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Examining the Distinction and Concordance between Implicit Measures of Alcohol Expectancies: Toward Agreement on Their Meaning and Use

by

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A thesis submitted in partial fulfillment
of the requirements for the degree of
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ABSTRACT

Alcohol expectancies have traditionally been measured with explicit self-report questionnaires, but in recent years implicit measures have also been used to explore the tenets of expectancy theory. The basic psychometric properties of reliability and validity have not been established for most implicit tasks, and the convergent validity of different implicit measures has not been explored. Despite these shortcomings, many researchers continue to treat implicit tasks as reliable and valid assessment tools. To address reliability and validity of implicit measures, 218 undergraduate women and men were recruited from the University of South Florida to examine the psychometric properties of and concordance between two previously established implicit measures, Free Associates (FA) and a Primed Recall (PR) task. The FA task was replicated, demonstrating high concordance between FA responses and explicit measures and drinking. The PR task did not show a drinker-type effect as was previously reported. Though the relationship between the tasks could not be examined, an exploration of practice and contamination effects offers insight into how performance in similar comparison studies may be affected.

Introduction

Alcohol expectancies are associations held in memory between stimuli, behavior, and outcome that affect alcohol-related behavior. These associations vary according to individual differences in experiences with alcohol and predict future alcohol use. It has been shown, for example, that heavier drinkers tend to endorse stronger positive and arousing expectancies than lighter drinkers, who tend to endorse sedating alcohol effects (Goldman, Reich, & Darkes, 2006; Reich & Goldman, 2005; Reich, Noll, & Goldman, 2005; Reich, Goldman, & Noll, 2004), and that such associations appear to develop in youth before drinking patterns do (Dunn & Goldman, 1998; Christiansen, Smith, Roehling, & Goldman; 1989). The alcohol expectancy literature using cognitive paradigms to probe these memory associations has grown tremendously over the past decade. With expanded methodology, however, has come growing debate over how best to capture alcohol-related memory associations. Use of explicit measurement tools and their drawbacks will be reviewed, followed by a discussion and review of implicit tools that have been used to understand alcohol expectancies.

Explicit Measurement

Alcohol expectancies have most commonly been examined using explicit questionnaires, which ask individuals whether they concur with specific statements about the effects of alcohol. In recent years, there has been a rise in the use of implicit measurement, and numerous implicit cognitive research paradigms have been adapted to probe alcohol expectancies. Use of implicit methods not only expands our assessment repertoire, but also allows researchers to address several limitations of explicit measurement.

For example, self-report of beliefs about alcohol may be distorted. They may reflect how one thinks one *should* feel about alcohol, instead of how one actually behaves in response to alcohol-related stimuli. Participants may also be sensitive to social desirability, which might vary in relation to reference group or experimental setting. For example, college students have been shown to use alcohol in greater amounts and more frequently than any other subgroup, and to hold peers that can "hold their liquor" in high esteem. Thus college students may be subject to the normative influences of peers' positive beliefs about the effects of alcohol when responding to questions about their own alcohol-related attitudes. The opposite may be true for individuals whose reference groups disapprove of alcohol use. Moreover, individuals may not actually be able to distinguish between their own beliefs about alcohol and those of their reference group. One who knows that alcohol is supposed to be "good" based on the reports and behaviors of her peers may endorse related positive effects of alcohol because she believes the experiences of others reflect truth, despite limited or negative personal experiences with alcohol. Another problem with self-report measures may be rooted in the language used by such measures. Words used by researchers to describe the potential effects of alcohol may not accurately describe the subjective effects experienced by each individual, leading to a miscommunication of ideas and the possible report of beliefs contrary to those actually held.

Implicit Measurement

There are two primary benefits that the implicit measures may offer. First, the use of implicit expectancy measures may minimize some of the above-stated problems associated with explicit self-report. Implicit cognitions are thought to be automatic and immediate, and less influenced by conscious deliberation, if at all (Goldman, Del Boca, & Darkes, 1999; Goldman, 1999; Roediger, 2003; Roediger & Amir, 2005; Fazio & Olson, 2003; Stacy, 1997). Therefore, it has been thought that finding a way to measure implicit cognitions about alcohol may circumvent measurement difficulties intrinsic to the use of explicit assessment. Automatic cognitive processes are far less available to deliberation than purposeful processes, and participants would be significantly less capable of monitoring responses or considering the beliefs of a reference group while responding (Fazio & Olson, 2003; Roediger, 2003; Roediger & Amir, 2005). Second, whereas the association between explicitly measured expectancies and alcohol use is strong, implicit measures may have unique predictive power (Stacy, 1997; Weirs, van Woerden, Fren, & de Jong, 2002a; Jajoia & Earleywine, 2002; Palfai & Ostafin, 2003). Thus, implicit measures do not appear to simply be another way of tapping the same constructs explicit measures do, but provide unique information about human memory (Nosek, 2007). To the end of utilizing these benefits, many researchers have employed implicit paradigms to draw conclusions about the nature of alcohol expectancies.

However, several problems arise when the study of implicit memory function is considered.

What is "implicit"?

First, the distinction between "explicit" and "implicit" types of memory must be understood. The frequency of pairing alcohol behaviors and outcomes, either by observation or action, strengthens associative memory between alcohol-related concepts or between behavior (e.g. alcohol use) and outcome. These associations appear to be formed at both explicit and implicit levels. Implicit cognition has been described in the alcohol field as automatic activation of associations in memory influenced by immediate motivational or situational factors (Stacy, 1997; Weirs, Stacy, Ames, Noll, Sayette, Zack, & Krank, 2002, Rather, Goldman, Roerich, & Brannick, 1992). According to this conceptualization, the distinction between implicit and explicit lies in the complex interaction between contextual or motivational cues and memory activation. Explicit processes involve deliberative retrieval of information based on cues available to awareness and known goals. Implicit processes occur before deliberation and interpretation, and under the influence of variables unidentified by the individual (Roediger & Amir, 2005; Roediger, 2003). Such processes are elusive by definition, and it has been argued that we cannot actually directly measure such implicit associations; implicit tasks can be employed, but it cannot be claimed that they fully reflect the memory content they attempt to measure (Fazio & Olson, 2003; Roediger, 2003; Roediger & Amir, 2005). Implicit tasks do not ask participants to recall events, but instead attempt to probe memory automatically activated by certain alcohol-related cues.

Therefore, that which researchers want to understand (i.e. alcohol expectancies) is by definition a construct that can only be accessed by the measures, or cues, we select for the task. In this way, it has been argued that exploration of alcohol expectancies must be described as being *through implicit means*, since we cannot verify that our measures truly quantify implicit alcohol-related cognition (Fazio & Olson, 2003).

Roediger (2003) defines implicit memory as being the "after-effects of stimulation that occur in the absence of attempts at conscious recollection." While this definition seems to encompass almost all memory processes, he goes on to point out that the range of available measures that do not employ "attempts at conscious recollection" is actually much more limited. Additionally, DeHouwer (2006) incorporates this idea into the three primary criteria he has established for a measure to qualify as implicit, one of which must be satisfied. These are: participant unawareness of the attitude or cognition of interest, lack of conscious access to the attitude or cognition of interest, or lack of participant control over measurement outcome. The presence of any of these three criteria within the design of an experimental task would block participants' "attempts at conscious recollection."

A further understanding of the goals of implicit measurement can be gained by considering how memory guides behavior. In addition to purposeful action, behavior is unintentionally influenced by the implicit memory of past events. Thus, implicit and explicit tasks reflect this conceptualization: explicit tasks are those in which participants draw consciously upon memory of specific events, while implicit tasks are those in which participants are unaware of the impact of past experiences on response. Explicit tasks are a straightforward and direct assessment of learning based on previous events; implicit tasks are a more indirect assessment of the influence of an individual's experiences.

Despite these functional differences, explicit and implicit tasks can be quite similar. Roediger and Amir (2005) use the comparison of word stem completion and cued word recall to demonstrate this. In both tasks, individuals are asked to study a list of words, perhaps including the word "elephant". In an implicit word completion task, a participant would later be simply asked to complete the stem ele-, with no further reference to the studied word list. Should the instruction set specify that the participant complete the stem with a word previously studied, the task would then be an explicit cued recall test. How would the implicit primed word stem completion task compare to a task in which an individual were to complete stems without studying a priming word list first? Both tasks are considered implicit by Roediger & Amir's standards. Would these tasks be measuring different things? This is one of the most fundamental questions facing the uses of implicit methods. Until it is understood how much information gathered from one measure is shared by other methods and how much is unique, we cannot accurately interpret our results.

Another factor that complicates implicit measurement is that the relationship between implicit and explicit, or purposeful, memory function is not well understood. The question of how distinct or similar implicit and explicit memory processes are complicates the understanding of implicit expectancy research. Concordance between implicit and explicit tasks has been reported, which has been interpreted as validation for such tasks by comparison with an explicit gold standard, working under the assumption that explicit and implicit memory function work in harmony (Weirs, van Woerden, et al., 2002; Jajoda & Earleywine, 2003). It has also been determined that implicit measures have incremental validity; they explain variance in behavior that explicit reports do not (Stacy, 1997; Nosek, 2007; Reich, Below, & Goldman, in preparation). This latter observation implies that though there may be concordance with explicit measures, implicit and explicit types of memory may actually have somewhat independent relationships to behavior. These discrepant findings cause disagreement among psychologists over how memory functions. Some researchers argue for a dual processing model of cognitive function in which implicit and explicit memories operate by different neural systems (e.g. Tulving, 1999). That discordance between implicit and explicit measures has been found may be evidence for this theory (Reich, Goldman, & Noll, 2004), although beliefs that theses systems are dissociable and thus separate abound. If we are unsure whether explicit and implicit memories are the same or different systems, how can we understand how explicit and implicit measures should relate to one another? And further, how can we be sure that our implicit tasks are actually probing the same memory system? It could be that implicit memory functions through multiple processes or systems instead of the monolithic entity that is commonly referenced by the term "implicit memory."

Herein lies the conundrum of implicit research. Calls for development of better theory to explain implicit-explicit relations are plentiful (Nosek, 2007; Ames et al., 2007; Reich et al., in preparation). Yet implicit research is notoriously difficult to conduct due to difficulties with contamination, practice effects, and construct validity. Because implicit measures have no genuine gold standard against which to be measured, little definitive evidence exists for the mechanisms by which they function. Making attempts to refine the distinction between implicit and explicit alcohol expectancy even more difficult is the fact that the tasks employed to explore implicit expectancy have been varied, and replication has been scant. When experimental research has been conducted more than once with the same implicit tasks for the study of alcohol expectancies, rarely have the same stimuli been used or the same procedures followed, as exemplified by use of different versions of the IAT (discussed below). Thus, the conclusions drawn from this body of literature are fragmentary and often conflicting.

Over the past 15 years, multiple implicit measures have been adapted from cognitive psychology for the purpose of measuring alcohol expectancies within the domain of clinical research. Many of these measures have shown promise in their ability to identify and predict patterns of drinking. However, most of these measures have begun to be used without having been subjected to the rigorous psychometric tests that are applied to most clinical instruments at development. A long history of division between experimental and "correlational" (e.g. observational or clinical) research fields has maintained differences in their goals for psychological science (Cronbach, 1957).

Experimental, or cognitive, psychology has traditionally focused on generalization, or explaining behavioral phenomena across individuals. Correlational, or clinical, research has focused on individual differences. What experimental psychology has regarded as noise and attempted to minimize, clinical scientists have sought to understand. Thus the experimental measures brought to the alcohol expectancy field from cognitive research were developed for a different set of theoretical goals, and judged by a differing criterion of acceptability. No matter how well established experimental methods may be in the cognitive field, their reliability and validity as measures of individual differences must be established separately within the realm of clinical research.

Yet for the implicit measures adapted for alcohol expectancy research, results from empirical testing of each have been reported on few occasion, and on only one in many cases (e.g. Reich et al., 2005; Kramer & Goldman, 2003; McCarthy & Thompsen, 2006). Where multiple tests of one measure have been conducted, variation in methodology (e.g. unipolar valence IAT versus separate positive and negative versions), stimuli (such as different sets of words representing similar constructs; e.g. alcohol words or alcohol-related expectancy words), and sample characteristics has been so great that true replication has been scant. In addition, the outcome indices of these implicit measures are greatly variable, and the use of different dependent variables across studies has rendered their results incomparable (e.g. quantity of drinking, frequency of drinking, alcohol-related problems, or measure of heavy drinking; Reich et al., in preparation). Moreover, differences or deficits in theoretical bases for research with implicit tasks have resulted in a disjointed theoretical discussion throughout the expectancy literature. Thus, although interest in the predictive power of implicit measures of alcohol expectancies has been great, the field has yet to refine implicit measures into useful diagnostic tools.

