQ; Brown, Christiansen, & Goldman, 1987) was also administered as part of the participant pool mass testing battery. Only those potential participants who responded to the mass testing protocol and met eligibility requirements were able to view and sign up for this experiment via the participant pool experiment system.

Sample Characteristics

The original sample included 101 participants, two of whom were excluded, one due to inability to successfully complete the practice session, the other because he fell asleep during the experiment. Data from the remaining 99 participants were included for analyses. The final sample included ninety-nine college-aged students, with a mean age of 20.04 years (SD = 1.69). All participants were currently enrolled at the University of South Florida as full-time, undergraduate, college students. The sample was reflective of Tampa Bay Area demographics: 75.8 % Caucasian, 5.1% African American, 9.1% Hispanic, 4.0% Asian, and 6.1% other. Fifty-three males and forty-six females were enrolled in the study, and gender groups did not differ in age [$t(97) = -.61$, $p > .05$], or race [$\chi2(4, N = 99) = 2.55$, $p > .05$].

Procedure

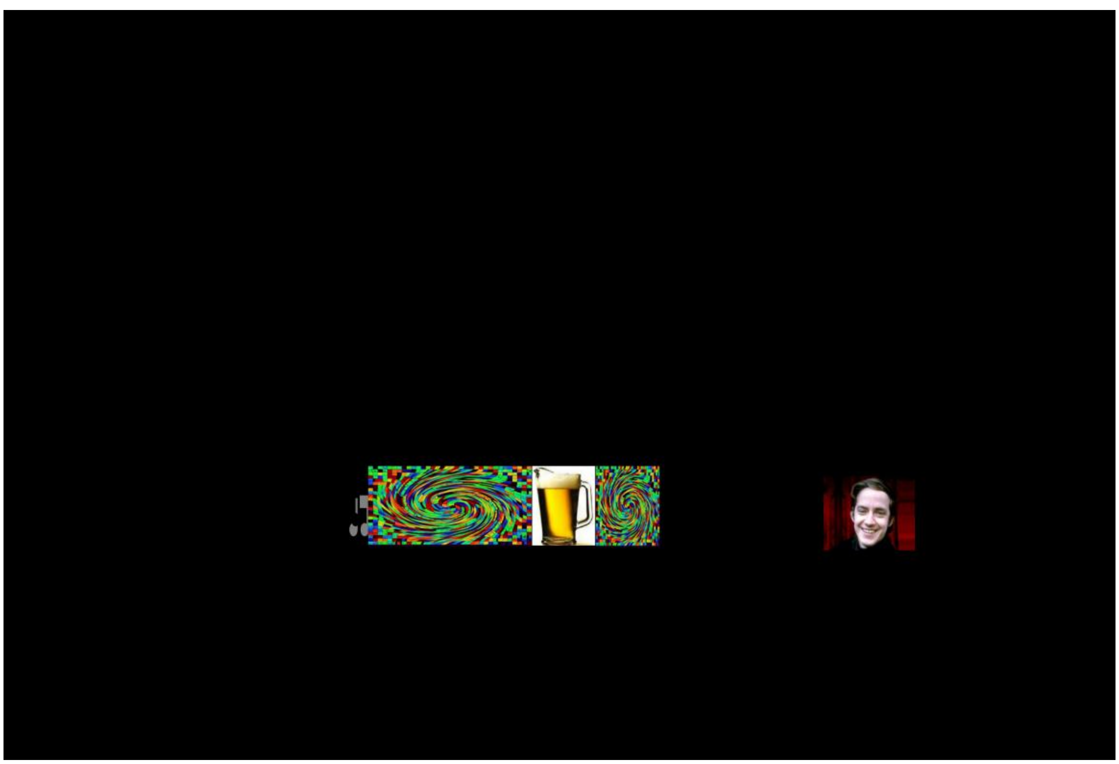
Participants who completed the screening instrument and met minimum criteria were eligible to register for an ostensibly unrelated study in the Student Research Institute (SRI) lab (USF, PCD 2101). The true nature of the study (i.e., that it involves alcohol related stimuli) was concealed until debriefing to avoid potential contamination and demand effects related to alcohol use. Eligible participants attended a one-time, fifty-minute laboratory session. All participants read and signed the IRB approved Informed Consent Document and were reminded of their volunteer status and given the opportunity to withdraw from the study. They were then briefed on procedure, which was described as part of a study of the effects of state affect on the ability to rapidly categorize briefly presented words and pictures; specifically, that participants would view words (condition 1) and pictures (condition 2) on a computer screen after each of which they would use a standard keyboard or keypad to make a categorization. Following the intake procedure, participants completed the trait version of the Positive And Negative Affect Scale (PANAS-trait version; *see Questionnaires and Written Assessments*). A state version of the PANAS was completed following each condition.

