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Paradoxical Effects of Alcohol Information on Alcohol Outcome Expectancies

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Abstract

Background—Cognitive associations with alcohol predict both current and future use in youth and young adults. Much cognitive and social cognitive research suggests that exposure to information may have unconscious influences on thinking and behavior. The present study assessed the impact of information statements on the accessibility of alcohol outcome expectancies.

Methods—The 2 studies reported here investigated the effects of exposure to alcohol statements typical of informational approaches to prevention on the accessibility of alcohol outcome expectancies. High school and university students were presented with information statements about the effects of alcohol and other commercial products. The alcohol statements were taken from expectancy questionnaires. Some of these statements were presented as facts and others as myths. The retention of detailed information about these statements was manipulated by (i) divided attention versus focused attention or (ii) immediate versus delayed testing. Accessibility of personal alcohol outcome expectancies was subsequently measured using an open-ended question about the expected effects of alcohol.

Results—Participants reported more alcohol outcomes seen during the information task as personal expectations about the effects of alcohol use than similar unseen items. Paradoxically, myth statements were also more likely to be reported as expectancies than unseen items in all conditions. Additionally, myth statements were generated less often than fact statements only under the condition of immediate testing with strong content processing instructions.

Conclusions—These observations are consistent with findings from cognitive research where familiarity in the absence of explicit memory can have an unconscious influence on performance. In particular, the exposure to these items in an informational format increases accessibility of the seen items even when the participants were told that they were myths. The findings have implications for the development of effective prevention materials.

Keywords

Alcohol Outcome Expectancies; Priming; Unconscious Influences; Associations; Memory

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During The Past couple of decades, there has been renewed interest in the role of unconscious or nonconsciously mediated influences on thinking, motivation, and behavior. Some researchers have proposed separate memory systems for explicit (deliberative) and implicit (outside awareness) memories (Graf, 1994; Graf and Schacter, 1985; Schacter and Graf, 1986). Others have argued that implicit and explicit memory are not separate systems, but rather reveal the differential processing resulting from implicit and explicit memory tasks (Jacoby and Kelley, 1992; Roediger, 2000; Roediger et al., 2002). Findings from neural imaging studies have provided support for differentiating implicit and explicit memories (Knowlton and Foerde, 2008; Rose et al., 2005) and have bolstered earlier study findings of explicit/implicit memory dissociations resulting from lesions to implicated brain regions (Gabrieli et al., 1995; Shimamura et al., 1992). Whether based on separate memory systems or processing demands, process dissociations have practical implications for learning and performance (Whittlesea, 2003; Yonelinas and Jacoby, 1995). In particular, process dissociation effects suggest that memory can exert influences on performance without reported awareness and even when awareness of the original explicit memory would influence performance in unexpected or even opposite directions (Jacoby et al., 1989a,b).

One interesting example of process dissociation is the demonstration of unconscious influences on the attribution of fame (Jacoby et al., 1989a,b). The logic is based on the expectation of different effects of explicit and implicit memories on a name recognition task. In one of these studies, a list of names was presented to the participants in an incidental learning task. In a subsequent, unrelated task, the subjects were asked to rate a series of names on how famous they were. The researchers postulated that explicit memory for previously seen names in the incidental learning task would not increase the likelihood of endorsing that name as being famous. By contrast, enhanced familiarity without attribution to the source would be misattributed to fame and increase the likelihood of the name being reported as famous. The force of this argument was supported by the finding that a manipulation designed to reduce explicit memory (i.e., 24-hour delay) actually increased the likelihood that the nonfamous name from the incidental list was judged as famous. After the delay, the studied names were still familiar (implicit memory), but the subject could not identify the source of this familiarity and incorrectly attributed it to fame. Jacoby called the effect *unconscious influences* because it is both implicit (without awareness) and automatic.

Social cognitive researchers have become increasingly interested in how implicit processes may have automatic influences on social behavior (Bargh, 2002; Bargh et al., 2001; Gawronski and Bodenhausen, 2005, 2006; Gawronski et al., 2005). For example, several researchers have shown that mere exposure to an object increases consumer choice for that object without awareness of the influence (Bargh, 2002; Tom et al., 2007). The mere exposure effect (Zajonc, 1968) is similar to the process dissociation in the famous names study in that unattributed familiarity has an automatic effect on attitudes or preferences. The evidence suggests that social interaction, evaluation, and judgment are influenced by automatic effects of memory without conscious awareness (Bargh and Ferguson, 2000). Recent approaches to substance use have also emphasized the role of automatic effects of implicit processes (Ames et al., 2006; Stacy et al., 2009; Wiers et al., 2007).