Implicit measures of semantic association in alcohol research

Priming

Several researchers have used priming procedures to assess memory of alcohol concepts. One study examined the effects of two primes on later consumption of a beer placebo by female participants. One prime consisted of sitcom scenes that took place in either a bar or an inn. The second prime was a Stroop task in which either expectancy or neutral words were embedded (Roehrich & Goldman, 1995). It was found that exposure to both types of alcohol-related cues (the bar sitcom scene and the alcohol expectancy Stroop) resulted in greater consumption of the placebo than exposure to neutral cues did. In another study of priming effects on consumption (Carter, McNair, Corbin, & Black, 1998), participants cued with negative expectancy words consumed less non-alcoholic beer in a taste-test than participants in a neutral prime condition, while participants primed with positive expectancy words drank more. Another study (Stein, Goldman, & Del Boca, 2000) compared a verbal priming approach using expectancy or neutral words to mood induction using positive or neutral music. In the positive expectancy word prime condition, participants drank significantly more than in the neutral word condition, and within the positive word condition heavier drinkers drank significantly more than lighter drinkers. In a priming study that did not include an ad lib drinking session (Reich, Noll, & Goldman, 2005), participants were presented with one of two word lists containing food and alcohol expectancy words. The lists were identical except for the first word, which was either "milk" or "beer." It was found that the "beer" prime resulted in a greater proportion of recall of expectancy words than grocery words. In addition, there was an expectancy word type/drinker type interaction, with heavier drinkers recalling more positive expectancy words than lighter drinkers. Although free recall of wordlists is widely understood to be an explicit task, this design examined implicit effects of memory, which in this study were type of word recalled within each experimental condition ("milk" versus "beer" prime) and type of expectancy word recalled.

Stroop

In a Stroop task, interference of alcohol-related memory primes with participants' ability to report the ink color of expectancy target words was examined (Kramer & Goldman, 2003). Participants were presented with one of eight priming words in black, four of which were neutral beverages, and four of which were alcoholic beverages. There were four categories of target words which were presented in either blue, green, or red: arousing expectancy words, sedating expectancy words, negative expectancy words, and neutral words. Each priming word was presented four times, once preceding a target word from each of the categories. Participants were asked to name the color of each target words, and their reaction time was measured. Lighter drinkers were found to experience more memory interference with their recall of sedating expectancy words following an alcohol prime, while heavier drinkers experienced more interference with arousing expectancy word recall following alcohol beverage primes. These results indicate a strong association in memory between the alcohol primes and sedating expectancy words for light drinkers relative to heavy drinkers, and a stronger association in memory between alcohol and arousing expectancies for heavier drinkers relative to light drinkers.

False Memory

Implicit tasks have also been used to assess recall of alcohol-related expectancy words. The false memory paradigm (Deese, 1959; Roediger & McDermott, 1995) has also been used to examine activation of alcohol-related words (Reich et al., 2004). Heavy drinking participants in a bar context falsely remembered having studied positive alcohol expectancy words after studying an expectancy word list in a bar setting than light or moderate drinkers. Additionally, this effect was enhanced when participants were in a bar setting as opposed to a neutral setting.

Automatic activation of alcohol-related words has also been examined using Free Associates (Reich & Goldman, 2005). It was found that the probability of using positive expectancy words (e.g. "happy") in response to the statement "alcohol makes me _________" increased across participants with higher reported quantity of alcohol consumed. The reverse pattern was found for negative expectancy words (e.g. "sick"), where probability of use increased as drinking level decreased.

Implicit Association Task

The Implicit Association Task (IAT; Greenwald, McGhee, & Schwartz, 1998) has been used as an implicit measure of alcohol expectancies. The IAT asks participants to categorize stimuli, often based on valence, from two target groups (such as "white faces" and "black faces") presented either together or individually and intermixed with stimuli from one of two attribute groups (such as "white names" and "black names". Task performance, as measured by reaction time, has been said to reflect implicit connections in participants' memory structures between a specific target group and a specific attribute group. The IAT effect is indicated by an overall difference in reaction time to categorize the two different target categories across condition blocks, and is considered to signify preference for a certain category over the other.

Weirs and colleagues (Weirs, van Woerden, et al., 2002) created two alcohol expectancy-based versions of the IAT, one to examine valence and one for the examination of arousal. The target stimuli for both where the same, with categories consisting of either alcohol words or soda words. Attribute categories were comprised of either valence-related words (positive or negative) or arousal-related words (active or passive), respectively for the valence and arousal versions. Weirs et al. reported that on the arousal IAT, heavy drinkers showed a stronger association between arousal and alcohol than light drinkers. On the valence IAT, it was found that both heavy and light drinkers held negative associations with alcohol. It was also reported that the results of the IATs added unique prediction to drinking at one month follow-up.

Jajodia and Earleywine (2003) also administered two IAT versions. Because it has been argued that positivity and negativity may not be true opposites, and because the predictive power of negative expectancies seems quite complex, this study sought to measure positive and negative expectancies separately. The positive expectancy IAT included 12 alcohol and 12 mammal words as target categories, and 12 positive and 12 neutral adjectives as attribute categories. The negative expectancy IAT substituted negative adjectives for the positive ones used in the first IAT. Findings were that the positive IAT had a positive relationship to drinking, while the relationship between performance on the negative IAT and drinking was nonsignificant.

A third experiment also used two different versions of the IAT. The attitude IAT consisted of alcohol and soft drink target categories, and liked and disliked food attribute categories (DeHouwer, Crombez, Koster, & De Beul, 2004). For the arousal IAT, target categories remained the same while the attribute categories were active and passive, as in Weirs, van Woerden, et al. (2002). Findings reflected those of Weirs et al., with evidence for more negative connotations with alcohol than soft drinks across drinker type, and stronger arousal connotations with alcohol for heavy drinkers than for light drinkers.

Palfai and Ostafin (2003) used electricity and alcohol-related words as stimuli for their target categories, and what they termed “behavior categories” of approach and avoidance-related words as attribute categories. With a sample of hazardous drinkers, strong approach-alcohol associations were found to relate to episodes of heavy drinking,

drinking quantity, drinking anticipation urges, and difficulty of consumption control, but not drinking frequency, drinking thoughts, or baseline urge to drink.

Most recently, McCarthy and Thompsen (2006) administered positive and negative IATs modeled after Jajodia & Earleywine's versions. They found positive relationships between the IAT and an explicit measure, the Alcohol Expectancy Questionnaire, as well as with drinking. Additionally, good test-retest reliability was established for this version of the IAT over a one-month period.

Comparison across these results demonstrates that the IAT has thus far not been a reliable tool for the establishment and replication of meaningful exploration of implicit expectancies. First, few of these tasks used the same stimuli. While the alcohol target category was consistent across studies, its comparison target category varied, including soft drinks, food, electricity, and mammals. These pairings of IAT target categories may present different types of choices to individuals. For example, the choice between soft drinks and alcohol is one that individuals may make in daily life (Weirs, van Woerden, et al., 2002), and thus regularly assign valence or arousal-related meaning to each of those beverage categories. One may not be used to making choices between mammals and electricity-related concepts. Even though those categories may have valence or arousal-related meaning to individuals, these meanings (and the reaction times that may differentially reflect those meanings) may not be comparable to the meanings held in memory for alcohol. Palfai and Ostafin (2003) hold that the selection of a target category such as electricity, for which light and heavy drinkers are likely to have similar associations, is preferable to the selection of a category that acts as an alternative to alcohol such as soft drinks. Because "alcohol" has no clear opposite, they argue, individual differences in contrast category associations may obscure measured associations to the alcohol category.

Different attribute categories have also been chosen for alcohol IATs. Valence, indicating negative or positive associations, and arousal, indicating arousing or sedating associations, have been the most commonly used. However, findings between IATs using similar attribute categories have led to differing conclusions. Using positive and negative attribute categories, Weirs, van Woerden, et al. (2002) found heavy and light drinkers alike to hold negative associations with alcohol as compared to soft drinks, as did DeHouwer et al. (2003). Jajoda & Earleywine's (2003) positive IAT showed a significant association with heavier drinking, but no significant relationship between the negative IAT and drinking. In contrast, McCarthy & Thompsen (2006) found significant relationships between both positive and negative IATs and drinking.

Motivation as assessed by the IAT has also been evaluated inconsistently, with either active and passive or approach and avoidance attribute categories.[1] While heavy drinkers show a stronger association between arousal and alcohol than lighter drinkers (Weirs, Stacy, et al., 2002; DeHouwer et al, 2003), approach-alcohol associations were

[1] It should also be noted that these categories and the stimuli therein are different from those that have been identified as underlying arousing or sedating associations with alcohol (Rather & Goldman, 1994; Rather at al., 1996; Goldman & Darkes, 2004). While there are certainly no restrictions on the verbal stimuli used in alcohol expectancy research, we must take care to ensure that those we select carry the meaning for participants that we expect they do. Additionally, utilization of stimuli that have an established relationship to expectancy or drinker type will serve to increase consistency and agreement between studies.

found to positively relate to indicators of hazardous drinking. Though these results are consistent, we cannot conclude that these results have been replicated, as testing stimuli and procedures varied, as did sample characteristics, and the hypothesized processes underlying the results.

Thus, future research must be conducted to advance our understanding of implicit measures and the memory systems they reflect. For construct validity to be established, however, our experimental methods must undergo more rigorous testing (Smith, 2005). Indeed, there have been recent calls to establish the reliability of implicit measures and to determine whether discrepant findings between them reflect error, or whether such discrepancies indeed reflect different constructs or processes (Waters & Sayette, 2006). It is to this end that the present study strives.

The Current Study

Use of the many implicit measures documented in the extant literature may greatly enrich our understanding of alcohol expectancy operation, but the scientific significance of these measures has yet to be adequately established. The relationships between explicit measures are commonly examined, in order to establish the criterion and construct validity of newly emerging measures. For example, scale 3 of the Alcohol Expectancy Questionnaire (the social pleasure scale, which has been shown to be most predictive of drinking) has been shown to significantly correlate to corresponding subscales of the Alcohol Expectancy Multiaxial Questionnaire: .52 with the aroused subscale, .51 with the positive/aroused subscale, and .61 with the positive subscale

(Darkes, Greenbaum, & Goldman, 1996). Likewise, implicit measures are often compared to explicit measures. For example, examination of the relationship of Free Associates to AEQ subscales has revealed that the valence and arousal of generated FA words correlated significantly with AEQ subscales from .18 to .46, with most correlations falling above .30 (Reich, Brandon, Morean, & Goldman, 2005). It has been shown that explicit and implicit measures of expectancies differentially predict drinking (Stacy, 1997), indicating that low correlations between implicit and explicit measures (than between two explicit measures) may reflect some qualitative differences in memory. Some implicit researchers discuss this uniqueness as evidence for a monolithic implicit memory store, without examining whether implicit and explicit memory serve parallel or divergent functions or, more crucially, whether that which implicit tasks are purported to probe is actually homogenous. To understand how alcohol concepts are stored in memory, we need to understand how our measures represent memory. To do this, we must better understand how our implicit measures function over time (e.g. their reliability) and in relation to one another (e.g. their construct validity). Only once we understand how our measures function and whether they perform in accord with our theories about memory can we interpret them meaningfully. Thus, the goal of this study is to examine the concordance between two different implicit measures of expectancy. In addition, the within-session test-retest reliability of each of these measures will be tested.

Two implicit tasks were selected for this project: Free Associates (FA; Reich & Goldman, 2005) and a Primed recall (PR; Reich, Noll, & Goldman, 2005). The wordlist consists of 30 words, 15 of which are grocery-related words, and 15 of which are alcohol-related words. The first word of this list, "beer," is considered to be the prime. The type of alcohol-related words from this list recalled by participants has been shown to vary in accord with drinking level.

These two tasks were selected for three primary reasons. First, both have been shown to be effective in differentiating between drinker type, with heavier drinkers either reporting more expectancy-related first associates or remembering more expectancy-related words from a grocery list. In addition, both tasks have an established capacity to distinguish between drinker types by expectancy types, with heavier drinkers demonstrating more positive and arousing expectancies and lighter drinkers endorsing more negative and sedating expectancies. Second, both tasks can be scored in a way that lends them to direct comparison (see details below). Third, both tasks can be administered to groups of participants. Additionally, because both of these tasks were originally designed and tested in the context of alcohol expectancy research, method adherence can be maximized.

Because individuals are asked to complete straightforward self-referential statements (e.g. "alcohol makes me _______"), a free associate measure may at face seem explicit. Criteria that have been established to consider a measure implicit clearly place Free Associates into this category, however (DeHouwer, 2006): a) free associate tasks do not direct individuals to retrieve information regarding past events (Fazio & Olson, 2003; Roediger & Amir, 2005), b) individuals completing such tasks are unaware of the attitude or cognition of interest, which in the case of the present study is the valence and level of arousal associated with specific beliefs about alcohol, and c) researchers across many cognitive domains have overtly classified free associate measurement as implicit (Fazio & Olson, 2003; Roediger, 2003; DeHouwer, 2006; Nelson, 2000).