Affective priming with words. Each participant completed at least three forty-trial practice blocks of irrelevant prime-target pairings to establish baseline response tendencies and to calibrate the response window (the Response Window Procedure is outlined in detail below). Four sixteen-trial test blocks of word presentations followed, in which affective words were paired with either affectively congruent alcohol prime words, affectively incongruent alcohol prime words, affectively congruent non-alcohol prime words, or affectively incongruent non-alcohol prime words. For example, the prime word *BEER* might be paired with the target word *HAPPY*, a presumably affectively congruent pairing for drinkers with high positive/arousing expectancies.

Each trial consisted of four components (see Figure 1), presented in order as follows: fixation icon (1000-ms cross), forward mask (400-ms), suboptimal prime (32-ms alcohol- or non-alcohol word), backward mask (32 ms), 1000-ms affectively polarized word (SOA = 64 ms).

Participants were instructed to evaluate each target word as positive or negative (i.e., for valence) within the 133 ms response window, after which they would prepare for presentation of the subsequent trial. Valence ratings/ categorization were made with designated key strokes on a standard computer keyboard.

Figure 1 Trial Level Schematic of The Response Window



Affective priming with pictures. Picture priming sessions were identical to picture priming sessions with the exception that pictures were used instead of words, both as primes and as targets. For example, a prime picture of a *BEER* might be paired with a target picture of a *PUPPY*, an affectively congruent pairing for drinkers with high positive/arousing expectancies.

Semantic priming with words and with pictures. The semantic priming manipulation was identical to the affective priming manipulation, including identical primes, targets, and prime-target pairings, except that participants were instructed to categorize targets according to a non-affective dimension [i.e., single v. multiple syllables (words) or subjects (pictures)].

Following the completion of the experiment, participants completed the remainder of the written assessments, including the BIS/BAS, and the SAQ (see *Questionnaires and Written Assessments* for a description of each).

Measures

Response window procedure. Greenwald, Draine, and Abrams (1996) designed the Response Window Technique, in which participants are given a very brief time to indicate whether they find a target to be positive or negative, with percentage correct being the DV. Percentage correct, or accuracy, is defined in this paradigm by the number of evaluations which accurately reflect actual target valence or category. For example, a positive evaluation of a positive prime-positive target pairing within the response window would be scored as correct response, because the target is positive. Conversely, a negative evaluation of the same pairing would be scored as an incorrect response. A positive response to a positive prime-negative target pairing would be scored as an incorrect response, because the target is negative. Any response made outside the response window would be scored as an incorrect response.

By restricting all respondents to similar latencies, speed is controlled and accuracy is used to index the priming effect. All congruent pairings are hypothesized to facilitate responding, so that accuracy should be higher for these pairings. For example, alcohol related prime-positive target pairings should lead to more accurate responding for participants with higher positive/arousing expectancies for alcohol. In this procedure, participants are allowed a window of 133 ms within which to evaluate the target item. The response window is set with its center at 400 ms after target onset, so that the participant is to respond between 333 ms and 467 ms following presentation of the target. In order to minimize potential floor and ceiling effects resulting from restriction of latency ranges, Musch and Klauer (2001), following Draine and Greenwald (1998), modified the window procedure to adapt to changes in individual performance. This adaptive response technique, initially centered at 400 ms following target onset, increases or decreases the window center by 33 ms at the end of each block according to performance in that block. The window center is decreased when the error percentage is less than or equal to 20% *and* the participant's mean response latency for that block does not exceed the current window by more than 100 ms. The window center is increased when the error percentage is greater than or equal to 45% *and* the mean response latency exceeds the current window by more than 100ms. If neither of these sets of conditions is met, the window center is not changed. Only trials in which the participant responds in the interval between 100ms and 1000 ms after target onset are included in determining percentage correct scores.