The studies reported here focus on unconscious influences of alcohol information statements on the accessibility of alcohol outcome expectancies. Alcohol outcome expectancies are cognitions about the effects of alcohol on oneself or others that correlate with and predict future alcohol use (Goldman et al., 1999, 2006). Such expectancies are learned through direct or indirect experiences with alcohol and can be well developed before any direct experience with alcohol (Dunn and Goldman, 1998; Miller et al., 1990; Smith and Goldman, 1994; Smith et al., 1995). For example, adolescents who expect positive effects from drinking are more likely to engage in future problem-drinking than those who do not have similar expectations (Christiansen et al., 1985; Smith et al., 1995).

Although typically measured by survey ratings of specific outcome statements, alcohol use expectancies may also be obtained through self-generation of outcome associations (Leigh and Stacy, 1993; Stacy et al., 1994). Self-generated outcome expectancy responses may be particularly important as more accessible alcohol expectancies are expected to have more influence on the relevant behavior (Dunn and Goldman, 2000; Goldstein et al., 2004; Reich and Goldman, 2005). Spontaneously generated outcomes are influenced not only by the strength of behavior associations in memory, but also by the environmental and cognitive context of the measurement (Krank and Wall, 2006; Krank et al., 2005). Specifically, substance use context or cues increase the generation of substance use memories selectively in those with more substance use and presumably stronger substance use associations. These findings emphasize the importance of memory retrieval processes (Roediger, 2000) in the accessibility of expectancy outcome content.

Study Design

The studies reported here assess the effect of alcohol information statements on subsequent self-generated production of outcome expectancies. The general procedure is similar to that used by Jacoby and colleagues (noted above) to measure unconscious influences in cognition (Jacoby et al., 1989a,b). The logic of the design is based on the expectation of different effects of explicit and implicit memories from earlier study materials on a subsequent task. Information statements about alcohol were presented in the first phase of the study. In a second putatively unrelated phase, the participants were asked in an open-ended task to generate outcome expectancies. The study phase items were taken from validated expectancy questionnaires so that the statement items had some probability of being reported in the test phase on the open-ended expectancy task. Some information statements about the effects of alcohol were presented as facts, others were presented as myths, and some were not presented. Comparing studied with nonstudied items from the scales provided a natural control condition for the test phase.

In addition, we used 2 different approaches to modify explicit and implicit memory for statements about alcohol outcomes. The first study manipulated attention (Jacoby et al., 1989b, 1992) and the second used a 24-hour delay to reduce explicit memory (Jacoby et al., 1989a). Focused attention encourages retention of details and is expected to enhance explicit memory, whereas divided attention reduces retention of such details and reduces explicit memory (Shapiro and Krishnan, 2001). Delayed testing is expected to produce forgetting and thus also reduce explicit memory compared to an immediate testing condition.

Hypotheses

We expected participants who explicitly remembered having seen the information as a fact in the study phase would be more likely to report this as an effect of alcohol. By contrast, a participant who explicitly remembered having seen the information as a myth would be less likely to report this as an effect of alcohol. Remembering having been being told a particular alcohol outcome is a myth conflicts with the task demands of the expectancy question to report the expected effects of alcohol. However, an unattributed increase in familiarity engendered by implicit memory should increase the accessibility of an association of an effect with alcohol regardless of the myth/fact distinction. Using a parallel methodology to that employed by Jacoby and others, we expected that manipulations designed to reduce explicit memory for the items would make it more likely that incongruent statements (myths) would enhance general familiarity and actually increase reporting the myth as an effect of alcohol.

Specifically, we expected that (i) prior exposure to an outcome expectancy would increase the accessibility of that outcome expectancy, (ii) myth designation during should decrease endorsement of an expectancy, and (iii) the impact of the myth designation would be reduced under conditions that reduce explicit memory (i.e. divided attention or delayed testing).

Method

Participants

Study 1—One hundred and seventy-two students from 3 senior secondary high schools were recruited from grade 11 level classes (98% participation). The sample consisted of 47% men with a mean age of 16.8 years. Our ethics protocol specified that the opportunity to participate would be extended to all students in each class. Grade 11 classes include a mix of students from grades 10, 11, and 12 because of the nature of our high school curriculum. As a consequence, our sample was comprised of approximately equal numbers of grade 11 (48.5%) and grade 12 (49.1%) students, with only 2.4% of the sample consisting of grade 10 students.