Because inadvertent priming may be a strong influence on recall of alcohol and alcohol-expectancy-related information, steps will be taken to mask the nature of this study. Additional questions about other common activities will be added to the Free Associates task to reduce potential priming effects. Participants will be informed that they are participating in research assessing the processing of written information. These masking design elements will enable us to thoroughly examine the differential relationships of real world behavior (i.e. drinking) and self-reported expectancies to each of these tasks. Thus, this experiment will advance our understanding of the meaning of these tasks: if each task shows strong relationships to drinking and self-report but a weak relation to the other, we can conclude that we have evidence for alcohol-related memory processes that are more complex than a binary implicit/explicit model. Conversely, if each task seems to mirror the results of the other as well as drinking and self-report measures, we can present these findings as evidence for a dual implicit/explicit storage system of alcohol-related memory.

Method

Participants

A total of 218 participants (46 male; 21.1%, 172 female; 78.9%) were recruited from ExperimenTrack, an electronic participant pool, at the University of South Florida. The mean age of participants was 20.65 (SD = 4.32; range = 18-45). Participants were randomly assigned to two different experimental groups in which the ordering of task administration was reversed (for FRF, n = 115, 26 (22.6%) male; for RFR, n = 103, 20 (19.4%) male). Course credit or extra credit for psychology courses was offered. Caucasians comprised 67.4% of the sample, African-Americans 15.1%, 1.8% were Asian, .9% Pacific Islander, and .5% Native American. 20.6% of the sample identified as being of Hispanic/Latino origin and having membership in another racial group (10.5%) or as being of Hispanic/Latino origin with no other racial identification (10.1%). 3.7% of the sample classified themselves as being of "other" racial or ethnic descent.

Means and standard deviations for drinking indices can be found in Table 1. Three individuals were eliminated from analyses because they reported drinking more than three standard deviations above the mean consumed by drinkers in a normal week (57.23 drinks per week). These responses indicated that these individuals did not fit within the parameters of a normal population of young social drinkers. An additional two were eliminated because they reported having reached excessive BACs (1.90 and 15.45).

These responses indicated that these two individuals either may not have been able to give accurate self report or did not respond to our questions truthfully. We felt that inclusion of these five cases would have compromised the integrity of our data and the normalcy of our sample. Thus for all reported analyses, n = 213.

Measures

Experimental Measures

Free Associates (FA; Reich & Goldman, 2005; Nelson, McEvoy, & Dennis, 2000)[2]. Participants were asked to free associate five words or phrases in response to each response stem, "Alcohol makes me_______". Consistent with Reich and Goldman (2005), they were instructed as follows:

> In the blank spaces provided below, please write down the words or short phrases you would use to complete the phrases "Alcohol makes me _______", "food makes me_______", "exercise makes me _______", "cooking makes me _______" and "shopping makes me_______". If you do not drink alcohol, exercise, cook, or shop, please indicate what you think would happen if you did. Please write your responses in order, starting with the top blank and working down toward the bottom or last (fifth) blank. Please write whatever

[2] Although this task is technically a sentence completion task, it is the most reliable method established to date for eliciting adjectives (alcohol expectancy words) in response to an alcohol cue. Because other words that have been used in pure alcohol free association tasks have such large associative sets, the base rate of expectancy-specific responses tend to be low (Stacy, 1997). Nonetheless, we refer to the present task as a free associates task

> first comes to mind. Do not think too long. Respond as quickly as you can, but please write legibly.

By nature, the FA task is a qualitative task, not a quantitative task. Thus, Free Associates were scored according to type of outcome they connoted. In keeping with the method used by Reich and Goldman (2005), they were be categorized based on how each corresponds to an empirically validated (Rather & Goldman, 1994; Darkes & Goldman, 2004) two-dimensional representation of expectancies. Specifically, this model reflects two distinct continua: positive-negative, and sedating-arousing. Where expectancy words fall in two-dimensional space in respect to both of these continua has been shown to represent eight independent expectancy types: negative, negative sedating, sedating, positive sedating, positive, positive arousing, and negative arousing. A large body of Free Associate responses have been normed previously according to the ratings of valence and arousal (Reich & Goldman, 2005). Previously uncategorized responses were given to two independent undergraduate or post-baccalaureate raters be categorized. Any responses on which the two raters disagreed were given to a panel of 3 raters, whose instructions were to reach consensus on valence and arousal ratings for each response.

Continuous Free Associates scores (ranging from .00 to 1.00) were calculated by examining the proportions of words produced. Thus, proportion of positive words produced comprises a positive score, and proportion of sedating words comprises a sedating score. Positive and sedating dimensions were chosen because they have been shown to most effectively differentiate drinker level (Reich, Noll, & Goldman, 2005).

Primed recall (PR; Reich, Noll, & Goldman, 2005). Reich et al. (2005) developed two word lists consisting of previously normed alcohol expectancy and grocery words. These lists were identical except for the first word, which was either "milk" or "beer." It was shown that the manipulation of the first word primed participants as to which type of word from the list to remember, so that those in the "milk" condition remembered more grocery words, and those in the "beer" condition remembered more alcohol expectancy words. Additionally, the number of alcohol expectancy words remembered by those in the "beer" condition covaried with expectancy level so that heavy drinking participants remembered more expectancy words in this condition. With this evidence for the ability of the "beer"-headed word list alone to distinguish drinker type, here we will exclude the "milk"-headed word list. Following the established method (Reich, Noll, & Goldman, 2005), participants were presented with 30-word lists, with 15 being grocery words and 15 being expectancy words. Also consistent with Reich et al. (2005), participants were instructed to remember as many words as possible prior to stimulus presentation, and words were presented individually on a screen in the front of the room at the rate of 3 seconds per stimulus 1-second inter-stimulus interval. Once the list was presented, participants were given 3 minutes to record all remembered words. There were six differently ordered lists presented to prevent order effects. As noted above, while this type of cued recall task is widely recognized as an explicit task in and of itself, the outcome of interest, namely incidental encoding of expectancy words, is an implicit variable. Thus, the PR measures of interest here will throughout be referred to as implicit measures, irrespective of how the task per se is classified.

In order to create a continuous score for the Primed recall task comparable to that created for the Free Associates task, the first five expectancy words recalled were examined. A continuous PR score for both positive and sedating dimensions was be created. Because the wordlist was originally designed using 15 expectancy words, 5 of which were sedating, 5 of which were positive, and 5 of which were overlapping (neutral), this scoring method utilized the full range of alcohol-expectancy words embedded in the PR task (Reich, Noll, & Goldman, 2005).

Additional scoring methods were utilized in order to replicate findings relating to this task as closely as possible. A proportion of total expectancy words recalled to total list words recalled was calculated, and raw number of type of expectancy words (positive, sedating) was calculated. These scores were correlated with explicit measures and drinking indices in order to establish expected parameters of the task and to duly replicate it.

Additional assessments

Alcohol Expectancy Questionnaire (AEQ; Brown, Christiansen, & Goldman, 1987). The AEQ asks participants to either agree or disagree with a series of statements about the effects of alcohol. The subscales of the 68-item AEQ have coefficient alphas ranging from .72 to .92. It has been shown to account for 57% of variance in concurrent drinking, and 50% of variance in drinking over one year (Goldman & Darkes, 2004).

Alcohol Expectancy Multiaxial Assessment (AEMax; Goldman & Darkes, 2004). The 24-item AEMax assesses the strength of explicit alcohol-related expectancies along a continuum of valence (positive-negative) as well as along a continuum of arousal (aroused-sedated), thus allowing for the mapping of expectancies in three-dimensional space (Rather, at al., 1992). Participants will be asked to rate the phrase "alcohol makes one_______" for twenty-four items on a 7 point Likert scale ranging from 0=never to 6=always. Additional items beginning "cigarettes make one _______" and "exercise makes one_______" will be added to mask the nature of the questionnaire.

Daily Drinking Questionnaire (*DDQ*: Collins, Parks, & Marlatt, 1985). Participants were asked to indicate how many drinks they typically consumed each day of the week (Monday through Sunday) for the previous 3 months, and over what period of time these drinks were typically consumed. From this information, frequency of drinking (0-7) was calculated, as was typical quantity consumed (total weekly quantity/frequency). In addition, participants were asked to report the number of drinks they drank on their heaviest drinking day within the past 30 days, and the period of time over which consumption took place. The DDQ also asked participants for their weight so that average BAC and 30-day peak BAC could be calculated (gender information was collected on the demographics questionnaire).

Demographics. The demographics questionnaire assessed age, gender, racial/ethnic background. Religious affiliation and religious activity for the preceding 6 months were also assessed.

Procedure

All subjects were administered two implicit tasks in a group classroom setting at one time point. Participants were randomly assigned to one of two conditions: FA-PR-FA or PR-FA-PR. Subjects in the FA-PR-FA condition were administered the Free Associates task followed by the Primed recall task, and were again asked to complete the Free Associates task before administration of questionnaires. Likewise, participants in the PR-FA-PR condition received the Primed recall first and third, and the Free Associates task second.

This design offers several advantages for dealing with potential sources of error in this study. First, it allows the convergent and discriminant validities of the two tasks to be assessed within subjects, while controlling for order effects. Second, it allows the within-session test-retest reliability of each task to be assessed. Third, this design is constructed to minimize contamination between tasks. Distractor tasks were administered between experimental measures, and careful selection of stimuli for the experimental measures were intended to mask the nature of the study and to deemphasize the measures of interest, decreasing their salience and likelihood of carry-over effects between tasks. Distractor tasks consisted of a series of multiplication problems, and counting nouns within written paragraphs describing the construction of an outdoor gazebo and the function of computer programming syntax. The function of these paragraphs was to occupy participant attention in a verbal task to minimize within-session memory of preceding experimental tasks, and to reduce the salience of experimental questions.

To further mask the nature of this study, the alcohol Free Associates task was embedded among four other Free Associates tasks (cooking makes me _______, exercise makes me _______, food makes me_______, and shopping makes me_______), which served to draw focus away from the alcohol-related task, and which all related in some way to the Primed recall wordlist, eliminating singular priming by the alcohol-related words across tasks.

Upon completion of the final implicit task, subjects will be asked to complete all additional explicit measures. The expectancy questionnaires were be administered in counter-balanced order, and demographics and the DDQ were administered last.

Results

Coding/Scoring

Because responses on the two implicit tasks used in this study consisted of verbal responses that were qualitative in nature, responses on the FA and PR tasks were first coded and composite scores were created. For the FA task, all responses were scored for valence (positive, negative, or neutral) and arousal (arousing, sedating, or neutral in accord with the Alcohol Expectancy Free Associates norms established by Reich and Goldman (2005). Responses that were not originally part of the norm set were coded according to the same scheme separately by two independent judges (undergraduate and post-baccalaureate research assistants). Any associate for which judges disagreed on valence or arousal was submitted to a panel of three additional judges. The panel was instructed to reach consensus for each score. For each participant, positive, arousing, positive arousing, negative, and sedating composites were calculated. For the positive composite, the total number of positive responses generated per task administration was summed and divided by the total number of FA responses calculated, resulting in a proportion of positive responses for that administration. The same procedure was followed for responses from the other categories. For participants that completed the FA task twice, composites were calculated for both time points.

For the PR task, a similar scoring method was employed. The proportion of expectancy words to total number of words recalled was calculated. Positive, arousing, positive arousing, negative, and sedating proportions were calculated by summing the number of each type of word recalled and dividing this number by the total number of words recalled. By adding recall for all words as the denominator of these proportions, for memory for specific types of expectancy words could be examined while controlling for overall memory performance.

Thus, five scales ranging from 0 to 1.0 were calculated for each task. These represent each end of valence and arousal continua and a positive arousing composite. A sixth scale representing the proportion of expectancy words recalled was calculated for the PR task.

Sample Characteristics

Before performance on the FA and PR tasks could be explored, group differences and sample characteristics were examined. This process was necessary to ensure that the conditions did not differ on any demographic or experimental characteristics. Additionally, we wanted to determine whether basic sample parameters had been established. These included distributions of drinking and relationships between explicit expectancy and drinking indices similar to those typically reported for college students. The confirmation of these parameters was necessary to support the validity of additional analyses.