Participants are instructed that their goal should be to respond as accurately as possible and that all responses falling outside of the response window are considered incorrect. Opening of the window is marked by a change in the target from grayscale to color. Early responses result in no change in target properties, while an on-time response allows the target to change to color 333ms after target onset, marking the beginning of the 133ms response window. When the response occurs during the window, the target is overlaid with a “correct” icon, which remains for 300ms. The screen is then cleared and the next trial is initiated after an additional 400 ms have passed. When the participant fails to respond during the window, the target changes to back grayscale for 300ms after the end of the response window. The screen is then cleared, and the next trial is initiated after an additional 1000ms interval.

Participants perform a minimum of three practice blocks of 40 irrelevant trials. Practice continues until there is no longer any adjustment of the window center. Participants then perform four 48 trial blocks, per the priming paradigm described.

Picture stimuli. Thirty-two alcohol-related pictures to be used as primes were selected from advertisements and the internet. Ninety-six neutral pictures (thirty-two primes and sixty-four targets) were selected from the International Affective Picture Set (IAPS; Lang, Öhman, & Vaitl, 1988).

***Word stimuli*.** Thirty-two alcohol words to be used as primes were selected from The University of South Florida Word Association Norms (Nelson, McEvoy & Schreiber, 1998). Ninety-six neutral words (thirty-two primes and sixty-four targets) were selected from the Affective Norms for English Words (ANEW; Bradley & Lang, 1999).

Questionnaires and written assessments. *Alcohol Expectancy Multiaxial Assessment – Short Version* (AEMax-Short; Goldman & Darkes, 2004). This measure includes 24 expectancy words which complete the phrase, "Alcohol makes one_____." Participants indicate how frequently they believe the newly constructed statement is true (7-point Likert: never to always). The AEMax has been shown to be both reliable and valid, directly predicting later alcohol use (Goldman & Darkes, 2004).

Alcohol Expectancy Questionnaire (AEQ; Brown, Christiansen & Goldman, 1987; Goldman, Greenbaum & Darkes, 1997). The AEQ consists of 68 true/false statements to which the participant responds regarding the effects of alcohol. Items correlate with alcohol consumption and related behavior, as well as alcohol abuse, with a mean reliability of 0.84. This measure is comprised of six factors: global positive changes, sexual enhancement, physical and social pleasure, increased social assertiveness, relaxation and tension reduction, and arousal and aggression. The AEQ was administered as part of the participant pool mass testing battery.

BIS/BAS Scale (Carver & White, 1994). This 20-item instrument is designed to assess sensitivity to the behavioral inhibition and activation systems of motivation. This measure has shown good reliability with Cronbach's alpha for the BIS/BAS and its subscales ranging from .65 to .83 (Jorm, Christensen, Henderson, Jacomb, Korten, & Rodgers, 1999). High scores on the BAS subscales (Drive, Fun, and Reward) have been associated with higher levels of sensitivity to reward in reaction to alcohol-related cues (Kambouropolous & Stager, 2001). The BIS/BAS was administered following the priming procedure.

Positive And Negative Affect Scale (PANAS) (Watson, Clark, & Tellegen, 1988). The PANAS is a state and trait affect measure containing twenty adjectives (e.g., “excited”, “scared”, “irritated”) using a general positive-negative index. The state and trait versions are differentiated by whether the instruction set refers to current, recent, or long term judgments of affect. The PANAS scale has good internal consistency [α = .89(PA), .85(NA)] and construct validity, is sensitive to changes over time , and is considered one of the best measures of current mood (Crawford & Henry, 2004; Watson et al., 1988), as well as trait affect over time (Watson & Walker, 1996). The trait version of the PANAS was administered immediatley following the intake procedure. The state version was administered once before the testing session and once following each condition in order to capture change or stability of affect during the experimental protocol.

Stimulus Awareness Questionnaire. This measure was created for this study and consists of a series of questions designed to assess the extent to which a participant was able to detect the presence of a priming stimulus. It is designed to be progressively specific, beginning with a general question of whether the participant noticed anything unusual at all, and building in the event of affirmative responses to direct questions regarding the nature of the stimulus or stimuli.

Post-trial measures. Following test trials, the participant completed a post-trial PANAS Scale to assess perceived state affect. By administering the affect self-rating scale immediately post-trial, any failure to report change in affect is not likely to be attributable to errors of memory, motivation, or attention. Subsequent behavior or physiological indicators of emotion can be assumed to have occurred outside of conscious awareness (Berridge & Winkielman, 2003). The participant then completed the AE-Max and BIS/BAS instruments.

Debriefing

Following the experiment protocol, participants were informed of the true nature of the study and completed the Stimulus Awareness Questionnaire to determine whether any of the subliminal stimuli were detected during presentation. No participants indicated detection of priming stimuli.