Study 2—Ninety-five introductory psychology students at a small liberal arts university in maritime Canada participated in the experiment to fulfill an introductory psychology option (37% men; mean age = 18.9 years).

Testing took place in groups ranging from 5 to 27 participants. Participation was voluntary with no remuneration. All procedures were reviewed and approved by the research ethics board of Okanagan University College (now UBC Okanagan).

Stimulus Materials

The target materials in these studies consisted of alcohol outcome statements derived from Leigh and Stacy's (1994) Alcohol Outcome Expectancy Questionnaire (AOEQ) in study 1 and the Comprehensive Effects of Alcohol Questionnaire (CEOA) in study 2 (Fromme et al., 1993). Twenty-four items from the AOEQ, the 3 items most frequently endorsed from each

of the 8 subscales (Krank and Johnson, submitted), were used as stimuli for study 1. Thirty items from the CEOA were used as stimuli in study 2. Items from the CEOA were chosen based on a pretest administered to twelve participants from the same population pool. Statements about the effects of alcohol were rated as true on a 5-point Likert scale from 1 = strongly disagree to 5 = strongly agree. Only statements where the majority of students indicated 3 (neutral) were selected.

Exposure Lists—Two lists of expectancies were constructed for each study. Each list included half of the target items (12 each in study 1 and 15 each in study 2). In study 1, items from the following subscales: social facilitation, negative reinforcement, negative physical, and negative social subscales comprised list 1. Items from the following subscales: fun, sex, negative emotions, and cognitive/performance comprised list 2. In study 2, list 1 included fifteen items from social facilitation, power, dominance, and negative self-perception subscales and list 2 included fifteen items from the negative reinforcement, sexual positive, and cognitive impairment subscales. The exposure manipulation in each study was which of the 2 lists the participants' saw during the initial study phase. Each participant saw items from either list 1 or list 2 during the study phase.

In study 1, stimulus lists were intermixed with 20 nonalcohol-related (distracter) statements also presented as either myths or as facts with half of each receiving semantic processing instructions and half count instructions. Distracter items consisted of information statements about other commercial products.

Myth/Fact Distinction—Half of the items in each list were presented with a statement that it was a myth, the other half that it was a fact. The test items seen as myth, facts, or not seen (control) were counterbalanced across groups so that base rates of self-generation could be controlled.

Procedure

The information statements were presented individually. Each presentation lasted 8 seconds. The items were randomly presented with the restriction that not more than 3 items of one type (myth vs. fact) were presented before the presentation of the other type.

Memory Manipulation—In study 1, half of the items on the list seen by the participants were accompanied with instructions to process semantically and half with instructions to count the number of words. These processing instructions were counterbalanced according to subscales. Processing instructions were presented on a slide for 3 seconds before each information statement. In the semantic processing condition, participants were instructed to evaluate the statement for its suitability in an education campaign about the effects of advertising. The nonsemantic processing condition required counting the number of words in underlined statements. Testing for the effects of the information statements and memory manipulation were conducted immediately after exposure.

In study 2, the memory manipulation was either immediate testing or 24-hour delayed testing. Participants were instructed that they were about to see statements about the effects of a moderate amount of alcohol: some facts and some myths. Participants were told that the

purpose of the experiment was to develop materials for information packages about alcohol and its effects suitable for an adolescent audience. After viewing the list, subjects were either immediately asked to fill out the questionnaires or were asked to return the next day, 24 hours later, to complete questionnaires. All participants in the delayed testing group were tested the following day.

Following the presentation of all information statements in the study phase, participants completed an open-ended expectancy task, an activities questionnaire, and the expectancy questionnaire. In study 2, participants also completed a recognition test as a manipulation check of explicit memory for the items seen in the study phase.

Measures

Open-Ended Alcohol Outcome Expectancy Task—On the open-ended alcohol outcome expectancy task (Krank and Wall, 2006; Leigh and Stacy, 1994), participants were instructed to generate 3 or 4 of the most important things that would happen to them if they were to drink a moderate amount of alcohol. In addition, they were to indicate whether they would *like* or *not like* each effect.