Results yielded significant relationships between drinking indices (see Table 1) and between drinking and the AEQ (see Table 2) and the AEMax (see Table 3). Additionally, the distribution of drinking levels among participants in this sample was as

Table 1. *Correlations Between Drinking Indices*

	QUAN	FREQ	DPW	TBAC	MBAC
Drinking					
Quantity					
ALL	**1.0**				
Women	1.0				
Men	1.0				
Frequency					
ALL	**.540****	**1.0**			
Women	.609**	1.0			
Men	.395**	1.0			
Drinks per week					
ALL	**.883****	**.729****	**1.0**		
Women	.874**	.778**	1.0		
Men	.904**	.622**	1.0		
T-BAC					
ALL	**.869****	**.402****	**.726****	**1.0**	
Women	.897**	.483**	.755**	1.0	
Men	.935**	.280	.846**	1.0	
Max-BAC					
ALL	**.704****	**.480****	**.684****	**.775****	**1.0**
Women	.712**	.558**	.705**	.780**	1.0
Men	.718**	.342*	.738**	.756**	1.0

*p < .05; ** p < .01;
QUAN = typical quantity of standard alcoholic drinks consumed per occasion; FREQ = frequency of drinking (per week); DPW = drinks consumed per week; TBAC = BAC reached during typical drinking occasion; MBAC = past 3 month maximum BAC reached

Table 2. *Correlations Between Drinking Indices and AEQ Subscales*

	QUAN	FREQ	DPW	TBAC	MBAC
AEQ					
Global positive					
ALL	**.442****	**.381****	**.434****	**.342****	**.336****
Women	.376**	.363**	.354**	.290**	.296**
Men	.598**	.420**	.614**	.588**	.487**
Sexual enhancement					
ALL	**.388****	**.310****	**.364****	**.295****	**.328****
Women	.333**	.298**	.303**	.254**	.283**
Men	.522**	.316*	.492**	.517**	.513**
Social/Physical Pleasure					
ALL	**.480****	**.540****	**.431****	**.385****	**.388****
Women	.548**	.557**	.481**	.439**	.464**
Men	.301*	.482**	.290	.233	.136
Social Assertion					
ALL	**.459****	**.465****	**.413****	**.340****	**.361****
Women	.456**	.439**	.383**	.330**	.364**
Men	.488**	.569**	.524**	.417**	.362*
Tension Reduction					
ALL	**.447****	**.457****	**.456****	**.369****	**.406****
Women	.454**	.493**	.449**	.362**	.403**
Men	.453**	.367**	.515**	.458**	.442**
Aggression/Arousal					
ALL	**.384****	**.328****	**.360****	**.332****	**.307****
Women	.359**	.281**	.300**	.309**	.293**
Men	.449**	.439**	.502**	.472**	.377**

*p < .05; ** p < .01
QUAN = typical quantity of standard alcoholic drinks consumed per occasion; FREQ = frequency of drinking (per week); DPW = drinks consumed per week; TBAC = BAC reached during typical drinking occasion; MBAC = past 3 month maximum BAC reached

Table 3. *Correlations Between Drinking Indices and AEMax Subscales*

	QUAN	FREQ	DPW	TBAC	MBAC
AEMax					
Sedating					
ALL	**-.298****	**-.199****	**-.281****	**-.202****	**-.215****
Women	-.246**	-.200**	-.238**	-.190*	-.185*
Men	-.391**	-.135	-.322*	-.352*	-.356*
Negative					
ALL	**-.242****	**-.211****	**-.208****	**-.179***	**-.246****
Women	-.281**	-.281**	-.265**	-.206**	-.280**
Men	-.138	.007	-.051	-.085	-.121
Positive/Arousing					
ALL	**.337****	**.393****	**.344****	**.295****	**.258****
Women	.372**	.396**	.384**	.333**	.345**
Men	.249	.369*	.240	.218	-.011
Horny					
ALL	**.049**	**.120**	**.080**	**.074**	**.022**
Women	.094	.125	.137	.116	.095
Men	-.093	.077	-.100	-.066	-.244
Egotistical					
ALL	**-.208****	**-.077**	**-.145***	**-.189****	**-.190****
Women	-.183*	-.126	-.141	-.153	-.178*
Men	-.315*	-.001	-.220	-.312*	-.218
Sick					
ALL	**-.315****	**-.209****	**-.269****	**-.253****	**-.250****
Women	-.308*	-.237**	-.262**	-.277**	-.259**
Men	-.319*	-.086	-.242	-.280	-.276
Woozy					
ALL	**-.231****	**-.171***	**-.224****	**-.121**	**-.103**
Women	-.171*	-.137	-.166*	-.105	-.059
Men	-.353*	-.170	-.293	-.300*	-.305*
Social					
ALL	**.344****	**.376****	**.333****	**.309****	**.304****
Women	.355*	.355**	.337**	.329**	.372**
Men	.335*	.485**	.374*	.230	.085
Attractive					
ALL	**.378****	**.403****	**.373****	**.297****	**.268****
Women	.392**	.412**	.392**	.315**	.325**
Men	.348*	.328*	.292	.357*	.116
Sleepy					
ALL	**-.187****	**-.109**	**-.206**	**-.116**	**-.173***
Women	-.097	-.098	-.135	-.055	-.112
Men	-.378*	-.114	-.340*	-.364*	-.378*
Dangerous					
ALL	**-.221****	**-.277****	**-.218***	**-.134**	**-.242****
Women	-.308**	-.354**	-.316**	-.211**	-.311**
Men	.046	.011	.106	.131	-.011

*p < .05; ** p < .01
QUAN = typical quantity of standard alcoholic drinks consumed per occasion; FREQ = frequency of drinking (per week); DPW = drinks consumed per week; TBAC = BAC reached during typical drinking occasion; MBAC = past 3 month maximum BAC reached

expected, and similar to that found for other college samples (see Figure 1; (Del Boca, Darkes, Greenbaum, & Goldman, 2004).

Next, analyses were conducted to ensure that there were no differences between conditions on key demographic or experimental variables. T-tests were used to examine possible differences between the FRF and RFR conditions. There were no differences in demographic variables, drinking, or responses on explicit expectancy measures between the two conditions.

T-tests were also used to look for possible differences on implicit task performance. Because each condition received one of the two tasks twice and the other only once, between-condition comparisons could only be made on the first administration of a task. In other words, performance comparisons for the PR were between the first implicit task administration (the first of two PR task administrations) for the RFR condition, and the second implicit task administration for the FRF condition (the only time this condition completed the PR task), since this group completed the FA task before they were presented with the PR task for the first time. The reverse was true for FA task comparisons (see figure 2).

No significant differences were found between the groups on FA task performance. However, differences between the groups on wordlist recall task performance were found. The RFR group recalled significantly more positive expectancy words from the PR wordlist (M = 4.70; SD = 4.50) than the FRF group (M = 4.51; SD = 1.91), and the RFR group recalled significantly more expectancy words overall at the

Figure 1. *Number of Drinks per Week*

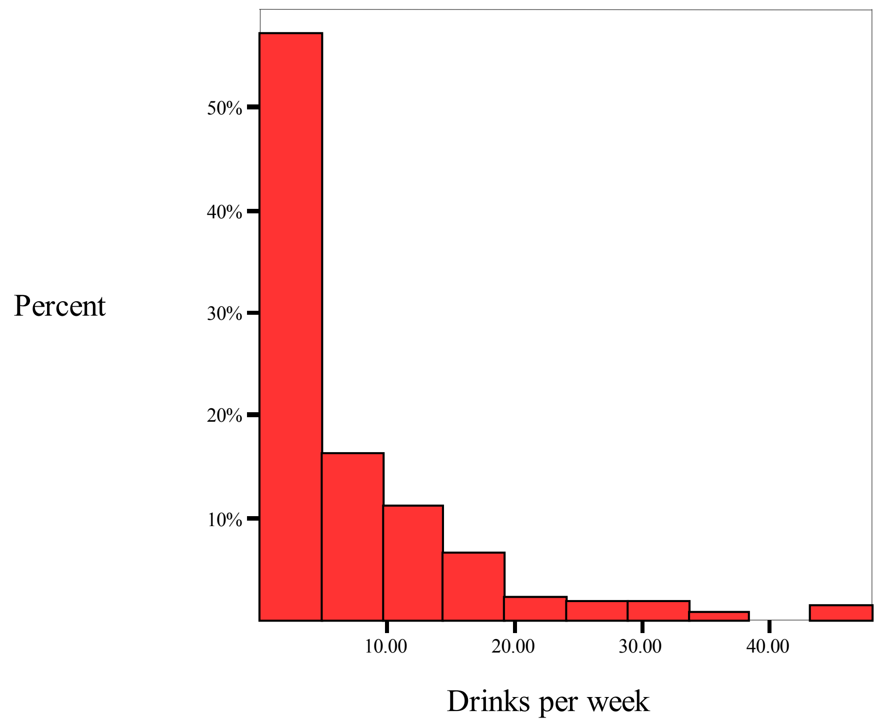
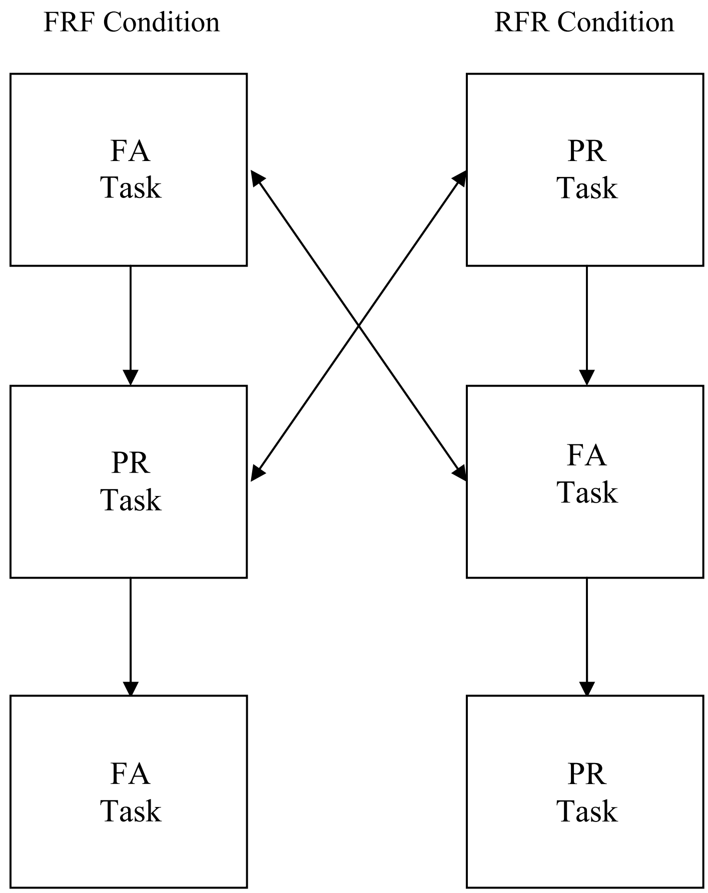


Figure 2. *Diagram of Between-Condition Comparisons*



Note: Unidirectional arrows indicated order of task administration; bidirectional arrows represent between-condition comparisons.

same time point (for RFR: M = 6.06; SD = 1.81, for FRF: M = 5.50; SD = 2.30). These differences appeared to be a result of the fact that the RFR group recalled significantly more words from the PR wordlist overall (M = 14.25; SD = 2.86) than the FRF group (M = 12.70; SD = 4.37). Indeed, when overall list recall was taken into account, these differences in recall of positive words and expectancy words disappeared. Thus, when memory performance was controlled for, type of word recalled did not vary significantly by group. Still, the significant difference in memory performance between the groups was unexpected. A likely explanation is that those in the FRF condition that had already completed the FA task and one round of distractor tasks were fatigued, and consequently recalled fewer words overall. It is also possible that participants in this condition experienced proactive interference on the PR task after having generated their own set of words for the FA task. Overall memory performance was controlled in all additional analyses as described above.

Thus, we found that overall, the present sample resembled other college samples used in alcohol research, and no significant differences between conditions were found.

Gender Analyses

Because this sample was comprised of disproportionate numbers of men and women, results could possibly have been influenced by this imbalance. Independent samples t-tests were conducted to explore gender differences on key variables, and correlations between implicit tasks, explicit tasks, and drinking were examined.

No significant differences on drinking indices were found, although differences on frequency of drinking approached significance (see Table 4 for drinking descriptives by gender; see figures 3 and 4 for distribution of drinks per week by gender). Equivalent percentages of men and women in this sample had not consumed alcohol in the three months preceding participation in this study (64.3% for women, 67.4% for men), had consumed alcohol in the previous three months but did not report drinking during a typical week (9.9% for women, 8.7% for men), and reported drinking during a typical week (25.7% for women, 23.9% for men).

Next, responses on the AEQ and AEMax were examined. No significant differences were found on any AEQ subscales. Differences on several AEMax subscales were noted. Women had significantly higher scores on the Woozy, Dangerous, and Sedating factors, and lower scores on the Attractive factor. Since no analysis of gender differences on specific factors scores of the AEMax has been reported, it is unknown whether the differences found reflect idiosyncrasies of our sample or parameters expected from equivalent groups.

Nonetheless, differential responding on the AEMax by gender does not appear to be tied to differential responding on our experimental tasks. No significant differences were found on Free Associate performance. One significant difference was found on PR task performance: women recalled more words from the word list. As described above, this overall memory difference was controlled for and thus did not affect any additional measures and analyses.