Results

Descriptive Statistics for Independent Variables

Drinking Behavior. Drinking behavior was assessed using single item, multiple choice quantity and frequency measures (see Table 1). Drinking frequency ranged from one to seven days per week [M = 2.00(1.28)] and did not differ between males [M = 2.00(1.24)] and females [M = 2.02(1.36); $t(97) = -0.08$($p > .05$)]. Drinking quantity ranged from one to eight or more drinks per occasion [M = 3.93(1.93)]. Males [M = 4.53(2.05)] reported drinking more than females [M = 3.24(1.55); $t(97) = 3.48$ ($p < .05$)]. Elevated skewness and kurtosis values for the drinking behavior variables indicated non-normal distribution. These variables were subjected to a natural log transformation, which were used in all subsequent analyses.

Table 1

Descriptive Statistics for Drinking Variables

		N	Min	Max	Mean	SD	Skewness	Kurtosis
Quantity	Males	53	1	8	4.53	2.05	0.17	-0.90
	Females	46	1	8	3.24	1.55	1.04	1.09
	Males(ln)	53	1	8	1.63	0.41	-0.48	-0.60
	Females(ln)	46	1	8	1.38	0.35	0.15	-0.29
Frequency	Males	53	1	6	2.00	1.23	1.31	1.25
	Females	46	1	7	2.02	1.36	1.80	3.47
	Males(ln)	53	1	6	1.03	0.36	0.71	-0.57
	Females(ln)	46	1	7	1.03	0.38	0.95	0.21

Alcohol expectancies. Alcohol outcome expectancies were assessed using the Alcohol Expectancy Questionnaire (AEQ) and the Alcohol Expectancy Multi-Axial Assessment (AEMax; see Table 2). The Subscales of the AEQ included Global Positive, Sexual Enhancement, Social and Physical Pleasure, Social Assertion, Tension Reduction, and Aggression/Arousal. The AEMax included three second-order factors (Positive/Arousing, Negative, and Sedating) and eight first-order factor subscales (Social, Woozy, Sick, Egotistical, Horny, Attractive, Sleepy, and Dangerous). Subscales reflected elevated social, positive and arousing subscale means across this sample, a pattern consistent with college-aged populations. Expectancy means did not differ between genders for any subscale.

Table 2

Descriptive Statistics for Alcohol Expectancy Questionnaire Scales

	Min	Max	Mean	SD	Skewness	Kurtosis
Global Positive	0	20	8.68	4.92	0.33	-0.77
Sexual Enhancement	0	7	2.71	2.12	0.36	-1.13
Social & Physical Pleasure	4	9	7.47	1.45	-0.74	-0.34
Social Assertion	0	10	6.99	2.89	-0.94	-0.13
Tension Reduction	0	9	5.83	2.28	-0.37	-0.72
Aggression/Arousal	0	9	4.57	2.14	0.04	-0.51

Behavioral inhibition/activation. Behavioral inhibition and activation were assessed using the BIS/BAS questionnaire (Carver & White, 1994). BIS (inhibition), and BAS (activation) subscales (Drive, Fun, and Reward) were analyzed. Consistent with previous research (Jorm et al., 2001; Leone et al., 1999), data indicated greater reported inhibition among females and greater sensitivity to reward among males. Females scored significantly higher than males (see Table 3 for means) on the BIS [$t(97) = -2.53$, $p < .05$], whereas males scored significantly higher on both the BAS Drive [$t(97) = 2.19$, $p < .05$] and BAS Reward [$t(97) = 2.8$, $p < .01$] scales than did females. Behavioral inhibition and activation were not related to reported drinking behavior or expectancy variables (see Tables 4-6).

Table 3

Descriptive Statistics for Behavioral Inhibition and Activation Scales

	Range		Mean(SD)		Skewness		Kurtosis	
	Male	Female	Male	Female	Male	Female	Male	Female
BIS	4-19	4-21	11.47(3.70)	13.57(4.54)	0.04	-0.41	-0.77	-0.67
BAS Drive	2-12	1-12	7.58(2.28)	6.5(2.65)	0.19	-0.23	0.14	-0.09
BAS Fun	2-12	0-12	8.47(2.31)	7.87(3.18)	0.59	-0.86	0.75	-0.02
BAS Reward	1-15	0-15	12.72(2.21)	10.78(4.41)	2.89	-1.25	14.39	0.17