Study 1: Expectancy Questionnaire: Alcohol Outcome Expectancy Questionnaire (AOEQ)—This questionnaire, developed by Leigh and Stacy (1993), consists of 34 potential positive and negative effects or consequences that may be experienced from drinking alcohol. Participants were instructed to "indicate how likely it is that each effect or consequence will happen to you after drinking alcohol" on a Likert scale anchored by "1 – no chance" to "6 – certain to happen." Mean scores (range 1–6) were calculated for 8 areas: 4 positive (social facilitation, fun, sex, negative reinforcement) and 4 negative (social, cognitive performance, emotional, physical). These 8 factors along with 2 general factors, positive expectancies and negative expectancies, have shown strong convergent, discriminant, and predictive validity in confirmatory factor analysis and structural equation modeling.

Study 2: Comprehensive Effects of Alcohol Questionnaire (CEOA)—The CEOA consists of 20 positive items with 4 subscales: sociability, liquid courage, and sexuality; and 18 negative items with 3 subscales: self-perception, risk and aggression, and cognitive and behavioral impairment. Participants rated both the level of expectancy on a 4-point Likert scale (1 = agree, 4 = disagree) and the evaluation of the effect on a 5-point Likert scale (1 = bad, 3 = neutral, 5 = good). The research has demonstrated adequate internal consistency, temporal stability, and construct validity (Fromme et al., 1993).

Quantity and Frequency of Drinking—Drinking behavior was obtained from 2 self-report measures. First, participants were asked *how many days did you drink in past 30* (frequency 0 to 30). Second, they were asked *how many drinks per occasion would you normally have* (quantity 0 to 15). In each case, a drink was defined as a standard drink: one beer, one 5 ounce glass of wine, or 1 single-mixed drink.

Study 2: List-Recognition Test—The list-recognition test was used in study 2 to assess participants' memory for the list of items presented on the study list. The list-recognition test

consisted of all the items from both lists. The list-recognition test required subjects to (i) distinguish old statements from new items and (ii) determine whether the statement was previously seen as a myth or as a fact.

Analyses

Responses on the open-ended expectancy question were classified by 2 independent raters with one of the raters being blind to the hypotheses and both raters blind to the group assignment. In study 1, responses from the open-ended expectancy questionnaire were coded according to the 8 expectancy subscales used in the creation of stimulus lists. In study 2, responses on the open-ended expectancy question were classified according to 3 possible types of exposure: seen as a fact, seen as a myth, and not seen. Responses that did not correspond to items from the expectancy scale (e.g., “get drunk”) were classified as other and not used in the open-ended analysis (45.5%). Interrater reliability for ordinal scale assignment was high, all Cohen's kappa >0.72. An average of the 2 was used for all subsequent analyses. The number of responses in these categories served as the dependent variables for these analyses.

In study 1, the responses on the open-ended expectancy question and the AOEQ scores were analyzed initially with a multivariate analysis of variance with the number of items produced in each of the 8 subscales as the dependent variables. The 3 between subject factors in the analyses were exposure (seen vs. not seen), bias (myth vs. fact), and memory manipulation (evaluate vs. count). The MANOVA provided a conservative omnibus test of the study hypotheses controlling for the counterbalanced expectancy exposure. Following the omnibus test, significant results were confirmed by separate ANCOVAs (with quantity and frequency as covariates) for each of the 8 expectancy categories. Where significant violations of the normality were found, nonparametric tests of differences were also conducted.

In study 2, the number of responses in each category (seen as a fact, seen as a myth, and not seen) and the CEOA scores were analyzed with a 2 × 3 mixed design ANOVA with delay (immediate vs. 24 hour) as the between-group variable and exposure (seen as a fact, seen as a myth, and not seen) as the within variable. The quantity and frequency of alcohol use were included as covariates. Based on our experimental hypotheses, we expected that items seen in the study phase would be generated more frequently, facts would be generated more frequently than myths, and manipulations designed to reduce explicit memory would reduce the effect of myth/distinctions.

Results

Overall, 83.7% of high school participants drank within the past year of the study and 48.2% drank within the past month. Most college students reported drinking in the past month (76.9%). High school boys consumed significantly more alcohol (M = 6.1) in a typical sitting than did girls (M = 4.9), F (1, 137) = 8.465, p = 0.004. The number of drinks per occasion was higher for boys (M = 6.2) than for girls (M = 4.6). Gender had no effect on the other drinking measures. These rates are typical of youth in this age group in Canada and North America (Adlaf et al., 2005; Flight, 2007; Wallace et al., 2003).