Table 4. *Drinking Descriptives by Gender*

	Women M (SD)	**Men M (SD)**	**All M (SD)**
Frequency	1.48 (1.47)	2.14(2.03)	1.62(1.62)
Drinkers only[¥]	2.00 (1.38)	2.91(1.86)	2.19(1.53)
Quantity	2.38 (2.66)	2.76 (3.68)	2.46 (2.90)
Drinkers only	3.16 (2.52)	3.85 (3.87)	3.30 (2.85)
Drinks/Week	5.89 (8.01)	8.92 (11.87)	6.52 (9.00)
Drinkers only	7.78 (8.04)	12.24 (12.41)	8.71 (9.26)
T-BAC	.042 (.06)	.028 (.05)	.039 (.06)
Drinkers only	.058 (.063)	.039 (.06)	.054 (.06)
Max BAC	.112 (.14)	.094 (.13)	.108 (1.35)
Drinkers only	.152 (1.37)	.129 (.14)	.147 (.14)
	N (%)	**N (%)**	**N (%)**
Abstinent in a typical week	61 (36.3%)	15 (34.1%)	76 (35.8%)
Do not binge in a typical week	53 (31.5%)	16 (36.4%)	69 (32.5%)
Binge in a typical week	54 (32.1%)	13 (29.5%)	67 (31.6%)

[¥] "Drinkers" defined as individuals that reported any drinking within the 3 months prior to participation.

Figure 3. *Number of Drinks per Week: Men*

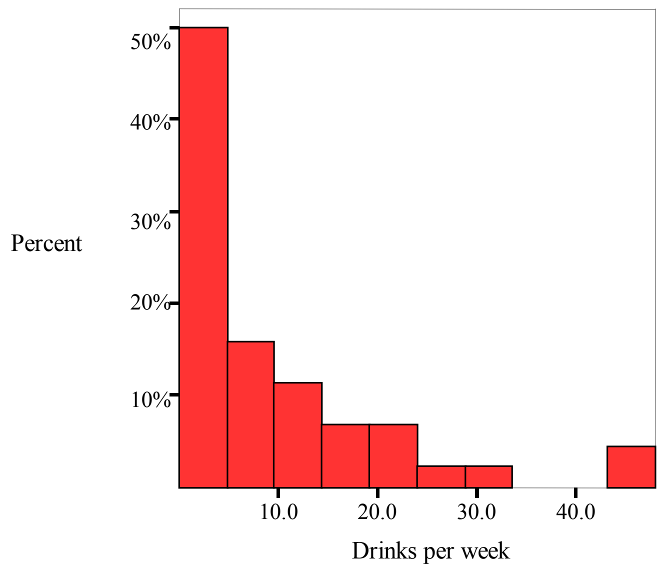
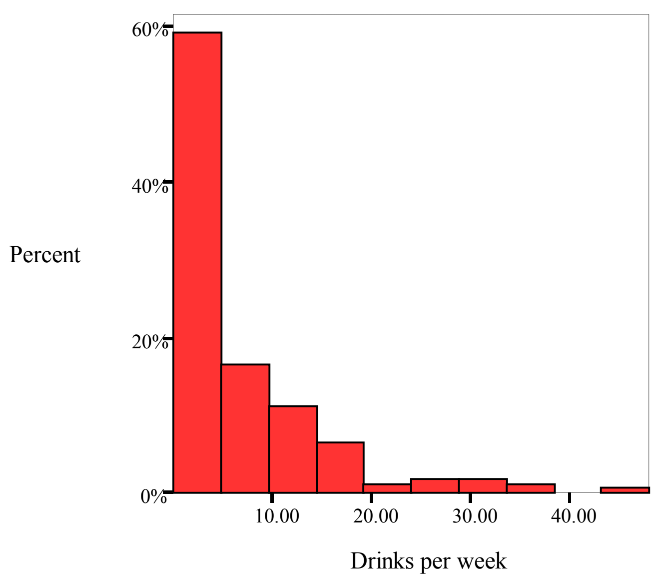


Figure 4. *Number of Drinks per Week: Women*



Thus it is possible that the disproportionate representation of each gender had little effect on the present results. Differences between the alcohol consumption of men and women in this sample were negligible, and performances on the experimental tasks were comparable. Although there were significant differences on explicit measures, these differences likely had little effect on our experimental questions. Correlations between drinking indices and between drinking and the AEQ and AEMax for both genders can be found in Tables 1-3, respectively.

Implicit Task Replication and Comparison

Before the relationship between the PR and FA tasks could be examined, we first needed to determine whether previous tests of these measures had been replicated. This determination was carried out by examining the relationships between both of these tasks, participant-reported drinking behavior, and responding on explicit tasks. Since each experimental condition completed one of the tasks after completing the other, it was important for us only to examine each task only within the condition in which it was presented first. Using this approach, performance on each task could be assessed in the absence of influence (contamination) of the other task. Thus we examined only the first administration of the Free Associates task within the FRF condition, and the first administration of the PR task only using individuals from the RFR condition.

Results showed strong relationships in the expected directions between composite scores on the FA task and drinking and explicit measures (positive relationships with drinking for positive or arousing scales and negative relationships with drinking for negative or sedating scales; see Table 5 for details on relationships with drinking variables; AEMax and AEQ see Table 6). Consistent with past findings (e.g. Reich et al., 2004; Reich et al., 2005b), the positive and positive arousing FA composites showed the most robust relationships with drinking indices. Correlations between the FA composites and the AEQ and AEMax reflected a similar pattern. These results demonstrate replication of the FA task. Next, relationships between performance on the PR task and drinking indices were examined (within the RFR condition). All relationships between the PR composites and drinking indices were nonsignificant (see Table 7). Correlations between the PR and AEMax and AEQ (Table 8) were also calculated. Two significant relationships were found. The Aggression/Arousal subscale of the AEQ correlated with the proportion of expectancy words recalled to all words recalled ($r = -.210$; $p < .05$) and with the proportion of positive expectancy words recalled ($r = -.238$, $p < .05$). No relationships were found between any of the PR composites and any of the subscales on the AEMax. The absence of any significant relationships between the PR task and drinking and the AEMax and its limited relationship with the AEQ indicated a failure to replicate the PR task. Performance on the PR task was explored further using analyses of variance and t-tests. ANOVAs using Bonferroni corrections compared drinker classes (abstainers, drinkers, and weekly bingers) on the probability of recalling specific words from the PR list. No significant differences were found. When the same analysis was done using a median split on drinks per week to create abstainer ($M = 0$; $SD = 0$), lighter drinker ($M = 2.62$; $SD = 2.10$), and heavier drinker classes ($M = 16.30$; $SD = 9.46$), a

Table 5. *Correlations Between Free Associate Composites and Drinking Indices*†

	FAPOS	FAA	FAPA	FAS	FAN
Free Associates					
Positive	1.0				
Arousing	.485**	1.0			
Positive/ Arousing	.632**	.828**	1.0		
Sedating	-.552**	-.519**	-.459**	1.0	
Negative	-.615**	-.321**	-.388**	.091	1.0
Drinking					
Quantity	.291**	.272**	.262**	-.228*	-.254**
Frequency	.373**	.296**	.301**	-.261**	-.307**
Drinks/Week	.283**	.206*	.219*	-.181	-.247**
T-BAC	.157	.207*	.230*	-.139	-.179
Max-BAC	.223*	.211*	.257**	-.178	-.151

‡ RFR condition only
* p < .05; ** p < .01
PRP = proportion of positive words recalled; FAPA = proportion of positive arousing words recalled; FAS = proportion of sedating words recalled; QUAN = typical quantity; FREQ = frequency of drinking (per week); DPW = drinks consumed per week; TBAC = typical BAC; MBAC = past 3 month maximum BAC reached

Table 6. Correlations Between Free Associate Composites and AEQ and AEMax Factors[†]

	FAPOS	FAA	FAPA	FAN	FAS
AEQ					
Global					
Positive	.439**	.249**	.319**	-.339**	-.236*
Sexual					
Enhancement	.424**	.260**	.316**	-.240*	-.230*
Social/Physical					
Pleasure	.484**	.318**	.348**	-.454**	-.268**
Social Assertion	.403**	.232*	.261**	-.418**	-.238*
Tension Reduction	.463**	.226*	.275**	-.399**	-.221*
Aggression/					
Arousal	293**	.200*	.157	-.275**	-.107
AEMax					
Sedating	-.268**	-.160	-.205*	.149	.115
Negative	-.128	-.074	-.071	.184	-.001
Positive Arousing	.365**	.374**	.320**	-.373**	-.240*
Horny	.217*	.248**	.212*	-.247**	-.130
Egotistical	-.035	-.085	-.044	.108	-.034
Sick	-.250**	-.080	-.136	.251**	.106
Woozy	-.224*	-.236*	-.219*	.126	.118
Social	.260**	.285**	.207*	-.243**	-.198*
Attractive	.365**	.332**	.319**	-.370**	-.230*
Sleepy	-.166	-.079	-.151	-.061	.049
Dangerous	-.175	-.049	-.077	.204*	.026

† FRF condition only;
*p < .05; ** p < .01
FAP = proportion of positive free associates produced to all; FAPA = proportion of positive arousing free associates to all; FAS = proportion of sedating free associates produced to all;

Table 7. *Correlations Between Primed Recall Composites and Drinking Indices*‡

	EXP	PRP	PRPA	PRA	PRS	PRN
Primed recall						
EXP	1.0					
PRP	.792**	1.0				
PRPA	.392**	.584**	1.0			
PRA	.489**	.610**	.856**	1.0		
PRS	.474**	.045	-.104	-.027	1.0	
PRN	.219*	.022	-.031	-.053	-.084	1.0
Drinking						
QUAN	-.137	-.115	.011	.045	-.017	-.002
FREQ	-.150	-.166	.004	.016	.059	.108
DPW	-.143	-.124	-.038	-.023	.014	.055
TBAC	-.119	-.105	-.041	.004	.003	-.028
MBAC	-.128	-.149	-.058	-.020	-.020	-.021

‡ RFR condition only
* p < .05; ** p < .01
EXP = proportion of expectancy words recalled; PRP = proportion of positive words recalled; PRPA = proportion of positive arousing words recalled; PRA = proportion of arousing words recalled; PRS = proportion of sedating words recalled; PRN = proportion of negative words recalled; QUAN = typical quantity; FREQ = frequency of drinking (per week); DPW = drinks consumed per week; TBAC = typical BAC; MBAC = past 3 month maximum BAC reached

Table 8. *Correlations Between Primed Recall Composites and AEQ and AEMax Subscales*†

	EXP	PRP	PRA	PRPA	PRS	PRN
AEQ						
Global Positive	-.203	-.136	-.010	-.033	-.103	.051
Sexual Enhancement	-.156	-.090	-.011	-.048	-.062	-.004
Social/Physical Pleasure	-.185	-.157	-.022	.019	-.121	.122
Social Assertion	-.168	-.187	-.025	-.048	.006	.006
Tension Reduction	-.128	-.143	-.014	.045	-.036	.050
Aggression/ Arousal	-.210*	-.238*	-.182	-.141	.028	.046
AEMax						
Sedating	.135	.071	.052	.003	.019	.044
Negative	.092	.056	-.091	-.063	.021	.051
Positive Arousing	-.133	-.071	-.006	-.059	-.062	.017
Horny	.064	.095	-.008	-.009	-.026	.066
Egotistical	.008	-.051	-.120	-.099	-.044	.065
Sick	.070	.039	-.075	-.052	-.034	.026
Woozy	.119	.055	-.083	-.021	.048	.037
Social	-.135	-.146	-.054	-.126	.025	.015
Attractive	-.213*	-.107	.037	-.010	-.122	-.033
Sleepy	.166	.091	.029	.087	.043	.052
Dangerous	.146	.135	-.050	-.022	-.003	.030

† FRF condition only
* p < .05; ** p < .01

FAP = proportion of positive free associates produced to all; FAPA = proportion of positive arousing free associates to all; FAS = proportion of sedating free associates produced to all; QUAN = typical quantity; FREQ = frequency of drinking (per week); DPW = drinks consumed per week; TBAC = typical BAC; MBAC = past 3 month maximum BAC reached

significant difference was found on the likelihood of recalling the word “sociable”, whereby heavier drinkers were significantly less likely to recall it (likelihood of recall = .43) than abstainers (likelihood of recall = .65; $p = .042$). This pattern was opposite of what would have been predicted from alcohol expectancy theory, that heavier drinkers would be *more* likely to generate such a response.

In a similar vein, t-tests were also used to examine differences on drinking variables between those that recalled each individual expectancy word and those that did not. No differences were found in frequency of consumption based on recall of any PR list words. A difference was found between those that recalled the word “slow” and those that did not: those that recalled the word drank significantly fewer drinks per week ($M = 4.85$; $SD = 5.84$ for those that recalled, $M = 7.18$; $SD = 9.86$ for those that did not; $p < .05$). Additionally, those that did not recall the word beer ($n = 5$) had a significantly lower t-BAC ($M = .009$; $SD = .01$) than those that did recall the word ($n = 200$, $M = .04$; $SD = .06$, $p < .01$). No other differences were found.

In sum, the FA task was strongly related both to drinking and to explicit measures, but the PR task was not. Additional post hoc analyses attempting to elucidate performance patterns on the PR task returned conflicting results, bringing us no closer to an explanation of the relationship between this task and any other sample parameter. Therefore, any comparison between performance on this task and performance on the FA task is uninterpretable. If we cannot demonstrate that the PR task is significantly related to explicit expectancy measures or to drinking, we cannot consider it to be a valid measure of alcohol expectancy, and therefore cannot use it to compare two measures of expectancy. Regardless, correlations between these tasks were calculated for exploratory purposes. Because these relationships differed by condition, correlations are presented by condition (within subjects) as well as for the entire sample (within and between subjects; see Table 9). The only two significant results obtained from this analysis were found within the FRF condition, and were negative relationships between the positive arousing FA composite and the arousing and positive arousing PR composites. These results contradicted the hypothesis that corresponding composites from the implicit tasks would be positively related to one another.