Table 4

Correlations Between BIS/BAS and Drinking Variables

	BIS	BAS Drive	BAS Fun	BAS Reward
Frequency	0.08	0.02	0.13	-0.06
Quantity	0.09	0.07	0.11	0.13

Table 5

Correlations Between BIS/BAS and AEQ Scales

	BIS	BAS Drive	BAS Fun	BAS Reward
Global Positive	-0.02	-0.04	0.00	-0.02
Sexual Enchancement	-0.20	-0.04	0.03	-0.13
Social/Physical Pleasure	-0.11	-0.01	-0.03	-0.09
Social Assertion	0.05	-0.06	0.02	-0.10
Tesnion Reduction	-0.11	-0.07	-0.11	-0.17
Aggression/Arousal	-0.03	-0.07	-0.10	-0.15

Table 6

Correlations Between BIS/BAS and AEMax Scales

	BIS	BAS Drive	BAS Fun	BAS Reward
Positive/Arousing	0.16	0.00	-0.01	0.05
Horny	0.10	-0.01	0.00	-0.04
Social	0.16	0.00	-0.02	-0.08
Attractive	0.13	0.02	0.00	0.07
Sedating	0.00	-0.05	-0.15	0.00
Sick	-0.05	-0.02	-0.06	-0.04
Sleepy	0.06	-0.09	-0.16	0.01
Woozy	0.00	0.00	-0.15	0.02
Negative	0.02	-0.01	-0.01	0.01
Dangerous	-0.05	0.04	0.00	-0.02
Egotistical	0.08	-0.06	-0.02	0.05

Within-session affect. Positive and negative affect were measured using the PANAS (see Table 7 for descriptive statistics). Trait scores, obtained prior to the experimental protocol, indicated no differences between genders. State scores, obtained following each task (i.e., Affective and Semantic), indicated that positive affect decreased significantly between the two tasks [$t(96) = 2.75$, $p < .01$], while negative affect remained unchanged[$t(97) = -.22$, $p > .05$]. State affect did not differ between genders at either point.

Table 7

Descriptive Statistics for Positive And Negative Affect Scales

	Range	Mean(SD)	Skewness	Kurtosis
Trait Positive	20-49	36.54(6.08)	-0.44	0.08
State Positive (Task1)	14-49	30.72(7.04)	-0.09	0.29
State Positive (Task 2)	11-48	27.65(8.09)	0.09	-0.22
Trait Negative	10-45	20.55(6.19)	0.85	1.84
State Negative (Task 1)	10-32	15.16(4.59)	1.07	0.99
State Negative (Task 2)	10-34	15.25(4.59)	1.37	2.46

Relationships Between Alcohol Expectancies and Drinking Variables. Based on prior alcohol expectancy research (e.g., Goldman & Darkes, 2004), it was expected that AEMax and AEQ subscales indexing positive, arousing, and social expectancies would correlate positively with drinking variables. AEMax subscale scores did not correlate with either of the drinking variables assessed (see Table 8). The single item, Social, of the AEMax approached significant correlation with Drinking Quantity ($r = .19$, $p = .06$). Examination of these correlations per individual investigator (i.e., principal investigator and four research assistants) revealed a possible experimenter effect, as several of the expected correlations were present for participants run by the lead investigator and some research assistants, whereas none were present for those run by others (see Table 9). Due to ambiguity within the AEMax data, all further analyses were based on the AEQ, which participants completed online prior to the experimental protocol. AEQ subscales Social and Physical Pleasure ($r = .22$) and Tension Reduction ($r = .27$) were positively correlated with Drinking Frequency, but not with Drinking Quantity (see Table 10).

Table 8

Correlations Between AEMax Scales and Drinking Variables

	Frequency	Quantity
Positive/Arousing	0.04	0.13
Negative	0.08	0.09
Sedating	-0.07	-0.04
Horny	0.02	0.07
Social	0.13	0.11
Attractive	-0.06	0.13
Sick	-0.07	-0.02
Sleepy	-0.08	0.00
Woozy	-0.02	-0.09
Dangerous	0.02	0.08
Egotistical	0.14	0.09

Table 9

Quantity Correlations By Investigator

	PI (N=18)	RA 1 (N=6)	RA 2 (N=14)	RA 3 (N=22)	RA 4 (N=39)
Frequency	0.71**	0.90**	0.19	0.17	0.08
AEMax - Positive/Arousing	0.20	-0.35	0.28	0.29	0.02
AEMax - Horny	0.17	-0.15	-0.01	0.26	-0.05
AEMax - Social	0.34	-0.66	0.32	0.13	-0.04
AEMax - Attractive	-0.02	-0.14	0.21	0.31	0.12