Self-Generated Expectancy Responses

The analysis of open-ended expectancy responses revealed an effect of exposure in both studies: study 1, $F(8,114) = 6.27$, $p < 0.001$, partial eta squared = 0.305; study 2, $F(2,186) = 15.8$, $p < 0.001$, partial eta squared = 0.145. Table 1 shows the mean number of responses produced and the effects of exposure as a function of expectancy category in study 1. ANCOVA tests for exposure effects on each of the categories revealed significance on 6 of the 8 subscales, social facilitation, negative reinforcement, negative physical, negative social, negative emotions, and cognitive/performance. Two, fun and sex, were not significant. Given that the modal number of responses for most categories that were not exposed was zero, all 8 expectancy category analyses were analyzed with a Kruskal–Wallis test. The chi-square tests from the Kruskal–Wallis tests confirmed the results in Table 1 with p values from the $\chi^2(1)$ tests equal to or exceeding those for the ANCOVAs. The nonparametric test also found a significantly higher number of sex expectancy responses when these items were seen, $\chi^2(1) = 5.50$, $p < 0.05$, even though the relative frequency of these items is very low. Combining responses across counterbalanced conditions for all positive scales and negative scales as a function of exposure eliminated any concerns with violations of normality. These scores were analyzed with 2 ANCOVAs and are also shown as totals in Table 1.

The main effect of exposure in study 2 interacted with delay $F(4, 85) = 3.76$, $p < 0.025$, partial eta squared = 0.39. Analysis of a priori predictions was conducted using planned comparisons ($p < 0.05$) to test at each delay condition whether: (i) items seen on the study list were generated more often than items not seen on the study list, (ii) items seen as facts were generated more than items seen as myths, and (iii) delay reduced the effects of the myth/fact distinction. The mean number of items reported according to this classification is shown in Fig.1. Both myth and fact items were reported more often than items not seen. Moreover, the manipulation of memory (delay) influenced the relative likelihood of reporting myths and facts. Facts were more likely to be reported than myths in the immediate delay condition. There was no difference between myths and facts in the delayed condition.

Expectancy Questionnaires

For study 1, the factor scores for the AOEQ were calculated and tested for differences based on exposure, myth/fact distinction, and processing condition. For study 2, the factor scores for the CEOA were computed (Fromme et al., 1993) and analyzed as a function of exposure, myth/fact distinction, and delay. Both analyses revealed no main effects or interactions of exposure, myth/fact distinction, and memory manipulation.

Memory Manipulation Check – Study 2

Study 2 contained a memory manipulation check. We analyzed item recognition using A'. A' is a nonparametric measure of sensitivity based on signal detection theory. A' scores range from 0 to 1 with scores of 0.5 indicating chance recognition and scores of 1 indicating perfect recognition. A' is useful as it accounts for the variability because of false alarm rates (Grier, 1971). There was an overall main effect of delay on item recognition, $F(1, 89) = 11.05$, $p < 0.001$. The A' for recognition was modestly better in the immediate condition, *M*

= 0.842 than in the delayed condition, $M = 0.771$. This finding confirms that delay effectively reduced explicit memory for the items seen in the study phase.

Discussion

The 2 studies reported here investigated the cognitive impact of alcohol information statements on accessibility of alcohol expectancies. The statements were presented in a style consistent with some informational approaches to alcohol education and included both fact statements that asserted putative true effects of alcohol and myth statements that negated putative false effects. Both studies reported here demonstrate the effect of the associative content of information statements on alcohol outcome expectancies in an open-ended assessment designed to measure accessibility (Goldstein et al., 2004; Krank and Wall, 2006; Leigh and Stacy, 1994; Reich and Goldman, 2005). Items corresponding to the associative content of the informational items presented were reported more often than control items that were not presented in the study phase. This main finding shows that mere exposure to outcome expectancy statements influences the accessibility of such expectancies up to at least 1 day later. Increased accessibility is consistent with priming and context effects on memory retrieval of substance use cognitions (Birch et al., 2004; Goldstein et al., 2004; Krank and Wall, 2006; Krank et al., 2005; McKee et al., 2003; O'Connor, 2007; Palfai and Ostafin, 2003; Reich et al., 2005).