Correlations were also calculated between the second implicit task conducted and the second administration of the first task. Even in the absence of meaningful relationships between the two implicit tasks at the first time points (first administration of the first task and only administration of the second), it was expected that these correlations would reflect contamination or practice effects. However, no correlations were significant (see Tables 10 and 11). This seemed to indicate that responses on the PR and FA tasks were not related, despite the fact that exposure to the PR wordlist may have provided responses to the FA task, or that responses on the FA task may have increased the salience of related PR words for participants.

In summary, performance on the FA task was highly related to drinking indices and responses on explicit measures, but the PR was not. Additionally, correlation analyses between the two tasks revealed few significant relationships, and no meaningful

Table 9. *Correlations Between Time 1 Free Associate Composites and Time 1 Primed Recall Composites*

	FAP	FAA	FAPA	FAN	FAS
Expectancy Prop.					
ALL	**.014**	**-.026**	**-.074**	**.047**	**.004**
FRF	(.133)	(.060)	(-.030)	(-.014)	(-.139)
RFR	(-.109)	(-.128)	(-.123)	(.117)	(.150)
PR Positive					
ALL	**-.005**	**-.020**	**-.064**	**.080**	**.030**
FRF	(.104)	(.066)	(-.002)	(-.020)	(-.050)
RFR	(-.097)	(-.119)	(-.131)	(.195)	(.101)
PR Arousing					
ALL	**.035**	**-.046**	**-.130**	**-.019**	**.026**
FRF	(-.062)	(-.115)	(-.286**)	(.009)	(.124)
RFR	(.160)	(.039)	(.059)	(-.057)	(-.085)
PR Positive Arousing					
ALL	**.048**	**-.044**	**-.125**	**-.024**	**-.013**
FRF	(.053)	(-.053)	(-.186)	(-.028)	(-.053)
RFR	(.054)	(-.032)	(-.042)	(-.018)	(.029)
PR Negative					
ALL	**-.026**	**.002**	**-.018**	**-.013**	**.038**
FRF	(.009)	(.021)	(.011)	(-.002)	(.081)
RFR	(-.080)	(-.023)	(-.057)	(-.022)	(.002)
PR Sedating					
ALL	**.008**	**-.042**	**-.019**	**.016**	**.038**
FRF	(.043)	(-.022)	(-.042)	(.014)	(-.071)
RFR	(-.034)	(-.066)	(.008)	(.019)	(.154)

* p < .05; ** p < .01
FAP = proportion of positive free associates produced to all; FAA = proportion of arousing free associates to all; FAPA = proportion of positive arousing free associates to all; FAS = proportion of sedating free associates produced to all; FAN = proportion of negative free associates to all; Expectancy Prop. = proportion of expectancy words recalled to all recalled in PR task

Table 10. *Correlations between Time 1 Primed Recall Composites and Time 2 Free Associate Composites*†

	FAP2	FAA2	FAPA2	FAN2	FAS2
PR Expectancy Proportion	.056	-.046	-.117	.056	-.130
PR Positive	.035	-.082	-.134	.085	-.043
PR Arousing	-.042	-.171	-.188	.042	.094
PR Positive Arousing	.080	-.150	-.127	.050	-.049
PR Negative	.072	-.096	-.038	-.051	.027
PR Sedating	.004	.048	-.053	.056	-.126

† FRF condition only
* p < .05; ** p < .01
FAP = proportion of positive free associates produced to all; FAPA = proportion of positive arousing free associates to all; FAS = proportion of sedating free associates produced to all; QUAN = typical quantity; FREQ = frequency of drinking (per week); DPW = drinks consumed per week; TBAC = typical BAC; MBAC = past 3 month maximum BAC reached

Table 11. *Correlations Between Time 1 Free Associate Composites and Time 2 Primed Recall Composites*‡

	PREXP	PRP2	PRA2	PRPA2	PRN2	PRS2
FA Positive	-.128	-.147	.044	.044	-.016	-.081
FA Arousing	-.145	-.037	.049	.049	.036	-.144
FA Positive Arousing	-.191	-.081	.105	.105	-.018	-.153
FA Negative	.123	.154	.116	.116	.021	-.031
FA Sedating	.128	.058	-.010	-.010	.065	.131

‡ RFR condition only
* p < .05; ** p < .01
FAP = proportion of positive free associates produced to all; FAPA = proportion of positive arousing free associates to all; FAS = proportion of sedating free associates produced to all; QUAN = typical quantity; FREQ = frequency of drinking (per week); DPW = drinks consumed per week; TBAC = typical BAC; MBAC = past 3 month maximum BAC reached

ones. The absence of any meaningful findings from the PR task was surprising, and precludes the completion of one of the major goals of this study: to directly compare implicit tasks. Despite the failure of the PR task to replicate, additional findings still provide us with valuable information about the nature of these two tasks, and the nature of implicit tasks in general. Further, the experimental design used here allows us to address several other equally important questions about the nature of inter-task contamination.

Intra-Session Reliability

Although we were unable to replicate previous findings from the PR task, a within subjects analysis of performance on the two separate administrations of this task can provide us with valuable information about the stability of this task, and likewise for the FA task. To this end, correlational analyses were conducted between composites calculated at the first administration of each task and the corresponding composites calculated for the second administration to examine within-session reliability of the FA and PR (see Tables 12 and 13). Because participants in each condition only completed one of the implicit tasks twice, these analyses were carried out within the respective conditions. As expected, valence and arousal proportions for each task at time one were strongly correlated with the same task's respective proportions at time two. Exceptions to this were the PR sedating and PR negative measures; correlations for neither set of measures approached significance. This finding may reflect a ceiling effect due to the

Table 12. *Correlations between Time 1 and Time 2 Primed Recall Composites*‡

	PREXP2	PRP2	PRA2	PRPA2	PRN2	PRS2
PREXP1	.382**	.321**	.244*	.244*	-.056	.215*
PRP1	.316**	.356**	.303**	.303**	-.141	.089
PRA1	.261**	.204*	.326**	.326**	.031	.038
PRPA1	.214*	.154	.292**	.292**	.019	.055
PRN1	.194	.109	.030	.030	.100	.210*
PRS1	.084	-.004	-.057	-.057	.063	.106

‡ RFR condition only
* $p < .05$; ** $p < .01$

Table 13. *Correlations between Time 1 and Time 2 Free Associates Composites*†

	FAP2	FAA2	FAPA2	FAN2	FAS2
FA Positive 1	.691**	.266**	.450**	-.508**	-.335**
FA Arousing 1	.365**	.576**	.595**	-.288**	-.369**
FA Positive/ Arousing 1	.385**	.502**	.622**	-.287**	-.336**
FA Negative 1	-.512**	-.254**	-.333**	.688**	.154
FA Sedating 1	-.431**	-.375**	-.430**	.197*	.599**

† FRF condition only
* $p < .05$; ** $p < .01$

content of the word list (see below for further discussion of list content). These findings indicate that the emotional content of the Free Associates generated and words recalled in the PR task was largely consistent across administrations.

Practice Effect/Contamination analyses

Repeated measures analyses of variance were used to assess change in each task composite across same-session administrations (see Table 14; all results are based on the Greenhouse-Geisser correction to control for violations of sphericity). As with many analyses reported here, all repeated measures analyses were conducted within the respective conditions, as each condition only completed one implicit task twice). For the free recall task, overall memory increased significantly from the first administration to the second. This increase likely reflects a practice effect: exposure to the same list of words twice undoubtedly results in better recall for these words than only one exposure. Additionally, the proportion of expectancy words recalled to all words recalled increased significantly across administrations ($F = 22.01$; $p < .01$). It is unlikely that this change occurred due only to overall increase in memory. A general memory effect would have resulted in a greater number of all words recalled from the list, and the proportion of expectancy words recalled would not have increased. Instead, this increase may have been driven by contamination; exposure to the FA task may have increased the salience of alcohol expectancy words in general over and above grocery words. The proportions of positive ($F = 11.90$; $p < .01$) and sedating words ($F = 7.87$; $p < .01$) recalled also increased significantly, while the proportions of negative, arousing, or

Table 14. *Intra-Session Task Analysis: Changes Across Administrations*†‡

	Time 1 M (SD)	Time2 M (SD)	F
FA positive	.335 (.283)	.348 (.283)	ns
FA arousing	.170 (.189)	.168 (.200)	ns
FA positive arousing	.118 (.174)	.120 (.171)	ns
FA negative	.334 (.289)	.344 (.282)	ns
FA sedating	.458 (.257)	.457 (.257)	ns
PR expectancy	.423 (.090)	.465 (.067)	22.01**
PR positive	.330 (.091)	.362 (.071)	11.91**
PR arousing	.152 (.064)	.150 (.044)	ns
PR positive arousing	.143 (.064)	.150 (.044)	ns
PR negative	.14 (.029)	.030 (.026)	ns
PR sedating	.102 (.067)	.125 (.053)	7.87**

† FA analyses conducted only within FRF condition
‡ PR analyses conducted only within RFR condition
** $p < .01$

positive arousing words did not. It is probable that this pattern of composite change was a result of the content of the wordlist. Only one negative word and four arousing words were on the PR list, leaving little room for improvement on these indices of performance, resulting in a ceiling effect. Increased recall of the more plentiful positive (11) and sedating (5) words was likely facilitated by the increase in overall recall at the second administration.

For the Free Associates task, no significant increases in the proportions of any type of associate generated were observed. This finding suggests that there was minimal contamination between implicit tasks. If the FA task had been affected by the content of the PR task, one might expect to see inflated positive or sedating composite scores.

To directly gauge effects of the PR word list on responses generated in the Free Associates task, an analysis of the frequency of expectancy words from the word list that participants generated as free associates was calculated (see Table 15; only the FRF condition was used for this analysis). This enabled us to assess FA performance both unaffected by the PR task and following the PR task, and allowed for an exploration of contamination effects of the recall task on the free associates. Four words from the wordlist were not generated as free associates at either time point: active, jolly, slow, and verbal. Four words were not generated at the first time point, but were generated at time two following exposure to the wordlist: confident, foolish, mellow, and noisy. Additionally, large increases (50% or greater) in the generation of several associates were found: dizzy, drowsy, fun, horny, sociable, and wild. The only word to have been

Table 15. *Frequency and Percentage of Primed Recall Words Generated as Free Associates*†

	Time 1	Time 2	Increase
Active	0 (0)	0 (0)	-
Confident	0 (0)	2 (.2%)	2 (-)
Dizzy	6 (.6%)	15 (1.5%)	9 (150%)
Drowsy	4 (.4%)	10 (1%)	6 (150%)
Foolish	0 (0)	1 (.1%)	1 (-)
Fun	8 (.8%)	9 (.9%)	1 (12.5%)
Happy	34 (3.5%)	35 (3.6%)	1 (2.9%)
Horny	6 (.6%)	9 (.9%)	3 (50%)
Jolly	0 (0)	0 (0)	-
Mellow	0 (0)	1 (.1%)	1 (-)
Noisy	0 (0)	2 (.2%)	2 (-)
Slow	0 (0)	0 (0)	-
Sociable	1 (.1%)	5 (.5%)	4 (400%)
Verbal	0 (0)	0 (0)	-
Wild	2 (.2%)	5 (.5%)	3 (150%)

† FRF condition only
All results expressed as whole numbers, or frequency of occurrence, and percentage of all free associates generated (in parentheses)

generated as an associate at time one that was not generated at an increased rate at time two was happy. Of all expectancy words from the wordlist, this word was most frequently generated as an associate at both time points. No direct analysis of the effect of the FA task on the PR task was possible.

Regression Analyses

Next, regression analyses were used to examine the incremental validity of explicit and implicit measures. Because no significant relationships between the PR task and drinking variables were found, only FA indices were included in regressions. Again, in order to eliminate the potential influence of contamination effects caused by completion of both implicit tasks, these analyses were conducted using only participants from the FRF condition. Separate analyses were conducted examining each drinking measure as a dependent variable and explicit and implicit composites as the independent variables. Analyses were conducted entering all AEQ subscales as a set of predictors, all AEMax composites as another set, and FA composites as a third separate set. This was done to examine the predictive power of each measure as a whole, and to examine the predictability of each subscale in the absence of overlapping predictors from other measures. Subscales for each predictor set were entered into equations simultaneously. Results for these analyses are presented in Table 16.