*p<.05, **p<.01

Table 10

Correlations Between AEQ Scales and Drinking Variables

	Frequency	Quantity
Global Positive	0.01	0.09
Sexual Enhancement	0.14	-0.02
Social and Physical Pleasure	.22*	0.10
Social Assertion	0.10	0.11
Tension Reduction	.27**	0.05
Aggression/Arousal	0.17	0.02

*p<.05, **p<.01

Descriptive Statistics for Dependent Variables

Response data. Task response data reflects the percentage of responses falling within the response window and accurately reflecting target valence. Responses falling outside of the response window were counted as incorrect responses, so total percent correct was calculated as the number of correct responses divided by the total number of trials in that block. Response Accuracy was computed for each block within each task domain and descriptive statistics are displayed in tables 11 & 12. Examination of non-alcohol prime conditions revealed that the overall priming effect did not occur. Whereas affectively congruent prime-target pairings should have facilitated response accuracy, these conditions did not differ significantly from their incongruent counterparts (although non-alcohol incongruent pairings were more highly associated with accuracy than were non-alcohol congruent pairings; [$t(98) = -2.19$, $p < .05$]), suggesting that congruency did not affect response accuracy differentially.

Table 11

Descriptive Statistics for Affective Task Response Accuracy

	Range	Mean(SD)	Skewness	Kurtosis
Alcohol Words - Congruent	0-1.00	.61(.22)	-0.36	-0.58
Alcohol Words - Incongruent	0-1.00	.67(.21)	-0.52	0.13
Non-alcohol Words - Congruent	0-1.00	.60(.22)	-0.50	-0.32
Non-alcohol Words - Incongruent	.13-1.00	.65(.22)	-0.16	-0.53
Alcohol Pictures - Congruent	0-1.00	.57(.25)	-0.66	0.02
Alcohol Pictures - Incongruent	0-1.00	.62(.22)	-0.33	-0.34
Non-alcohol Pictures - Congruent	.13-1.00	.59(.21)	-0.28	-0.73
Non-alcohol Pictures - Incongruent	.13-1.00	.59(.20)	-0.27	-0.47

Table 12

Descriptive Statistics for Semantic Task Response Accuracy

	Range	Mean(SD)	Skewness	Kurtosis
Alcohol Words - Congruent	0-1.00	.71(.20)	-0.28	-0.54
Alcohol Words - Incongruent	0-1.00	.70(.22)	-0.73	0.26
Non-alcohol Words - Congruent	0-1.00	.68(.25)	-0.83	0.74
Non-alcohol Words - Incongruent	0-1.00	.69(.24)	-0.72	0.25
Alcohol Pictures - Congruent	.13-1.00	.61(.23)	-0.70	0.30
Alcohol Pictures - Incongruent	0-1.00	.67(.21)	-0.74	0.07
Non-alcohol Pictures - Congruent	.25-1.00	.66(.23)	-0.44	-0.73
Non-alcohol Pictures - Incongruent	0-1.00	.66(.23)	-0.95	0.59

Relationships Between Alcohol Expectancies and Dependent Variables

It was hypothesized that positive expectancies would be positively correlated with response accuracy for Affective task trials, but not Semantic task trials, in which alcohol primes were paired with positively valenced targets. Bivariate correlations performed on these variables revealed a significant relationship between affective task response accuracy for alcohol prime/positive target pairs and the AEQ Tension Reduction scale (r = .38, p<.01), but only for males and only in the picture condition. Semantic task accuracy for alcohol prime/positive target pairs was negatively correlated with this scale (r = -.31, p<.05), but only in the word condition and, again, only for males. Among all remaining variables, bivariate correlations revealed no significant relationships. That is, prime-target congruency was not related to level of positive alcohol expectancy endorsement aside from the Tension Reduction scale of the AEQ (see Tables 13 through 16), which was not systematically related to accuracy across tasks.