Prefacing the statement as a myth had only a small effect on the increased tendency to report the content portion of the statement as an outcome of alcohol. Myth statements explicitly stating that the content was not true actually increased the likelihood that the content was reported as an expected outcome across all conditions. This enhancement effect is surprizing as negation if remembered should produce a tendency not to report the content. Figure 1 shows that myth designation can reduce reporting under some conditions. Myth statements were less likely to be reported in the immediate test condition than fact statements, but both were still more likely than content items not presented in the study phase. Moreover, consistent with Jacoby and colleagues (1989a), the meliorating effect was transitory and not present after a 24-hour delay despite the strong persistence of the exposure effect.

This finding is consistent with cognitive processing accounts that emphasize the role of unconscious influences (Bargh et al., 2001; Jacoby and Kelley, 1992; Jacoby et al., 1992) and the general difficulty of processing and remembering negation (Deutsch, 2004; Lea and Mulligan, 2002; Mayo et al., 2004). This argument parallels Jacoby and colleagues (1989a,b) suggesting that familiarity is misinterpreted as fame when explicit knowledge of the source of familiarity is not available. In study 2, when explicit negation information is less well remembered after a 24-hour delay, only the exposure effect on ease of access is left. Recognition data for statements presented suggest that explicit memory for both item content and the myth/fact distinction is weak and even weaker after the delay. Yet, the exposure effect remains strong despite the reduction in explicit memory. Moreover, only the loss of explicit information about the myth distinction explains the absence of negation in this condition.

It must be acknowledged that study 1 did not include a memory manipulation check and negation had no effect. Thus, the increased accessibility found in study 1 may be consistent with, but does not provide clear evidence for unconscious influences. Nevertheless, the findings do indicate that prior information even when accompanied by negation has a strong influence on accessibility of outcome expectancies. Perhaps, our myth manipulation was not strong enough and produced effects only under very sensitive conditions. Typical informational approaches would be expected to use more elaboration to support the disputation. Such elaboration is expected to improve explicit memory (Brooks et al., 2001; Graf, 1993; Phaf and Wolters, 1995). Indeed, study 2, where there was an effect of the myth designation, did include more emphasis on remembering the information phrases. Further work should be carried out to address the conditions under which negations is effective. Research on negation suggests that the lack of impact is quite general and effective use of negation requires special attention (Deutsch, 2004; Deutsch et al., 2006; Gawronski et al., 2008).

It should also be noted that the exposure effects that so strongly affected the open-ended expectancy measure might reasonably be expected to extend to the expectancy questionnaires. In neither study did the item exposure influence expectancy judgments. Accessibility in the open-ended expectancy measure is affected, while the rating of the statement is not. This lack of effect is likely because of the greater sensitivity of the open-ended measure to accessibility of specific content memories.

Limitations

One major limitation of the present study is the absence of memory measures that demonstrate an unconscious or implicit effect. Although the evidence is consistent with an effect of memory without awareness, only study 2 contained a test of explicit memory. This test revealed poor retention of both the source information about the item having been seen in the information phase of the study and the myth/fact information that accompanied these information statements. As a consequence, explicit memory influences on the absence of a myth effect may be attributable to poor retention of this designation. Only the reduced production of myth items in study 2 suggests an effect of the designation. The increase in myth production and the maintenance of fact production after a delay that did produce explicit memory loss is consistent with the “unconscious influence” effect reported by Jacoby, but this effect could be because of differential forgetting of the myth designation. Stronger evidence for process dissociation is required to unambiguously conclude an implicit memory effect. Nevertheless, presenting an information statement about alcohol as untrue leads to increased accessibility as an explicit expectancy. This outcome is unexpected by current informational approaches to prevention.

In addition, the 2 present studies used different samples and different stimulus materials. This was carried out to enhance generalization of the results, however, these differences compromise interpretation of the lack of a memory processing effect in study 1 versus study 2. It cannot be determined whether the differences between the 2 studies were because of processing manipulation (i.e., attention vs. delay), sampling differences (college students vs. high school students), or stimulus materials (CEOA vs. AOEQ). Nevertheless, the main

finding that informational myth statements increase accessibility of these statements as expected outcomes of alcohol use is consistent across studies and thus can be generalized to some extent.

The general application of the present research is limited to the sample range and ages, the procedures for presenting information, the brief time frame, and the particular expectancy assessments. It may be argued that young adults (aged 16 and above) in college and senior secondary grades are not representative of younger audiences who may be the primary target for prevention. Nevertheless, prevention programs are directed at problem use in these age groups, and the results may well apply to younger and more naïve samples. Another possible limitation is that the procedures for presenting information statements are not typical of informational brochures. Moreover, the time frame for the effects found here was tested only over a very brief period, 24 hours. In addition, the myth/fact distinction used here is somewhat artificial. Future research will have to establish the impact of these effects in more naturalistic materials, in different ages, and over longer retention intervals.