With frequency of consumption as the dependent variable, the AEQ was the best overall predictor (adjusted $R^2 = .296$; $F = 8.76$; $p < .01$). The Social and Physical Pleasure ($\beta = .372$; $p < .01$) was the only subscale that was a significant predictor. Of the

Table 16. *Linear Multiple Regression Analyses Predicting Drinking Indices from Separate AEQ, AEMax, and FA Models*[†]

Drinking index / Predictor	*B*	*SE*	*β*
Frequency			
AEQ Social/Physical Pleasure	.221	.078	.372**
Full AEQ Model		**R^2 = .296, *F* = 8.76****	
AEMax Social	.109	.044	.244**
AEMax Attractive	.117	.044	.286**
Full AEMax Model		**R^2 = .237, *F* = 5.28****	
Full FA Model		**R^2 = .131, *F* = 4.34****	
Quantity			
Full AEQ Model		**R^2 = .239, *F* = 6.86****	
AEMax Social	.198	.073	.266**
AEMax Attractive	.199	.073	.289**
Full AEMax Model		**R^2 = .245, *F* = 5.50****	
Full FA Model		**R^2 = .080, *F* = 2.95***	
Drinks per Week			
AEQ Tension Reduction	.798	.289	.281*
Full AEQ Model		**R^2 = .232, *F* = 6.60****	
AEMax Social	.541	.223	.244*
AEMax Attractive	.594	.224	.292**
Full AEMax Model		**R^2 = .215, *F* = 4.77****	
Typical BAC			
Full AEQ Model		**R^2 = .107, *F* = 3.17****	
AEMax Egotistical	-.007	.002	-.513**
AEMax Sick	-.004	.002	-.300*
AEMax Woozy	.005	.002	.273*
AEMax Social	.003	.002	.214*
Full AEMax Model		**R^2 = .190, *F* = 4.17****	
Max BAC			
Full AEQ Model		**R^2 = .151, *F* = 4.26****	
AEMax Woozy	.113	.005	.328**
AEMax Social	.010	.004	.260*
Full AEMax Model		**R^2 = .220, *F* = 4.84****	

† FRF condition only
*p < .05; **p < .01

three predictor sets, the AEMax explained the second highest amount of variance (adjusted R^2 =.237; $F = 5.28$; $p < .01$). The Social ($\beta = .244$; $p < .05$) and Attractive ($\beta = .286$; $p < .01$) factors both significantly predicted frequency of drinking. Lastly, the Free Associates set explained the least variance in frequency (adjusted $R^2 = .131$; $F = 4.34$; $p < .01$), and none of the FA composites were significant predictors.

Using typical quantity as a dependent variable, the AEMax model (adjusted $R^{2} = .245$; $F = 5.50$; $p < .01$) predicted more variance than the AEQ model (adjusted $R^{2} = .239$; $F = 6.86$; $p < .01$) or the FA model (adjusted $R^{2} = .080$; $F = 2.95$; $p < .05$). The Social ($\beta = .266$; $p < .01$) and Attractive ($\beta = .289$; $p < .01$) factors of the AEMax were significant predictors, but none of the subscales from the AEQ of FA were significant predictors of quantity.

Drinks per Week (DPW) were significantly predicted by the AEQ (adjusted $R^{2} = .232$; $F = 6.60$; $p < .01$) and AEMax (adjusted $R^{2} = .215$; $F = 4.77$; $p < .01$), but not the FA model. The AEQ Tension Reduction scale ($\beta = .282$; $p < .05$) and AEMax Social ($\beta = .244$; $p < .05$) and Attractive ($\beta = .292$; $p < .01$) Factors were all significant predictors. Using t-BAC as the criterion, again the AEQ (adjusted $R^{2} = .107$; $F = 3.17$; $p < .01$) and

AEMax (adjusted $R^{2} = .190$; $F = 4.17$; $p < .01$) models were significant, while the FA model was not. While none of the AEQ subscales were significant predictors, the Egotistical ($\beta = -.513$; $p < .01$), Sick ($\beta = -.300$; $p < .028$), Woozy ($\beta = .273$; $p < .05$), and Social ($\beta = .214$; $p < .05$) factors of the AEMax were each significant predictors of t-BAC.

Lastly, the AEQ (adjusted $R^{2} =$ .151; F = 4.26; p < .01) and AEMax (adjusted $R^{2} =$ .220; F = 4.84; p < .01) models were significant in predicting past 3-month max-BAC, while again the FA model was not. Only the AEMax Woozy (β = .328; p < .01) and Social (β = .260; p < .01) factors were significant predictors; no AEQ subscales were.

Next, to determine whether FA and the explicit measures predicted unique variance in our drinking variables, implicit and explicit measures were combined into one model (see Table 17). These analyses were conducted only for frequency and quantity of drinking, since these are the only two drinking indices that the FA model significantly predicted. Because no specific FA subscales were significant as individual predictors, all five of the FA composites were entered as a block. Subscales from the AEQ and AEMax that had reached significance in their respective regression models were entered into equations. For frequency, the AEQ Social and Physical Pleasure and AEMax Social and Attractive factors were entered simultaneously with the FA block. Since no specific subscales reached significance as individual predictors for quantity, the AEQ was also entered as a block. The AEMax Social and Attractive factors were entered into this model as well.

With the frequency criterion, neither the AEMax Social factor (β = .338; p < .01) nor the Free Associates added unique prediction over and above the AEQ-SPP (β = .338; p < .01) and the AEMax Attractive factor (β = .328; p < .01). In fact, the adjusted R^2 for the model containing only the three explicit subscales (adjusted $R^2 = .305$; p < .01) was

Table 17. *Linear Multiple Regression Analyses Predicting Drinking Indices from Implicit and Explicit Blocks* [†]

Drinking index Predictor	*B*	*SE*	*β*
Frequency			
AEQ Social and Physical Pleasure	.202	.061	.338**
AEMax Attractive	.092	.040	.226*
Explicit Model	***adj. R^2 = .305, F = 17.19****		
AEQ Social and Physical Pleasure	.173	.066	.289**
Combined Explicit/Implicit Model		***adj. R^2 = .288, F = 6.56****	
Quantity			
Explicit Model	***adj. R^2 = .245, F = 5.49****		
Combined Explicit/Implicit Model		***adj. R^2 = .216, F = 3.35****	

† FRF condition only
*p < .05; **p < .01

higher than that for the model with the FA composites included (adjusted $R^2 = .288$; $p < .01$). A similar pattern was found using typical quantity as the criterion, where the adjusted R2 for the model including both implicit and explicit measures (adjusted $R^2 = .216$; $p < .01$) decreased from the R2 for the explicit only model (adjusted $R^2 = .245$; $p < .01$). No explicit subscales were individually predictive.

In review, the AEQ, AEMax, and FA were each entered into regression equations as individual predictor models separately for each drinking criterion. Results were that the AEQ and AEMax significantly predicted each of the five drinking variables, but that FA only significantly predicted frequency and quantity. Thus in order to determine whether our implicit measure added unique explanation of drinking, additional regression analyses were conducted, and included all significant predictors for each criterion from the first set of analyses. Our findings were that scores on implicit measures did not explain unique variance in drinking variables beyond that predicted by the explicit measures.

Discussion

The use of implicit measures in social and clinical research has seen a sharp increase over the past decade. Most of these measures have been imported from the experimental cognitive field. Consequently, most implicit measures used as indicators of real-world behavior have not been subjected to rigorous psychometric testing as are most other clinical instruments. This pattern holds especially in the alcohol expectancy field. To address this shortcoming in the expectancy literature, one goal of the present study was to examine the stability of implicit measures of alcohol expectancy and to examine the degree to which they probe the same underlying construct. We proposed to assess the reliability of two implicit measures by comparing our results to those reported in the literature (replication), and by measuring intra-individual intra-session performance on each. We also hoped to compare performance across implicit tasks in order to determine the degree of concordance. Our design used two conditions which each received both implicit tasks, with each condition completing one task twice. We used multiplication problems and a verbal distractor task (counting nouns in paragraphs) between administrations of implicit tasks to prevent (or at least reduce) processing of alcohol expectancy information between tasks. Not only did this design enable us to address same-session test-retest reliability and concordance between tasks, but it also allowed us to examine contamination and practice effects both between and within tasks.

Earlier findings from the Free Associates sentence completion task were successfully replicated, with responses on this task found to be highly related to self-reported alcohol consumption and to explicit reports of alcohol expectancies. The FA task also demonstrated high within-session test-retest reliability. On the other hand, while most of the indices of PR task performance demonstrated reliability across the experimental session, earlier findings relating to the PR free recall task were not successfully replicated. The present research found no significant relationship between performance on this task and drinking, and only two significant relationships between two indices of performance on this task (proportion of expectancy words recalled and proportion of positive expectancy words recalled) and one AEQ subscale (Aggression/Arousal).

That the Aggression/Arousal subscale of the AEQ was the only subscale to correlate with the PR task was rather surprising, since this subscale has been shown to be a relatively weak predictor of drinking (Goldman, Greenbaum, & Darkes, 1997), to have comparatively low internal consistency (Goldman, Brown, Christiansen, & Smith, 1991), and because it showed some of the weakest relationships with drinking in this sample. Additionally puzzling was the fact that these relationships are both negative, indicating that recall of expectancy words and positive expectancy words on the PR task was related to low Aggression/Arousal scores.

There may be several reasons for the failure of the PR task to replicate. First, it may not be a reliable probe of alcohol-related associations in memory. As demonstrated by Reich et al. (2004), simply changing the first word of the list from “milk” to “beer” significantly affected the type of words that participants recalled, whereby more expectancy words were recalled when the first word of the list was “beer.” Additionally, heavier drinkers remembered more *positive* expectancy words when the first word on the list was “beer.” The fact that such significant changes took place as a result of such a slight change in stimuli is a testament to the sensitivity of automatic memory processes. However, a stimulus change so small may also lead to performance changes that are unreliable or due either to noise or context specificity. Cognitive responses to contextual change are so nuanced that these patterns are tricky or impossible to reliably identify.

An other possible explanation is that implicit memory processes themselves developed to be highly responsive to context, and thus may vary in accord with uncontrolled (or uncontrollable) elements of the environment. Our knowledge about the world is constantly updated by new experiences and exposure to new contexts. Individuals have no criterion against which to measure the stability or “correctness” of output implicit memory processes as we have awareness to modulate output of declarative information. Thus, continuous revision of the associations we hold in memory based on ever-changing contingencies and contextual cues lead to inconsistent responses to the same stimuli. Indeed, evidence of this is found in responses on free association tasks, despite the strong reliability reported here and elsewhere (Reich et al., 2005, Ames et al., 2007). While individuals tend to respond to alcohol expectancy Free Associates with words having similar properties, specific responses are impossible to predict. In fact, an individual's responses on a free association task are better predicted by established norms than by that individual's own past performance.

Although findings from earlier administrations of the FA task were replicated, the fact that earlier findings related to the PR task were not precluded any direct comparison between the tasks. However, we were still able to assess intra-session reliability of each task and practice and contamination effects both within and between tasks. Both tasks showed good within session test-retest reliability. This finding may have been influenced by practice effects, specifically double exposure to a task within a short time frame (less than one hour). Many participants in the FRF condition generated the same free associates at both time points, a phenomenon which most likely would have been less frequent had the time interval between the two FA task administrations been longer. Overall memory improved on the free recall task from the first administration to the second, increasing the likelihood that grocery and expectancy words alike would be recalled from the list.

Interestingly, we did not find as much contamination across tasks as one might expect; we expected that this would have resulted in significant within-condition correlations between the second administration of the repeated task and whichever task was administered only once. In addition, while there seemed to be some direct influence of the PR task on the FA task, several expectancy words from the PR list were never generated as free associates ("active", "jolly", "slow", and "verbal"), and in one other case ("happy") there was a minimal increase in PR word use as free associates from the first FA administration to the second. This may indicate that distractor tasks were somewhat successful in blocking processing of alcohol expectancy information between tasks. It may also be the case that the PR task actually had little effect on subsequent performance on the FA task; the fact that no significant changes in any of the FA composites were observed from time 1 to time 2 lends support to this suggestion.

While individuals tend to respond to alcohol expectancy Free Associates with words having similar properties, specific responses are impossible to predict. In fact, an individual's responses on a free association task are better predicted by established norms than by that individual's own past performance (Jenkins, in process of confirming date). Therefore, the mere fact that some of the words from the PR word list either increased in frequency as free associates or appeared as associates for the first time at the second time point may be a reflection of associate fluctuation and not of contamination per se. Only comparing results from a procedure similar to this one to another in which the FA task is administered twice with no other intervening alcohol expectancy task can offer a definitive explanation.

Practice effects were observed primarily in the PR task. Memory for all word types improved at the second administration. The positive, positive arousing, and sedating PR composites all increased from the first time point to the second. This was likely due to the content of the wordlist. Of 15 words, 11 were positive and 5 were sedating, while only one was negative and four arousing. No significant changes in any of the FA composites were observed from time 1 to time 2. Although the pattern of composite scores for both tasks both remained consistent across the two administrations, it is notable that despite this consistency correlation coefficients between these composites and explicit measures and drinking were far from perfect, and the relationship between the tasks was negligible.