A univariate ANOVA performed on Drink Quantity and the Affective/Alcohol-Positive Congruent block revealed significant group differences (F = 2.67, p<.05). Bonferroni-corrected post hoc tests indicated that participants who reported consuming five drinks per occasion differed significantly in accuracy compared to those who reported drinking one and those who reported drinking more than five, suggesting a possible non-linear relationship between Drink Quantity and accuracy for the Affective/Alcohol/Congruent block. Quadratic regressions revealed significant relationships for this block in both the picture (β = 1.99, p < .01) and word (β = 1.90, p < .01) conditions, but also for the Affective/Alcohol/Non-Congruent block in the word condition (β = 1.97, p < .01).

Table 13

Correlations Between AEMax Scales and Affective Task Response Accuracy

	Social/Physical Pleasure	Tension Reduction
Alcohol Words - Congruent	0.04	0.15
Alcohol Words - Incongruent	-0.03	0.01
Non-alcohol Words - Congruent	0.03	-0.01
Non-alcohol Words - Incongruent	0.09	0.08
Alcohol Pictures - Congruent	0.02	0.06
Alcohol Pictures - Incongruent	-0.02	-0.07
Non-alcohol Pictures - Congruent	-0.03	-0.03
Non-alcohol Pictures - Incongruent	-0.04	0.10

Table 14

Correlations Between AEMax Scales and Semantic Task Response Accuracy

	Social/Physical Pleasure	Tension Reduction
Alcohol Words - Congruent	-0.02	0.09
Alcohol Words - Incongruent	-0.04	-0.03
Non-alcohol Words - Congruent	-0.02	0.04
Non-alcohol Words - Incongruent	0.09	0.07
Alcohol Pictures - Congruent	-0.02	-0.08
Alcohol Pictures - Incongruent	-0.04	0.04
Non-alcohol Pictures - Congruent	0.06	-0.09
Non-alcohol Pictures - Incongruent	-0.03	-0.01

Table 15

Correlations Between AEMax Scales and Affective Task Response Accuracy by Gender

	Social/Physical Pleasure		Tension Reduction	
	Males	Females	Males	Females
Alcohol Words - Congruent	0.01	-0.02	0.10	0.01
Alcohol Words - Incongruent	-0.12	0.03	-0.05	-0.10
Non-alcohol Words - Congruent	0.04	-0.14	0.03	-0.09
Non-alcohol Words - Incongruent	0.03	-0.14	0.11	0.08
Alcohol Pictures - Congruent	0.20	-0.17	0.38**	-0.06
Alcohol Pictures - Incongruent	0.14	-0.26	0.14	-0.16
Non-alcohol Pictures - Congruent	0.00	0.09	-0.02	0.01
Non-alcohol Pictures - Incongruent	-0.03	0.18	0.00	0.14

Table 16

Correlations Between AEMax Scales and Semantic Task Response Accuracy by Gender

	Social/Physical Pleasure		Tension Reduction	
	Males	Females	Males	Females
Alcohol Words - Congruent	-0.03	0.04	0.31*	0.19
Alcohol Words - Incongruent	-0.07	-0.02	-0.01	0.08
Non-alcohol Words - Congruent	0.12	-0.02	-0.19	0.00
Non-alcohol Words - Incongruent	-0.09	0.01	-0.09	0.06
Alcohol Pictures - Congruent	-0.05	-0.02	0.01	0.16
Alcohol Pictures - Incongruent	-0.18	0.16	-0.23	0.18
Non-alcohol Pictures - Congruent	-0.07	-0.01	-0.10	0.17
Non-alcohol Pictures - Incongruent	0.19	-0.02	-0.03	0.16

Discussion

Drinking behaviors, alcohol expectancies, trait and state affect, behavioral inhibition and activation, and response accuracy to primed affective and semantic evaluation tasks were measured in a sample of 18-24 year old college student drinkers. The primary aim of this study was to demonstrate the affective component of expectancy operation by using a suboptimal-priming paradigm in which alcohol related cues were hypothesized to automatically facilitate evaluations of affectively congruent targets. The paradigm was based on previous research supporting automatic cognitive and affective priming with both words and pictures (see Musch & Klauer, 2003), whereas the use of alcohol related cues as affective primes in this study was novel. Of particular interest was the relationship between positive/arousing alcohol outcome expectancy endorsement and response accuracy in the affective task.