Implications

These findings have implications for the construction of information statements in alcohol education materials and suggest that such material development should be grounded in a sound understanding of its cognitive impact (Krank and Goldstein, 2006; Stacy et al., 2009; Wiers et al., 2007). It is common to present information about alcohol in both educational campaigns and in assessment. It is therefore important to understand the residual effects of these materials. Some information designed with good intentions may in fact produce counterproductive effects at least in some individuals. Standardized assessments of outcome expectancies may actually increase one's future likelihood of accessing problematic outcomes associated with drinking. For example, the statement “Alcohol makes me feel sexy” associates the 2 key concepts, alcohol use and sexual behavior, regardless of the level of endorsement and may have the effect of increasing the expectancy that alcohol increases sexuality.

The answer may not be as simple as avoid negation, but the cautionary note is that information sometimes has unintended consequences. Educational materials should be rigorously tested to determine that the cognitive impact promotes positive behavioral change as intended. Negation may play a part, but only when negation can be effectively integrated with the message to be processed as part of the content of the information (Kaup and Zwaan, 2003; Lea and Mulligan, 2002; Mayo et al., 2004). Alternatively, providing affirmation of information is often more effective (Gawronski et al., 2008; Mayo et al., 2004). At the very least, the findings call attention to the potential for counterproductive influences from educational information or assessment in substance use prevention. Future prevention science research should consider the cognitive impact of the information and assessment.

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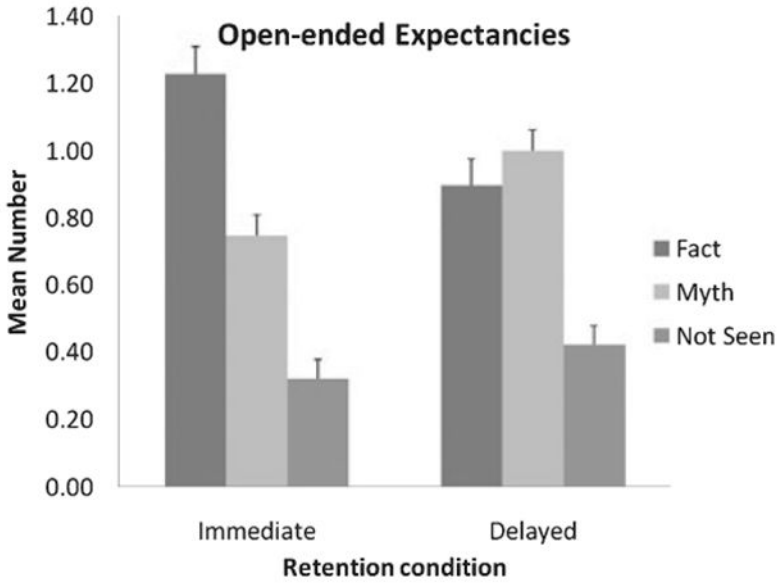

Fig. 1.

This figure shows the mean number (with standard errors) of items generated by participants in study 2 as a function of (i) whether the item had been seen as a fact, a myth, or not seen in the study phase and (ii) whether the open-ended task occurred immediately or after a delay of 24 hours.

Table 1

The Effect of Exposure on Each Category of Open-Ended Expectancy Responses Adjusted for Log Number of Drinks Per Occasion and Log Number of Days Drinking in the Past 30. Also Shown are the Mean Responses for Positive and Negative Expectancies

	Seen		Not seen	
	Mean	**SE**	**Mean**	**SE**
Positive				
Social facilitation*	0.42	0.06	0.25	0.06
Fun	0.31	0.06	0.28	0.06
Negative reinforcement*	0.10	0.03	0.02	0.03
Sex	0.09	0.03	0.03	0.02
Total***	0.91	0.09	0.58	0.09
Negative				
Negative physical**	0.85	0.09	0.48	0.09
Negative social*	0.16	0.04	0.08	0.02
Negative emotions*	0.09	0.02	0.02	0.03
Cognitive/performance***	0.75	0.07	0.23	0.07
Total***	1.84	0.12	0.81	0.12

* $p < 0.05$;

** $p < 0.01$;

*** $p < 0.001$.