The finding that both tasks are sufficiently stable to produce similar results at administrations about 30 minutes apart may be evidence that instability of one task may not solely account for the lack of noteworthy relationships between the tasks. While same session test-retest reliability may be explained by a contamination effect, it is curious that no such effects were found between the tasks. It is possible that each task may measure a construct reliably, at least 30 minutes apart, but that the constructs they tap are not the same.

Regression analyses were used to determine whether explicit and implicit measures predicted unique variance in drinking indices. Results indicated that the FA task did not contribute unique explanation of variance in drinking. This is in contrast to multiple studies that have demonstrated that implicit measures do seem to explain unique variance (Ames et al., 2007; Stacy. 1997; Palfai & Woods, 2001; Wiers et al., 2002; Jajodia & Earleywine, 2003; McCarthy & Thompsen, 2006; Kramer & Goldman, 2003; Reich et al., 2004), though the added explanation had tended to be small (Reich et al., in preparation). Our failure to find unique implicit predictive power is likely due to the manner in which the FA task was scored. The five composites that were created were highly intercorrelated, which may have meant that they all indexed the same underlying performance tendencies. Future examination of the differences in Free Associate versus explicit measure predictability may include examination of latent performance variables to parse out overall response patterns.

Much of the present experiment was exploratory. Although Free Associates have been shown to be reliable, we were unsure as to whether results associated with the PR task would replicate, and whether there would be reliability for either task from one administration to a second within the same experimental session. While we expected contamination and practice effects, we did not predict a specific pattern. The largest surprise was the failure of the PR to replicate. The procedure used here was identical to that described by Reich et al. (2004), using the same words, identical timing, and the same instructions verbatim. The only variation was in the lists used to present the stimuli to participants. Both experiments used six randomized lists, but we created our own for this experiment. It is possible that our lists had some systematic flaws that suppressed the effects reported by Reich et al. (2004). Whether this is the case or not, our inability to replicate previous results indicates that either the PR task is an unstable measure, or the phenomenon being measured is unstable. Perhaps both are true. The best way to address this uncertainty is to continue to explore previously established tasks and the conditions under which they do and do not replicate.

Limitations

While the present work brought us a step closer to understanding the nature of implicit alcohol expectancy measures, there were several shortcomings. First, our sample contained a significantly smaller number of men (n = 46; 21.1%) than women (n = 172; 78.9%). Our analyses indicated no major differences between the sexes on indices of drinking or on implicit task performance. Past research has consistently shown that men tend to drink more than women, with more men identifying as current drinkers, drinking more frequently and in greater quantities than female drinkers (York, Welte, & Hirsch, 2003; Substance Abuse and Mental Health Services Administration, 2006; National Institute on Alcohol Abuse and Alcoholism, 2002), although this gender gap has been narrowing among college-aged individuals in recent years (Young, Morales, McCabe, Boyd, & D'Arcy, 2005). The present failure to find significant differences between men and women on drinking variables may be due to a lack of power as a result of the smaller number of men in the sample, as is likely the case with the trend toward a significant difference in drinking frequency. However, since our results indicate that men and women are quite similar on the remaining indices of drinking, it is possible that there are simply few sex-based differences in alcohol consumption in our sample.

Some significant differences were found on the AEMax, with women scoring higher on the woozy, dangerous, and sedating factors, and lower on the attractive factor. Although no gender differences on these factors have been published to date, these patterns seem to contrast those reported by Darkes, Greenbaum, & Goldman (1999) that women's alcohol use is best predicted by higher scores on positive and positive arousing factors and lower expectations of illness. Women's lower score on the Attractive factor is consistent with Darkes & Goldman's finding that attractiveness was a stronger predictor of drinking for men.

However, further examination of the parameters of our sample confirmed that the drinking patterns observed here are similar to those reported by other samples. We found that the abstinence rate of 62.4% and the percentage of students that reported binge drinking during a typical week (31.9%) were both consistent with other reports of college student drinking (Del Boca et al., 2004). These findings reassured us as to the similarity of the present sample to other undergraduate samples used in alcohol expectancy research. It is still possible that because we obtained so many fewer male participants, that this sample deviated in some other undetected way. The only way to completely eliminate the question of whether gender differences influenced our final results would have been to include equal numbers of men and women to provide sufficient power for separate gender difference analyses.

The limited content of the PR word list may also have suppressed effects of this task. Significant effects were reported for this task in the past and one of the major goals of this research was to closely replicate past work, yet the unequal distribution of types (e.g. valence and arousal properties) of words surely increased the likelihood of memory for the more frequently occurring positive words and suppressed any effects for memory for negative words. Additionally, all grocery words on the PR list were concrete nouns, while the expectancy words were abstract. Again, although Reich and colleagues (2004) found effects on this task in spite of this variation, matching neutral and expectancy words for concreteness in future incarnations of this task may help determine whether the findings we report here are a function of inconsistency of the task or of the implicit construct it attempts to measure.

Directions for Future Research

We feel that the present work has great implications for future implicit alcohol expectancy research. First, we feel that the lack of significant results on the PR task underscore the necessity of replicating implicit tasks before attempting to use them as diagnostic tools, or in lieu of well-established explicit measures. Furthermore, we hope that future research addressing the psychometric properties of implicit tasks will elucidate the issue of whether inconsistent findings reported here and elsewhere are in fact a function of unreliable measures or the transience of implicit memory states.

In conclusion, the present research underscores the complexity of implicit research and its interpretation. Although we were not able to answer each of the questions we set out to address, these findings provide us with valuable insight that will hopefully help inform implicit research endeavors in the future.

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Appendices

Appendix A. Primed recall Stimuli by Word Type

Grocery words	Expectancy words
1. Beer	16. Active
2. Apples	17. Confident
3. Beans	18. Dizzy
4. Bread	19. Drowsy
5. Butter	20. Foolish
6. Catsup	21. Fun
7. Cereal	22. Happy
8. Cheese	23. Horny
9. Eggs	24. Jolly
10. Flour	25. Mellow
11. Granola	26. Noisy
12. Jelly	27. Slow
13. Mustard	28. Sociable
14. Pasta	29. Verbal
15. Sugar	30. Wild

Appendix B. Free Associate Cues

1. Alcohol makes me _________

2. Cooking makes me _________

3. Exercise makes me _________

4. Food makes me _________

5. Shopping makes me _________

Appendix C. Alcohol Expectancy Questionnaire Items

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1. Some alcohol has a pleasant, cleansing, tingly taste.
2. Drinking adds a certain warmth to social occasions.
3. When I'm drinking, it is easier to open up and express my feelings.
4. Time passes quickly when I'm drinking.
5. Drinking makes me feel flushed.
6. I feel powerful when I drink, as if I can really influence others to do what I want.
7. Drinking gives me more confidence in myself.
8. Drinking makes me feel good.
9. I feel more creative after I've been drinking.
10. Having a few drinks is a nice way to celebrate special occasions.
11. When I'm drinking I feel freer to be myself and do whatever I want.
12. Drinking makes it easier to concentrate on the good feelings I have at the time.
13. Alcohol allows me to be more assertive.
14. When I feel "high" from drinking, everything seems to feel better.
15. I find that conversing with members of the opposite sex is easier for me after I've had a few drinks.
16. Drinking is pleasurable because it's enjoyable to join in with people who are enjoying themselves.
17. I like the taste of some alcoholic beverages.
18. If I'm feeling restricted in any way, a few drinks make me feel better.
19. Men are friendlier when they drink.
20. After a few drinks, it is easier to pick a fight.
21. If I have a couple of drinks, it is easier to express my feelings.
22. Alcohol makes me need less attention from others than I usually do.
23. After a few drinks, I feel more self-reliant than usual.
24. After a few drinks, I don't worry as much about what other people think of me.

25. When drinking, I do not consider myself totally accountable or responsible for my behavior.
26. Alcohol enables me to have a better time at parties.
27. Drinking makes the future seem brighter.
28. I often feel sexier after I've had a couple of drinks.
29. I drink when I'm feeling mad.
30. Drinking alone or with one other person makes me feel calm and serene.
31. After a few drinks, I feel brave and more capable of fighting.
32. Drinking can make me more satisfied with myself.
33. My feelings of isolation and alienation decrease when I drink.
34. Alcohol helps me sleep better.
35. I'm a better lover after a few drinks.
36. Alcohol decreases muscular tension.
37. Alcohol makes me worry less.
38. A few drinks makes it easier to talk to people.
39. After a few drinks I am usually in a better mood.
40. Alcohol seems like magic.
41. Women can have orgasms more easily if they've been drinking.
42. Drinking helps get me out of a depressed mood.
43. After I've had a couple of drinks, I feel I'm more of a caring, sharing person.
44. Alcohol decreases my feelings of guilt about not working.
45. I feel more coordinated after I drink.
46. Alcohol makes me more interesting.
47. A few drinks makes me feel less shy.
48. Alcohol enables me to fall asleep more easily.
49. If I'm feeling afraid, alcohol decreases my fears.
50. Alcohol can act as an anesthetic, that is, it can deaden pain.
51. I enjoy having sex more if I've had some alcohol.
52. I am more romantic when I drink.
53. I feel more masculine/feminine after a few drinks.
54. Alcohol makes me feel better physically.

55. Sometimes when I drink alone or with one other person it is easy to feel cozy and romantic.
56. I feel like more of a happy-go-lucky person when I drink.
57. Drinking makes get-togethers more fun.
58. Alcohol makes it easier to forget bad feelings.
59. After a few drinks, I am more sexually responsive.
60. If I'm cold, having a few drinks will give me a sense of warmth.
61. It is easier to act on my feelings after I've had a few drinks.
62. I can discuss or argue a point more forcefully after I've had a drink or two.
63. A drink or two makes the humorous side of me come out.
64. Alcohol makes me more outspoken or opinionated.
65. Drinking increases female aggressiveness.
66. A couple of drinks make me more aroused or physiologically excited.
67. At times, drinking is like permission to forget problems.
68. If I am tense or anxious, having a few drinks makes me feel better.

Appendix D. Alcohol Expectancy Multiaxial Assessment Items

0	**1**	**2**	**3**	**4**	**5**	**6**
Never	**Very Rarely**	**Rarely**	**Occasionally**	**Frequently**	**Very Frequently**	**Always**

"DRINKING ALCOHOL MAKES ONE ________."

1. Dizzy ________
2. Arrogant ________
3. Horny ________
4. Light-headed ________
5. Erotic ________
6. Appealing ________
7. Deadly ________
8. Beautiful ________
9. Sociable ________
10. Egotistical ________
11. Tired ________
12. Woozy ________
13. Attractive ________
14. Ill ________
15. Sleepy ________
16. Lustful ________
17. Social ________
18. Cocky ________
19. Sick ________
20. Dangerous ________
21. Outgoing ________
22. Hazardous ________
23. Drowsy ________
24. Nauseous ________

Appendix E. Demographics and Daily Drinking Questionnaire

---

1. How old are you? ___________________

2. Gender (please circle): Male Female

3. What is your class standing?

   (1) Freshman
   (2) Sophomore
   (3) Junior
   (4) Senior
   (5) Non-matriculating
   (6) Other (Please specify): __________________

4. Which of the following best describes you?

   (0) Native American/American Indian
   (1) Asian
   (2) Pacific Islander
   (3) African-American/Black, <u>not</u> of Hispanic origin
   (4) African-American/Black, and of Hispanic origin
   (5) Caucasian/White, not of Hispanic origin
   (6) Caucasian/White, and of Hispanic origin
   (7) Hispanic/Latino origin
   (8) Other (please specify) _________________________

5. What is your religious preference? _________________________

6. How many times in the past 6 months have you attended religious services?_____

7. Below, please write below the number of standard drinks on average that you had each day of the week for the past 3 months (how many standard drinks did you have on a typical Monday, Tuesday, etc.; **see standard drink guide below**). After you have done so, please specify the amount of time in which you typically consume alcohol each day of the week for the past three months (how much time you usually spend drinking on a typical Monday, Tuesday, etc.)

Standard Drink Guide:

BEER:
12 oz. (1 bottle or can) = 1 drink
40 oz. = 3 ½ drinks
1 pitcher = 6 drinks

HARD LIQUOR and MIXED DRINKS:
(Vodka, Rum, Whiskey, Bourbon, Scotch)
1 ½ oz. of liquor (1 shot) = 1 drink
mixed drink with 1 shot = 1 drink
375 ml. (1 pint) = 8 ½ drinks
750 ml. (fifth or quart) = 17 drinks

LIQUEUR:
(schnapps, Kaluah, Baileys)
1 ½ oz. (1 shot) = ½ drink
3 oz. (2 shots) = 1 drink

MALT LIQUOR:
40 oz. = 4 drinks

WINE:
5 oz. (1 glass) = 1 drink
25 oz. / 750 ml. (standard bottle) = 5 drinks
Wine cooler = 1 drink

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Number of Standard Drinks							

Number of Hours							

8. What is your weight in pounds? _________________

9. Below, please write a number indicating the maximum number of drinks you had on your heaviest drinking occasion during the last six months. After you have done so, please write a number indicating how many hours you spent drinking on your heaviest drinking occasion.

Max Drinks Past 6 months	
Hours Spent Drinking Max drinks	