This sample reported drinking twice weekly at a moderately high level, just below NIAAA-defined binge levels for both males [M = 4.53(2.05)] and females [M = 3.24(1.55)]. These levels are consistent with boundary conditions regarding the relationship between drinking and positive expectancies. Despite this, expected relationships were not borne out. Most notably and critically, these basic boundary conditions were not met for alcohol expectancies endorsed via the AEMax, the expectancy measure (of the two utilized here), most closely aligned in time with participants' current drinking. Previous research (see Goldman & Darkes, 2004) has consistently shown a positive relationship between measures of current drinking and the Positive/Arousing subscales of the

AEMax, whereas in this study, drinking was not significantly related to any aspect of the AEMax. Correlations between these measures at the level of individual investigator (PI and four RA's), showed the expected relationships for three of five investigators but these did not reach statistical significance, likely because the resultant sample division sacrificed power. Although this pattern suggests experimenter error, examination of the raw data, together with interviews of each experimenter, did not indicate any systematic difference in the way the measures were delivered.

Participants had also completed the AEQ at an earlier timepoint (sometimes as distally as 90 days or more), as part of online mass testing through the Psychology Department. Both the Social and Physical Pleasure scale and Tension Reduction scale were significantly correlated with reported drinking frequency, but not quantity, at least partially establishing boundary conditions necessary for further analysis. This dataset does not contain information necessary to determine the cause of the lack of correspondence between expectancies and drinking quantity, despite their significant correlations with frequency, but it is reasonable to assume that the gap in time between expectancy endorsement and collection of drinking data may have contained a context-related shift in the relationship. It could be, for example, that these student participants, having completed the AEQ early in the semester and the drinking items later, had meanwhile adjusted their quantity but not frequency in response to academic and other demands, whereas expectancies remained relatively unchanged.

Mean response accuracy across tasks ranged from .57 to .71, which is consistent with research on similar tasks using the response window technique (Draine & Greenwald,1998). It was expected that positive expectancy endorsement would be posititively correlated with each of the affective conditions (word and picture) in which alcohol primes were paired with positively valenced targets. This relationship was born out only for the AEQ Tension Reduction scale, only in the picture condition, and only among males. That is, male drinkers with higher positive expectancies for the tension reduction properties of alcohol responded with greater accuracy to positive pictures when they were preceded by pictures of alcohol. Contrary to hypotheses, a similar relationship was not evident in the corresponding word condition. This somewhat confusing and counterintuitive result may suggest that in this sample of student drinkers, men sensitive to alcohol's anxiolitic properties responded more strongly to pictures of alcohol as a function of their current environment, which in this case was a potentially stress-inducing laboratory task in an academic setting, a possibility indirectly supported by the overall downward trend of positive affect across tasks. As for the absence of such an effect in the word condition, it may be that real world representations (i.e., pictures) of alcohol were salient enough to overcome contextual interference to influence response accuracy for these drinkers, while language-based representations (i.e., words) were not. This possibility runs counter, however, to the preponderence of previous research demonstrating affetcive priming with words and much less with pictures.

Relationships between drinking variables and response accuracy were also examined. Although correlations between these variables revealed no significant relationships, univariate ANOVA suggested a possible, non-linear drink quantity group effect. Quadratic regressions indicated such effects in both congruent and incongruent conditions of Affective/Alcohol-Positive cue conditions, a result which was not anticipated and is not theoretically supported. The ambiguity of these results likely reflects experimental artifact, rather than anything related to hypothesized effects.

It is likely that the design of this study was ill-suited to its purpose. Specifically, the effects demonstrated by many other studies of affective priming were achieved within very constrained experimental space; that is, what constituted several conditions within a single study here might have made up several independent studies in the affective priming literature. Future studies should take more care in determing the limits of the methodology and variables of interest involved and incorporate these caveats accordingly.

Finally, decreased positive affect across the experimental procedure suggests that participants may have become fatigued or at least bored with the tasks to a degree that associative activation failed to engage beyond predominantly cognitive processing. Future research should focus on building into the procedure a means of engaging and maintaining sufficient affective activation.

There is a burgeoning interest in alcohol research regarding the ways in which the complementary roles of affect and cognition interact to affect the operation of alcohol expectancies. Though the relationship between these two basic (and perhaps ultimately inseparable) processes is complex and difficult to examine, recent methodological advances have shown promise in this area. This study utilized one of these methods (i.e., the response window technique of affective priming), in an attempt to demonstrate the interactive relationship between affect and alcohol expectancies. Due to methodological limitations, no conclusions can be made about the role of affect in expectancy operation based on the findings reported in this study. It does, however, highlight the elusive nature of affect as a psychological construct outside of tightly constrained experimental settings, raising several important points regarding its study in relation to real world phenomena, such as drinking and expectancies.

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